Whale-watching in NSW: research to integrate the needs of whales, tourists and industry

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Publication Date:
2009

DOI:
https://doi.org/10.26190/unsworks/20603

Whale-watching in NSW: research to integrate the needs of whales, tourists and industry

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A thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

School of Biological, Earth and Environmental Sciences,

University of New South Wales

Sydney

May 2009

ABSTRACT

This thesis examines the human and animal dimensions of whale-watching and develops a framework for management of the humpback whale-watching industry in New South Wales (NSW), Australia.

The short-term responses of humpback whales to whale-watching vessels during their southward migration on the south coast of NSW were assessed. The behaviour of pods was recorded from commercial whale-watching vessels during tours and compared to pods in the absence of vessels observed from shore in the same area. Pod sizes and composition were typical of southward migrating whales. Calf pods were more sensitive to the presence of vessels than non-calf pods. Whilst there was a longer dive time and a greater percentage of time spent submerged by whales in the presence of vessels, there were no associated changes in respiration intervals. Some surface behaviours were suppressed in the presence of vessels. Surface-active behaviours were prevalent in this study which indicates that social interactions amongst conspecifics are common during the southern migration.

Feeding pods were observed on 24.5% of all whale-watching trips and during 14% of all observations made from shore. South-eastern NSW is probably a significant supplemental feeding ground for migrating whales. Feeding behaviour did not alter in the presence of vessels but the time between feeding lunges increased when vessels were closer than 100 m and when more than one vessel was present.

The demographics, expectations, experience and satisfaction of land-based and boat-based whale-watchers in NSW were assessed by a questionnaire to participants. Land-based whale-watchers had high and often unrealistic expectations about their whale-watching experience and were moderately satisfied. Boat-based whale-watchers had high, but often realistic expectations of their experience and were highly satisfied. Satisfaction was a function of the degree to which expectations were met, the proximity of whales, the numbers of whales, their behavioural displays and the level of information available on whales. Whale-watchers showed limited increase in their knowledge and conservation-oriented behaviours over the long term. Current education about whales requires better structure and clearer conservation objectives.

This study identifies research, education and vessel management as three fundamental components for the sustainable management of the whale-watching industry, and makes recommendations incorporating these components.

ACKNOWLEDGEMENTS

I owe a huge debt to the many people who have helped me over the past few years. This project could never have gone ahead without the generosity of operators and staff of Cat Balou Cruises, Merimbula Marina, Narooma Charters and Freedom Charters. They not only let me on board their vessels, but showed me friendship and shared with me their knowledge of whales and the local environment. Their conversation and humour helped pass the many hours spent staring out to sea waiting for a blow.

Thanks go to all volunteer observers: Sandy Roadknight, Regan Deale, Peter Harris, Deborah Harcourt, Michael Stone, Xenia Schleuning and Christina Henschel. Their time and effort collecting whale behavioural data has been invaluable.

I acknowledge NSW National Parks and Wildlife Service staff at the Kurnell, Merimbula and Narooma and offices. In particular Geoff Ross, Christine Hopkins, Craig Dickmann, Stephen Dovey, Ross Constable, Mark Westwood, Max Beukers and Preston Cope for their help in getting this project operational and their continued support since. Thanks to Ross, Preston and others at the Narooma office for their help in transporting and accommodating volunteers at Montague Island.

A special thanks to all the NPWS staff and volunteers at Kurnell who distributed questionnaires in 2004, especially Vanessa Morissey, Wayne Reynolds and Catherine Bell. Additional thanks to Catherine who also assisted with entering survey data for 2004. I appreciate you all stepping in to help me out when my daughters medical condition meant that I could not be there and I was in jeopardy of losing a sampling season.

A huge thanks to the numerous people from NPWS and visitor information centres who provided me with information on land-based whale-watching sites and whale-watching operations in their area.

I also owe thanks to many people at UNSW who were willing to help me out in various ways over the years, even though I was rarely around. In particular Dan Ramp, Terijo Arianna-Lovasz and Louise Mazzaroli for helping with the distribution and collection of operator surveys and Ian Suthers for identification of plankton samples. I

am grateful to Simon Jarman and Nick Gales from the Australian Antarctic Division for faecal DNA analysis and to Peter Corkeron for his constructive comments on Chapter 4.

Thanks to Wayne Reynolds for generously allowing me to use his amazing photos. Your commitment and dedication to wildlife is inspirational.

I thank my brother, Clem Stamation for designing the brochure and editing video clips in amidst his chaotic work schedule. I am in awe of your talent for all things artistic.

This work could not have been accomplished without the help of Mum, Dad, Noelene, Darryl, Jennie and Kassie who cared for my children whilst I was in the field. My children are much richer for having you in their lives

To my supervisors David Croft, Peter Shaughnessy, Sue Briggs and Kelly Waples who have supported me every step of the way, despite the fact that we are dispersed all over the country. You have all been a great source of knowledge and encouragement. To David, thank you for agreeing to take on a student who wanted to be based in Melbourne. Thank you for your constant support, for your hard work in correcting drafts and for putting up with my many requests for statistical support and my numerous questions (which I'm sure at times were tiresome). To Peter (my mentor), you have been there for me ever since I first began my journey into the marine mammal science world. Thank you for the opportunities you have given me and for believing in me, even when my life took an unexpected path. Thank you for your invaluable comments on drafts. I'm sorry that I have frustrated you with my less than perfect grammar but I blame the school curriculum of the 80s. To Sue and Kelly, thank you for working so hard getting this project up and running in the beginning and for not giving up when things started to look hopeless. I appreciate your faith in me. Thank you also for your helpful advice on the management implications of my findings.

Thank you to my friends Lesa, Ken, Denise and Emmanuel for helping me keep my life balanced, for always being a good source of laughter and for always being there for Ayden and Asha.

To my children, Ayden and Asha, I always tried to put you first but finding the balance was sometimes difficult. Thank you for making me laugh (my very own Charlie and Lola). You helped me put things into perspective. Ayden, your patience, compassion

and understanding goes well beyond your years. Asha, your courage and resilience gave me strength. You are by far my two best achievements! You can have a turn on the computer now.

I owe a special debt of gratitude to my husband, Simon, who wore the brunt of my stress and frustration throughout this process. We have grown together and thankfully not apart. You loved me despite my flaws and could see past the PhD monster that possessed me some days. Hopefully that monster has now been exorcised. I look forward to moving into the next chapter of my life with you.

To my Mum and Dad, Val and Bill, I find it difficult to express my gratitude. I know the sacrifices you have made for me. Now that I am a parent I know how difficult it must have been for you to send your teenage daughter away, to a world she knew nothing about, to pursue her dreams. Your belief in me and your unwavering support is why I am at this point in my life today. You are both an inspiration to me. For you to have grown up in an unfamiliar country, at a time when there was little understanding and support, and become the people you are today amazes me. You have passed this determination on to me.

Finally, to all those people that have asked me over the last couple of years – Yes, I have finished my thesis!

The Sustainable Tourism Cooperative Research Centre, an Australian Government initiative, funded this research in collaboration with NSW Department of Environment and Conservation.

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CHAPTER 1: Introduction

1.1 BACKGROUND

Public demand for viewing animals in their natural environment has seen nature-based tourism fast become a lucrative industry. Nature-based tourism is a subset of natural area tourism and includes wildlife tourism which takes place in the natural environment. Newsome *et al.* (2005: page 20) define wildlife tourism as "a sustainable tourist activity undertaken to view and/or interact with wildlife in a range of settings". Ecotourism is another subset of natural area tourism and is defined by the Australian National Ecotourism Strategy as "nature-based tourism that involves education and interpretation of the natural environment and is managed to be ecologically sustainable" (Alcock *et al.* 1994) and by Ecotourism Australia as "ecologically sustainable tourism with a primary focus on experiencing natural areas that fosters environmental and cultural understanding, appreciation and conservation" (Ecotourism Australia http://www.ecotourism.org.au/).

While there are many definitions of ecotourism, it is generally accepted that it encompasses five key principles; these are that ecotourism is:

1) nature –based;
2) ecologically sustainable;
3) environmentally educative;
4) locally beneficial; and
5) generates tourist satisfaction

There is a great deal of overlap between the elements of ecotourism and nature-based wildlife tourism. Wildlife tourism that occurs in natural settings is often expected to incorporate ecotourism's key principles of being sustainable, educative and fostering conservation (Newsome *et al*. 2005).

Viewing animals in the wild is generally thought of as a non-consumptive form of wildlife tourism (Duffus and Dearden 1990). Although, it may involve forms of indirect

consumption such as damage to the environment through trampling of vegetation, erosion and construction of facilities as well as the consumption of fossil fuels and other resources. Furthermore, wildlife tourism can have direct impacts on the focal species through direct disturbance and degradation of habitat. These impacts are likely to vary with the succession of the wildlife attraction. Nature-based wildlife tourism is a dynamic industry in which human-wildlife interactions; wildlife populations; and tourism sites and operations evolve and change over time.

Duffus and Dearden's (1990) illustrate this evolution in their conceptual framework for non-consumptive wildlife tourism. They describe an expert-novice continuum which predicts that during the early phases of wildlife tourism development, visitors are likely to be well informed, appropriately motivated, few in number and have minimal impact on the target species and its environment. With time, awareness of the attraction increases and visitor profiles shift to a less informed, less motivated, more generalist tourist who are more likely to impact on the attraction. Demand for facilities increases as does the provision of more basic types of information. This ultimately reduces the appeal of the wildlife attraction for the more specialist and genuine wildlife enthusiast. Higham (1998) applied this conceptual framework to describe the progression of wildlife tourism centred on a breeding colony of Royal Albatross in New Zealand. He found that visitors to the colony, the focal species and the natural habitat all showed various dimensions of change over time. Higham (1998) concluded that in the absence of deliberate management strategies wildlife tourism attractions evolve over time to the detriment of both the visitor experience as well as the wildlife being observed.

The development of wildlife tourism in natural environments is under-pinned by the responsibility to ensure that it is conducted sustainably. Achieving sustainability in a wildlife tourism industry is complex and requires the protection and enhancement of biological, social, physical and economic values. **"**The likelihood that sustainability will be achieved is related to many intrinsic and extrinsic factors such as economic viability, competition and the sustainability of the resources upon which the system relies" (Higham 2009: page 297).

Sustainable wildlife tourism can only succeed through the development of appropriate polices, planning and management that maximises the symbiotic relationship between wildlife and tourism and minimises any detrimental impacts (Newsome *et al*. 2005). An integral part of this process is to try and understand the various impacts caused by wildlife tourists. These impacts can be divided into economic, social and environmental and may either be positive, negative or neutral (Green *et al.* 2001; Higginbottom *et al*. 2001a; Newsome *et al*. 2005).

A review of the positive effects of wildlife tourism is given by Higginbottom *et al*. (2001a) and outlines the benefits wildlife tourism can bring to conservation through financial and non-financial contributions, socio economic incentives and education. It is, however, the negative effects of wildlife tourism on wildlife which have been the focus of most wildlife tourism studies (Higginbottom *et al.* 2001a). Green *et al*. (2001) review the negative effects of wildlife tourism and grouped these effects into three main categories: 1) disruption of activity, 2) direct killing or injury and 3) habitat alteration (including provision of food).

An understanding of the impacts of human-wildlife interactions requires scientific research that provides baseline ecological data including: knowledge of the species habitat requirements; their behaviour; their movement patterns; and their response to tourism activities. Newsome *et al*. (2005: page 225) list four main reasons why wildlife biologists need to become involved in studies of wildlife tourism: 1) impacts from tourism on wildlife and their environment can be identified and minimised; 2) the methods of wildlife biology are appropriate to determine the presence and extent of any problems and the success of ameliorative strategies; 3) education and conservation; and 4) anticipation of future problems.

1.2 STUDY RATIONALE

There is an escalating demand for wildlife tourism experiences around the world, with increasing value being placed on viewing animals in the wild rather than in a captive setting (Reynolds and Braithwaite 2001). The marine tourism industry has shown rapid growth in recent decades and viewing marine mammals continues to increase in popularity (Orchiston 2006). Whale-watching is a popular form of nature-based wildlife tourism and has experienced rapid growth around the world in recent decades (Hoyt 2001, Hoyt 2002)**.** This growth coincides with a changing of attitudes across many nations around the world from seeing whales as a commodity to something to be cherished and ultimately conserved. In Australia, whale-watching is worth millions of dollars per annum for regional towns and local economies (Birtles *et al.* 2001, Hoyt 2001) where free-ranging marine mammals can be viewed from air-based, boat-based and land-based platforms.

Like all wildlife tourism, whale-watching has the potential to have both positive and negative effects on the focal species and their habitat. As the popularity of boat-based whale-watching has intensified, so too has the concern over the negative impacts the activity could have on the whales being watched (Beach & Weinrich 1989, Forestell & Kaufman 1990, Orams 1999, Corkeron 2004, Corkeron 2006). As a result much research has been stimulated on the subject across a variety of species and locations. This research has provided evidence that tourist vessels can change the short-term behaviour of cetaceans e.g. humpback whales (Baker and Herman 1989; Baker *et al.* 1983; Bauer 1986; Bauer and Herman 1986; Corbelli 2006; Corkeron 1995; Scheidat *et al.* 2004), bottlenose dolphins (Constantine 2001; Constantine *et al*. 2004; Lusseau 2003), Hector's dolphins (Bejder *et al.* 1999), killer whales (Williams *et al.* 2006; Williams *et al*. 2002) and beluga whales (Blane and Jackson 1994). The short-tem behavioural reactions noted in these studies include changes in direction and speed of travel; respiratory patterns; and surface activity.

Recently studies have indicated that these short-term changes in behaviour have the potential to lead to long-term impacts at the population level (Bejder *et al.* 2006b, Lusseau 2005). Bejder *et al*. (2006a) in their study of behavioural responses of

bottlenose dolphins to tour vessels in Shark Bay, Australia noted erratic changes in speeds and direction of travel as well as changes in group social patterns during vessel approaches. However, these effects were stronger and longer lasting for dolphins in areas of low vessel traffic (control site) than in regions of high vessel traffic (impact site). In a simultaneous study conducted in the same area Bejder *et al.* (2006b) documented a decline in bottlenose dolphin abundance in Shark Bay coinciding with an increase in tour operators. The authors concluded that vessel-based dolphin watching tourism had led to a shift in the most sensitive individuals to areas of low vessel traffic. Another example of the long-term consequences of vessel whale-interactions is that of bottlenose dolphins populations in Fiordland, New Zealand. These dolphins have shown a shift from short-term avoidance tactics to long-term avoidance strategies (i.e. habitat displacement) during high levels of vessel traffic in order to avoid the significant energetic costs of vessel interactions (Lusseau 2003; Lusseau 2004; Lusseau 2005; Lusseau *et al.* 2006). Williams *et al.* (2006) also illustrate the potential significant biological impacts of whale-vessel interactions. Their study showed that vessel interaction can affect the behavioural budget of foraging killer whales in Johnstone Strait, Canada by reducing the foraging opportunities and thus decreasing energy intake (Williams *et al*., 2006).

Sustainable management of wildlife-human interactions is multi-faceted, requiring an understanding of real and potential biological impacts and non-impacts as well as an understanding of the needs and perspectives of tourists, the tourism industry and other stakeholders. Whale-watching research needs to provide quantitative measures of effects of whale-watching that can be monitored, information about no or low effects of whale-watching on whales, as well as providing insight into the human dimensions of whale-watching. Thus sustainable whale-watching management requires an integrated approach which draws on research from both social and biological sciences. Many authors have documented the importance of using multi-disciplinary science to advise the management of wildlife tourism (Duffus & Dearden 1990, Newsome *et al.* 2005, e.g. Archer *et al.* 2001) and in particular marine mammal tourism (Orams 1999, e.g. Berrow 2003, Waples 2003, Valentine & Birtles 2004).

Information for sustainable management of whale-watching along the NSW coast is lacking, especially for southern NSW (Mandelc 1999, Shaughnessy & Briggs 1999, Jeffery 1996, Mandelc 1998, Smith 1997). A successful framework for the management of the industry must maximise the benefits of whale-watching for industry, for management authorities, for regional communities, for tourists and for conservation while minimising adverse effects on whales.

The behaviour of humpback whales is well studied especially, on the northern hemisphere low-latitude breeding grounds (Bauer 1986, Baker & Herman 1989, Tyack & Whitehead 1983, Whitehead 1985, Mobley & Herman 1985, Glockner-Ferrari & Ferrari 1990, Clapham *et al.* 1992, Baker & Herman 1984) and high-latitude feeding grounds (Watkins 1986, Corbelli 2006, Clapham *et al.* 1993, Weinrich & Kuhlberg 1991, Weinrich 1991, Weinrich 1995, Whitehead 1983, Dolphin 1987b, Dolphin 1987a, Weinrich *et al.* 1992b). However, little is known of their behaviour during migration. Most whales in the northern hemisphere migrate through open ocean (Stone *et al.* 1987) making investigations difficult. In the southern hemisphere the migration route of the Antarctic Area V population of humpback whales closely follows the east Australian coastline (Dawbin 1966, Paterson *et al.* 2002). Despite their accessibility, there have been few investigations into the behaviour of this population during migration but some studies have been conducted on the pod characteristics and association patterns of southward migrating whales in waters around Queensland (Brown & Corkeron 1995, Cato 1991, Brown *et al.* 1995).

Very little is known of the impacts of whale-watching on humpback whales in Australia**.** Some research has been done on the behavioural responses of the Area V population of humpback whales to whale-watching vessels on their nursery grounds in Hervey Bay, Queensland (Corkeron 1995) and for other humpback populations on their breeding and feeding grounds elsewhere in the world (Baker *et al.* 1983, Baker & Herman 1989, Bauer & Herman 1986, Bauer 1986, Scheidat *et al.* 2004, Corbelli 2006). However, no research has been done on the responses of travelling humpback whales along the migratory path to the potential disturbance of whale-watching vessels. Migrating whales are nutritionally stressed and so the impacts of vessel interaction

may have greater energetic consequences. As a result, migrating whales may respond differently to vessels than whales on their feeding or breeding grounds.

Much of the work on the responses of humpback whales to tour vessels so far has documented changes in respiration and diving behaviour, however, very little information is available on the effects of vessels on the aerial behaviours of humpback whales. It is believed that aerial displays by humpback whales have important communicative and social functions which may vary amongst age-classes. Thus it is important to understand the impacts (if any) that tourism may have on the social behaviour of this species.

Whale-watching regulations and guidelines adopted in Australia are largely based on approach distances and angles of approach developed overseas. The biological significance of these approach limits, however, is largely untested and nothing is known of their relevance to whale-watching in New South Wales.

South-eastern NSW, from waters just north of Narooma to just south of Eden, was chosen as the study site for the vessel-whale interaction investigations and boat-based whale-watcher survey. In south-eastern NSW whales move through open, rough waters, whereas further north they are more sedentary in calmer waters (Muloin 1998). Furthermore, south-eastern NSW is of particular importance as humpback whales feed in this area (see Chapter 4). For some time the south-eastern NSW coastline has been thought to be an opportunistic feeding ground for humpback whales during their southern migration to the Antarctic feeding grounds. Anecdotal evidence of whales feeding in south-eastern NSW waters has existed since 1986 (Paterson 1987), but until now the frequency of this occurrence had not been documented.

In order to manage human-whale experiences it is essential that the characteristics, expectations, motivations and satisfactions of the human participants are understood. To echo the sentiments of (Forestell & Kaufman 1993, p.24) “It is not the whales that need to be managed, but the humans that hang out with them.” Some knowledge of this kind has been published for boat-based whale-watchers in Queensland, Australia (Valentine *et al.* 2004, Neil *et al.* 2003, Orams 2000, Muloin 1998, Muloin 2000, Corbelli 2006, Smith *et al.* 2006) and for boat-based whale-

watchers in other parts of the world (Warburton *et al.* 2000, Corbelli 2006, Parsons *et al.* 2003). Few studies, however, have investigated the effectiveness of whale-watching experiences in increasing visitors' knowledge and promoting positive attitudinal or behavioural changes and despite the popularity of whale-watching in NSW, information on the characteristics of NSW whale-watchers and the quality of the experience offered in NSW is lacking.

In general wildlife tourists often have unrealistically high expectations of wildlife viewing (Green & Higginbottom 2001, Moscardo *et al.* 2001, Higginbottom *et al.* 2001b). Education to modify these expectations has been recommended as a way of increasing satisfaction amongst wildlife tourists and as an indirect means of managing visitor behaviour (Moscardo et al. 2001, O'Neill *et al.* 2004, Hammit *et al.* 1993, Green & Higginbottom 2001). Detailed and rigorous studies on the accuracy of whale-watchers' expectations and how these expectations are generated are required. Both land-based whale-watchers and boat-based whale-watchers were included in this study and comparisons of expectations and satisfaction with the two experiences were made. Cape Solander in the Botany Bay National Park, near Sydney, was chosen as the land-based whale-watching study site. It is a popular land-based viewing site, situated close to a major capital city attracting large numbers of whale-watchers.

For whale-watching to be a sustainable form of ecotourism, ways of maximising its positive effects must be examined. Whilst there are numerous definitions of what constitutes ecotourism (reviewed by Garrod 2003) it is generally accepted that ecotourism should educate participants and contribute to conservation. The belief that nature-based tourism can lead to a greater awareness about the animals and areas being viewed, and promote conservation and environmental protection in general is widespread (Moscardo & Saltzer 2005, Higginbottom et al. 2001a, Orams 1995b, Duffus & Dearden 1993, Weiler & Davis 1993, Kimmel 1999, Moscardo et al. 2001, Reynolds & Braithwaite 2001). This conviction is repeated by researchers concerned with cetacean-based tourism (Higginbottom 2002, Orams 1996, Reid 1999, Lück 2003a, Meinhold 2003) and by many non-government organisations concerned with the conservation of cetaceans (Corkeron 2004, Corkeron

2006). Despite this general common belief, little information is available on the educational quality of whale-watching experiences and their effectiveness in promoting a conservational ethic (Corkeron 2006, Corbelli 2006, Orams 1999).

1.3 STUDY OBJECTIVES

This thesis examines the human and animal dimensions of the interface between whale-watching tourism and the whales to create a management framework aimed at sustaining the whale-watching industry in NSW.

The specific objectives of the study have been designed to address the data gaps outlined above and are as follows:

1) To determine the frequencies and locations of encounters between whale-watching vessels and humpback whales in south-eastern NSW, particularly the frequencies of encounters with mother-calf pairs.
2) To determine the responses of humpback whales on their southern migration in open water to the approach and following of whale-watching vessels.
3) To quantitatively describe the behaviour of southward migrating whales and compare with that of humpback whales during different stages of the breeding migration and with humpback whales from other populations around the world.
4) To determine changes in behavioural frequencies with varying pod size and composition.
5) To propose functions for the most common aerial behaviours observed during the southward migration of the Antarctic Area V humpback whale population past the NSW south-eastern coast.
6) To report the occurrence of humpback whales, from the Antarctic Area V population, feeding along the south-eastern coast of NSW.
7) To investigate the importance of south-eastern NSW waters as a supplemental feeding ground for humpback whales and the implications for management of the area.

8) To profile people who go whale-watching at Cape Solander in NSW and those who participate in boat-based whale-watching on the south coast of NSW
9) To ascertain the expectations of land-based and boat-based whale-watchers and test the hypothesis that whale-watchers have high, and often unrealistic expectations of their whale-watching experiences
10) To determine the level of satisfaction with the land-based whale-watching and boat-based whale-watching experience and what factors may contribute to visitor (dis)satisfaction.
11) To compare the boat-based whale-watchers and their experience on the south coast of NSW with the land-based whale-watchers and their experience at Cape Solander, NSW.
12) To determine the quality and use of interpretation in whale-watching experiences in NSW.
13) To assess the effectiveness of whale-watching in increasing knowledge and promoting conservation to whale-watchers.
14) To apply the findings towards the development of best-practice guidelines and regulations for the sustainable management of whale-watching in NSW.
15) To make recommendations to government agencies (principally DECC) and to industry on the development of effective interpretation programs to meet visitor expectations and enhance satisfaction levels and conservation values.

1.4 THESIS STRUCTURE

This thesis is presented as a series of 'stand-alone' chapters all of which have or will be, submitted to scientific journals for publication. Chapters 2 to 7 have their own Abstract, Introduction, Methods, Results and Discussion. A single common reference list is provided at the end of the thesis. Publications from this research (current at the time of submission) are provided at the back of the thesis. Three main perspectives for management are considered in this thesis:

1) The biological conservation perspective

2) The whale-watchers' perspective

3) The ecotourism perspective.

Chapter 2 presents a profile of the NSW whale-watching industry. Chapters 3 to 5 are concerned with the biological conservation perspective. Chapter 3 provides a description of the general behaviour of southward migrating humpback whales. This chapter includes a discussion of the possible functions of the most common surface behaviours observed. Chapter 4 reports the occurrence of humpback whales feeding on the south-eastern coast of NSW. Chapter 5 documents vessel-whale interactions on the far south coast of NSW. Chapters 6 and 7 relate to the whale-watchers perspective. Profiles of the characteristics, expectations and satisfaction levels of land-based whale-watchers at Cape Solander, near Sydney and of boat-based whale-watchers on the south coast of NSW are given in Chapter 6 and Chapter 7, respectively. Chapter 7 also provides a comparison between the land-based whale-watching experience and the boat-based whale-watching experience. Chapter 8 examines the NSW whale-watching industry from an ecotourism perspective and evaluates the educational and conservation value of whale-watching. Chapter 9 summarises the results of this research and provides a framework for the sustainable management of the NSW whale-watching industry based on these findings.

CHAPTER 2: Profile and management of whale-watching activities in NSW

2.1 PROFILE OF THE NSW HUMPBACK WHALE-WATCHING INDUSTRY

This thesis focuses on the two main platforms for whale-watching in New South Wales (NSW); commercial boat-based whale-watching, and land-based whale-watching. Recreational boat-based whale-watching, where people use their own private vessels to view whales, is also common in parts of Australia but is not the focus of this thesis.

The commercial boat-based whale-watching industry on the east coast of Australia developed rapidly from about 1987 (Anderson *et al.* 1996, Hoyt 2001). Hoyt (2001) estimated that almost 735,000 people participated in whale-watching in Australia in 1998. By 2003 this figure had risen to 1,618,027, an annual growth rate of 15% (IFAW 2004). New South Wales has a higher participation in whale-watching than any other Australian state (IFAW 2004). The latest whale-watching figures are that 58% of all whale-watching in Australia occurs in NSW with 319,706 people participating in boat-based whale-watching in 2003 and 616,924 participating in land-based whale-watching in 2003 (IFAW 2004).

Humpback whales (*Megaptera novaeangliae*), are the main focus of whale-watching in NSW although many other cetacean species such as common dolphins (*Delphinus delphis*), southern right whales (*Eubalaena australis*), killer whales (*Orcinus orca*), false killer whales (*Pseudorca crassidens*), blue whales (*Balaenoptera musculus*), and minke whales (*Balaenoptera acutorostrata*) are sometimes sighted during whale-watching tours (Personal observations, Waples 2003). Tours targeted at other marine mammals, specifically bottlenose dolphins (*Tursiops sp.)* and fur seals (*Arctocephalus pusillus doriferus* and *Arctocephalus forsteri)* are also popular in parts of NSW. Humpback whales are an ideal focal species for whale-watching industries as their seasonal movements and distribution are predictable, they migrate and rest close to shore, they sometimes approach vessels for close viewing and they often display energetic and acrobatic surface behaviours. These factors have also led to humpback

whales being highlighted in the media which has helped to increase public interest in this species.

The humpback whales that migrate along the east coast of Australia are part of the Antarctic Area V population. This population of humpback whales (like all other humpback populations) was severely depleted by commercial whaling (Bannister *et al.* 1996). In 1963 the International Whaling Commission (IWC) imposed a ban on whaling in Antarctic waters and since the mid – 1970s the Group V population has been recovering in the order of 10.5% annually (Paterson *et al.* 2004). Despite such promising signs of recovery, population estimates are still well short of pre-exploitation levels (Clapham *et al.* 2005). Humpback whales are listed as vulnerable by the World Conservation Union (IUCN), under the Commonwealth's *Environment Protection & Biodiversity Act 1999* and the *New South Wales Threatened Species Conservation Act 1995* as well as by the Australian Action Plan for Cetaceans (Bannister *et al.* 1996).

The migration route of the Antarctic Area V population of humpback whales follows the east Australian coastline closely (Dawbin 1966, Paterson et al. 2002). Humpback whales can be seen travelling north along the NSW coast to their tropical breeding grounds in winter (typically May – August) and south to their Antarctic feeding grounds in spring (typically September – November) (Figure 2.1). In some areas of NSW (particularly around Sydney), best whale-watching opportunities occur during the northern migration whilst in other areas (particularly the far south coast) whale-watching is only viable on the southern migration when whales are moving more slowly and closer to shore than on their passage northwards. Whales can be observed regularly during both the northern and southern migration on the mid-north to north coast and in areas around Jervis Bay.

2.2 GROWTH AND CURRENT STATUS OF THE COMMERCIAL BOAT-BASED HUMPBACK WHALE- WATCHING INDUSTRY IN NSW

Commercial boat-based whale-watching in NSW experienced rapid growth during the mid to late 1990s. In 1994 there were eight or more dedicated whale-watching vessels operating from four or more ports in NSW, with another 13 vessels from two ports mainly conducting dolphin-watching tours (Anderson *et al.* 1996). By 1998, this figure had increased to 17 or more vessels dedicated to whale-watching operating from 11 or more ports, with another 69 vessels from 24 ports conducting whale-watching tours opportunistically (F. Mandelc, pers. comm.). In 2003 a report by the International Fund for Animal Welfare (IFAW) indicated that 28 operations undertook targeted whale-watching tours in 2003. The term 'whale-watching' used by IFAW refers to the viewing of any cetacean species (i.e. whales, dolphins and porpoises). This census did not include those that operated scenic tours and opportunistically watched whales if they appeared (IFAW 2004). Furthermore, this census only offered figures for operations not individual vessels. Because some operations are likely to operate more than one vessel, the total number of vessels conducting dedicated whale-watching tours in NSW during 2003 is likely to have been in excess of 28. The IFAW report found that New South Wales had the highest growth rate for whale and dolphin-watching of any Australian state and cited an increase of 37% average annual growth between 1998 and 2003. This growth was strongly led by dolphin watching, particularly in Port Stephens (IFAW 2004). In 2005 another IFAW report revealed that Sydney had experienced a dramatic increase in whale-watching with a growth rate of 97% for land and boat-based whale-watching combined between 2003 and 2004 and a 626% increase in commercial boat-based whale-watching participants (IFAW 2005).

In order to determine the current status of the NSW humpback whale-watching industry a search of whale-watching operations was conducted by the researcher in May 2005 using the Yellow Pages directory, internet search engines and contact with various regional visitor information centres. This search was repeated in June 2007. In this survey whale-watching operations were defined as either 'dedicated' an operation which advertises regular humpback whale-watching trips (at

least weekly) during the humpback whale-watching season or 'opportunistic' - an operation which primarily conducts fishing or dive charters, but will run humpback whale-watching tours according to demand. Results of this search revealed 24 dedicated humpback whale-watching operators and 47 opportunistic humpback whale-watching operators along the NSW coast in 2005. These figures increased to 28 dedicated and 60 opportunistic humpback whale-watching operators in 2007. This relates to a 16% increase in dedicated operations, 28% increase in opportunistic operations and a 22% increase overall in two years. The largest increases occurred in the mid-north coast, Sydney and south central coast regions (Figure 2.2).

Obtaining a realistic estimate of the size of the commercial boat-based whale-watching industry in NSW is difficult, especially for opportunistic whale-watching operations. The extent to which many fishing and diving charters conduct whale-watching tours is unknown and is likely to vary considerably between seasons. There are at least a further 116 charter boat operations in NSW. It is possible that whilst these businesses do not advertise whale-watching specifically, they may watch whales if they appear. The difficulties in estimating the number of whale-watching operations have been documented before (IFAW 2004). There is no requirement for whale-watching operations to document their activities unless operating in a Marine Park Area. Waples (2003) recommended a national whale-watching operator register which would allow for assessment of the industry and its growth, and could also help identify areas where potential and cumulative impacts need to be examined. To date no register has been constructed placing limitations on a full assessment of the whale-watching industry in Australia.

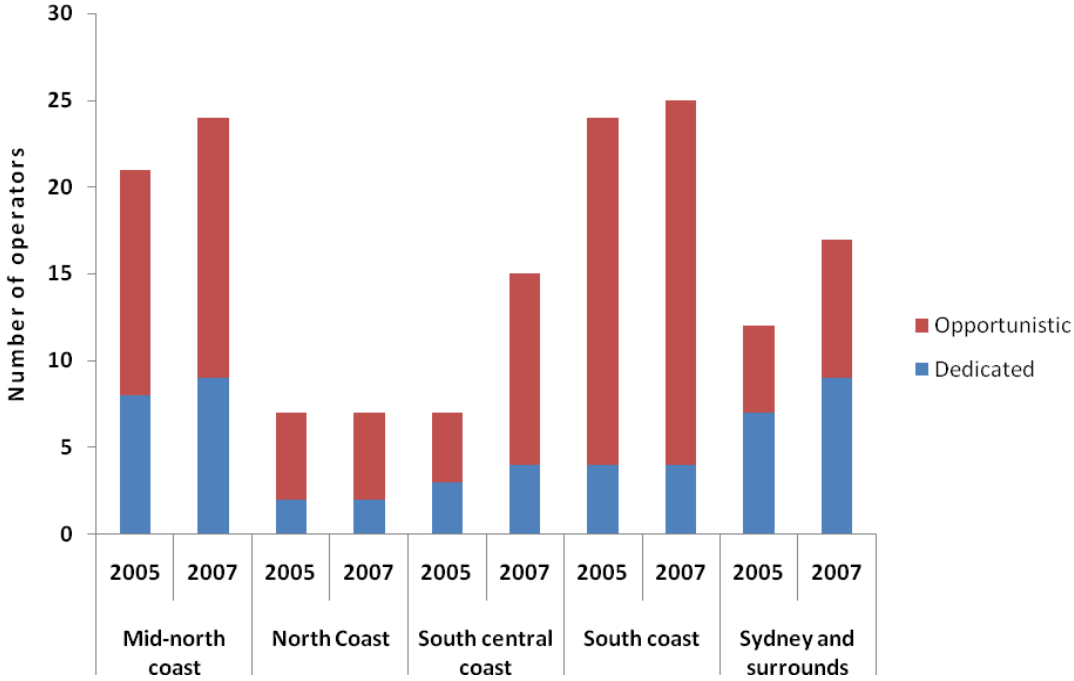


Figure 2.2. The number of dedicated and opportunistic commercial humpback whale-watching vessels operating in NSW during 2005 and 2007. 'North coast' = Byron Bay to Wooli, 'Mid-north coast' = Coffs Harbour to Newcastle, 'South central coast' = Wollongong.

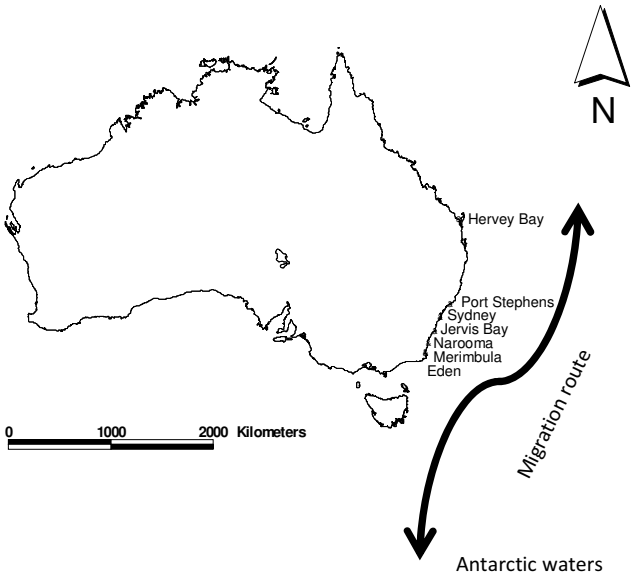


Figure 2.1 Map showing the migration route of Antarctic Area V humpback population and the location of some of the popular boat-based whale-watching sites on the east coast of Australia.

2.3 PROFILE OF THE COMMERCIAL NSW HUMPBACK WHALE BOAT-BASED WHALE-WATCHING INDUSTRY

In order to obtain a profile of the commercial boat-based whale-watching industry, a questionnaire (see Appendix 1) was posted to charter boat operators in NSW over a period of three years (i.e. 2003-2005). A search of charter boat operations in NSW was conducted by the researcher using the Yellow Pages directory, internet search engines and contact with various regional visitor information centres. A total of 200 charter boat operations were identified and a questionnaire posted to each. A total of 29 questionnaires were returned by whale-watching operators, a further 36 operators indicated that they did not conduct whale-watching tours and 135 gave no response at all. This translates to a sample of 33% of all known whale-watching operators in NSW.

A summary of the result from this survey is provided in Table 2.1. The proportion of respondents operating opportunistic whale-watching businesses (69%) closely represents the proportion of opportunistic vessels operating in NSW (i.e. 68% see above under *Status of the commercial NSW humpback whale-watching industry*). Whale-watching occurs during both the southern and northern humpback whale migrations in both State and Commonwealth waters, with 44% of operations conducting whale-watching tours on both the northern and southward migrations (Table 2.1). The majority of respondents began whale-watching post 1988. The primary business of most respondents was either fishing or diving charters. Twenty-four per cent of respondents operated either dolphin/seal charters or scenic cruises outside of the whale-watching season. Seven operators (i.e. 24%) used two vessels for whale-watching purposes. Specifications (i.e. vessel type, vessel size and vessel capacity) for each of the thirty-six vessels are presented in Table 2.1. Vessels used for whale-watching in NSW include both monohull and catamarans. Respondents' vessels ranged in size from 5.5 m to 30 m and passenger capacity from 4 to 165 (Table 2.1). There are larger whale-watching vessels operating in Sydney and Port Stephens which have passenger capacities between 200 and 300- but the operators of these vessels did not respond to the questionnaire.

The most common method that whale-watching operations use to deliver information to whale-watching passengers is via live commentary (Table 2.2). Fact sheets, videos, books and posters are sometimes used. Fifty-two per cent of respondents indicated that they provide their passengers with information on whale biology. More than half of respondents indicated that they provided their passengers with information on whale conservation, other wildlife and local history (Table 2.2). Few operators indicated that they funded research projects directly or donated to conservation organisations but 45% stated that they assist with research projects and contribute to conservation through educating whale-watchers on conservation issues (Table 2.2).

Table 2.1. Profile of NSW commercial humpback whale-watching operations surveyed.

	Percentage of respondents
Whale-watching business status	**(*n* = 29)**
Dedicated	31
Opportunistic	69
When whale-watching occurs	**(*n* = 29)**
Northern migration	19
Southern migration	37
Both northern and southern migration	44
Where whale-watching occurs	**(*n* = 29)**
NSW waters only	38
Both NSW and Commonwealth waters	62
Year began offering whale-watching	**(*n* = 29)**
1988 – 1989	8
1990s	58
2000-2003	33
Primary business	**(*n* = 29)**
Fishing Charter	31
Diving Charter	41
Dolphin/seal watching charter	14
Scenic cruises	10
Sailing	3
Vessel type	**(*n* = 36)**
Monohull	67
Catamaran	33
Vessel size	**(*n* = 36)**
< 10 metres	36
10 – 15 metres	47
> 15 meters	17
Passenger capacity	**(*n* = 36)**
≤ 10	33
11 - 25	39
26 - 50	17
51 - 100	8
> 100	3

Table 2.2. Education provided by NSW commercial whale-watching operations surveyed during their whale-watching cruises and operators' contributions to research and conservation. Respondents could choose more than one response.

	Percentage of respondents
Educational Material	**(*n* = 29)**
Live Commentary	72
Fact Sheets	21
Videos	7
Books	27
Posters	7
Photos	34
None	10
Education Content	**(*n* = 29)**
Whale Biology	52
Whale Conservation	59
Other wildlife	55
Marine environment	45
Marine conservation	21
Local history	62
Contributions to research/conservation	**(*n* = 29)**
Assists with research	45
Donate to conservation organisations	21
Fund research projects	17
Educate whale-watchers on conservation issues	62

2.4 LAND-BASED WHALE-WATCHING IN NSW

There are several land-based vantage points in NSW to view humpback whales during their annual migration. Many of the popular whale-watching headlands are inside National Parks and are therefore managed by the local National Parks and Wildlife Division (NPWS) and within the Department of Environment and Climate Change (DECC). These sites stretch from the Cape Byron State Conservation Area on the NSW north coast to the Ben Boyd National Park on the far south coast of NSW (Figure 2.3). There are many other headlands located along the NSW coastline which are managed by local councils. A list of popular whale-watching sites in NSW and a description of whale-related interpretation provided at these are given in Table 2.3. This information was sourced from a number of NPWS staff working in coastal areas. It is not a complete list of headlands to view whales, but an overview of some of the

more popular sites. Some of these sites contain viewing structures and some have whale-related interpretive signs. Typically these signs relate to humpback whales and southern right whales and include information on distinguishing features, migration patterns and NSW whale-watching regulations (Table 2.3). Very few land-based sites provide any other forms of interpretation, although whale-watching Discovery Ranger tours occur at five locations during peak whale-watching times (Table 2.3). Other interpretive material available to land-based whale-watchers in NSW includes a whale-watching booklet entitled 'Wild About Whales'. This booklet was developed by DECC and IFAW in 2005 and updated in 2007. It includes information on where to watch whales, basic biology of humpback and southern right whales, NSW whale-watching regulations and five ways people can help whales. This booklet is held at various NPWS offices and handed out during field days such as the Sydney Whale Expo (Sue Luscombe, pers. comm.).

Figure 2.3 NSW Land-based whale-watching.
Source: www.nationalparks.gov.au/npws.nsf/content/whale+watching+in+nsw. Numbers refer to locations listed in Table 2.3.

2.5 MANAGEMENT OF WHALE-WATCHING IN NSW

In 1993 whale-watching was formally recognised by the International Whaling Commission (IWC) as an expanding tourist industry which provided sustainable use of cetaceans. As a result, a resolution was passed to encourage further development of the industry (International Whaling Commission 1994). In 1996 the IWC adopted a new 'Resolution on Whalewatching' which underlined the IWC's future role in providing advice on the development of whale-watching rules via the Scientific Committee Whale-watching Working Group (International Whaling Commission 1996). Since then whale-watching has been on the agenda of the IWC's annual meetings with numerous discussions and workshops on the scientific aspects of whale-watching and the development of general principles for management of the industry. Australia has a leading role in these international forums and is party to several other international agreements and conventions that involve whales, such as the Convention on the International Trade of Endangered Species of Wild Fauna and Flora (CITES), Convention on Migratory Species (CMS), Convention on Biological Diversity (CBD) and South Pacific Regional Environment Program (SPREP).

As whale-watching has developed, numerous countries have formulated their own set of rules for cetacean observation including regulations, guidelines and codes of conduct. These rules vary considerably between countries and sometimes within the same country (Carlson 2004, UNEP MAP RAC/SPA 2003). In Australia, each State and Territory with the exception of the ACT (which is land bound) has its own system for the management of human interactions with marine mammals. Lalime (2005) provides a review of Australian legislation and policy relating to the management of whale-watching activities and its development in this country. As of 2005, State legislation included at least 11 Acts with seven Regulations and five policy framework documents relevant to management of activities around whales (Lalime 2005). A further six pieces of legislation and policies are administered by the Australian Commonwealth, three of which specifically relate to the Great Barrier Reef and one relates specifically to the Great Australian Bight (Lalime 2005). In NSW, NPWS (part of the Department of Environment and Climate Change) has the responsibility for the protection of marine mammals in NSW waters. Legislation which applies to the

management of whale-watching activities in this state includes the *National Parks and Wildlife Act 1974 (NSW);* the *National Parks and Wildlife Amendment (Marine Mammals) Regulation 2006*; and the *Threatened Species Conservation Act 1995 (NSW).*

In recent years a number of amendments to both Commonwealth and State legislations and guidelines have been made in response to the increase in public demand for viewing cetaceans in the wild, in order to increase consistency across jurisdictions and to address research findings relating to negative effects on the wildlife concerned. For example, the Victorian government amended the *Wildlife (Whales) Regulations 1998* in 2004 after growing concern for the welfare of dolphins subjected to swim-with-dolphin tours in Port Phillip Bay (Department of Sustainability and Environment. 2004). Although driven primarily by concern for bottlenose dolphins, the *Wildlife (Whales) (Amendment) Regulations 2004* prescribed new minimum approach distances for all whales in Victorian waters. The Victorian government has since begun drafting of new regulations for marine mammals which aim to further increase consistency with the National guidelines and address human-seal interactions. These new regulations are expected to be finalised by December 2009. In 2006 the Western Australian Government reduced the number of permits available for dolphin watching at Shark Bay following a study by Bejder *et al*. (2006) that showed local dolphin abundance declining with increased exposure to vessel activity.

Table 2.3. A list of popular land-based whale-watching sites in NSW and a description of whale-related interpretation provided at these sites .Sources: National Parks and Wildlife staff and Booderee National Park staff.

	Figure 2.3 reference	Man-made viewing areas	Whale related interpretive signs	Whale related Discovery Ranger talks	Further information
NSW North Coast					
Cape Byron Headland (*Cape Byron State Conservation Area*)	1	√	√	√	Mobile whale information centre manned by volunteers
Iluka Bluff (*Bundjalung NP)*	2	√	×	√	Free tours during school holidays
Angourie Point *(Yuraygir NP)*	3	√	×	×	
NSW Mid-north Coast					
Muttonbird Island *(Muttonbird Island NR)*	4	√	√	√*	*Free tours during school holidays. Rangers provide binoculars/telescopes, posters, baby whale cut out
Woolgoolga Headland *(Council land)*		×*	×	×	*Some seating and hardened surfaces
Sawtell Headland *(Council land)*		×*	×	×	*Some seating and hardened surfaces
Boambee Headland *(Council land)*		×*	×	×	*Some seating and hardened surfaces
Nambucca Head (*Council land*)		×*	×	×	*Some seating and hardened surfaces
Scotts Head (*Council land*)		×*	×	×	*Some seating and hardened surfaces
Korogoro Point *(Hat Head NP)*	5	×*	√	×	*Some seating and hardened surfaces
Smoky Cape *(Hat Head NP)*	5	×*	√	×	*Courthouse type structure at base of lighthouse
Tacking Point *(Council land)*		×*	×	×	*Cleared grounds around lighthouse
Tacking Point 2 (*Sea Acres NR*)		√	×	×	Interpretation planned for this site in future
Crowdy Head *(Crowdy Bay NP)*		×	×	×	
Queens Head *(Crowdy Bay NP)*		×	×	×	
Perpendicular Point (*Kattang NR*)	6	√*	√	×	*Dual purpose lookout for whale-watching and to reduce access to dangerous cliff edge

	Figure 2.3 reference	Man-made viewing areas	Whale related interpretive signs	Whale related Discovery Ranger talks	Further information
Boat Harbour (*Council land*)		×	×	×	
Fisherman's Bay (*Tomaree NP*)	7	×	×	×	
Sydney and Surrounds					
Wybung Head (*Munmorah SCA*)		×	√	×	
Norah Head (*Council land*)		×	×	×	
Crackneck lookout (*Wyrrabalong NP*)	8	×	√	√*	*Whale-watching days (approx. 9 days in June/July). Temporary display with brochures, posters, kids activities, whale song c.d., live commentary.
The Skillion (*Council land*)		×	×	×	
Coppacabana (*Council land*)		√	×	×	
Gerrin Point (*Bouddi NP*)		×	×	×	
Box Head (*Bouddi NP*)		×	×	×	Not actively promoted as a little unsafe
Barrenjoey Headland (*Ku-ring-gai Chase NP*)	9	×*	×	×	*Cleared grounds around lighthouse
West Head (*Ku-ring-gai Chase NP*)	9	√	×	×*	*May introduce Discovery Ranger talks in future
North Head (*Sydney Harbour NP)*	10	√	√	×	
Dobroyd Head (*Sydney Harbour NP*)	10	√	×	×	
South Head (Sydney Harbour NP)	10	√	×	×	
Cape Solander (Botany Bay NP)	11	√	√*	√**	*Large interpretive sign developed by NPWS and IFAW in 2004 **Discovery Ranger talks approx every half hour on busy whale-watching days
NSW South Central Coast					
NSW Jervis Bay NP*	12	×	×	×	*No specific sites, but various vantage points for opportunistic whale-watching

	Figure 2.3 reference	Man-made viewing areas	Whale related interpretive signs	Whale related Discovery Ranger talks	Further information
Point Perpendicular Lighthouse (*Jervis Bay Military Reserve*)*.		×	×	×	* Managed by the Australian Department of Defence
Cape St George Lighthouse (*Booderee NP*)*		√	√	×**	* Managed by Australian federal government ** Irregular talks which may incorporate whale-watching, targeted whale-watching talks may be conducted in the future
NSW South Coast					
Moruya South Head (Toragy Point) (*Eurobodella NP)*	13	√	√	×	
Montague Island (*Montague Island NR*)		×	×	×*	*Discovery Ranger tours of Montague Island will include information on whales if sighted.
Short Point (Council land)		×	×	×	
Eden Lookout Point (Council land)		√	√	×	
Red Point (*Ben Boyd NP*)	14	√	√	×	
Green Cape (*Ben Boyd NP*)	14	×*	√	×**	*Cleared grounds around the base of the lighthouse **Regular lighthouse tours will include information on whales if sighted.

NP = National Park
NR = Nature Reserve
SCA = State Conservation Area

In 2005, the Australian National Guidelines for Whale and Dolphin Watching 2005 replaced the Australian National Guidelines for Cetacean Observation and Areas of Special Interest for Cetacean Observation (ANZECC 2000). These guidelines were developed jointly by all Australian, State and Territory governments through the Natural Resource Management Ministerial Council and set a national standard for whale-watching practices in all Australian waters (Commonwealth, State and Territory). Since their introduction the South Australian Department for Environment and Heritage (DEH) has began a review of their regulations and has recently released for public comment *Draft National Parks and Wildlife (Protected Animals - Marine Mammals) Regulations 2007* to replace the *National Parks and Wildlife (Whales and Dolphins) Regulations 2000.*

After recognition of the growth of the industry and its potential impacts on whales as well as the inconsistencies between the State and Commonwealth standards, the NSW government amended the *National Parks and Wildlife Regulation 2002 (NSW)* with the *National Parks and Wildlife Amendment (Marine Mammals) Regulation 2006* under *National Parks and Wildlife Act 1974.* The amendments prescribed new minimum approach distances for watching whales and other marine mammals to bring them into line with the national standards. Changes relevant to humpback whale-watching included increasing the minimum vessel approach distance from 200 m to 300 m for pods containing calves (the 100 m approach distance for pods without calves remained). By introducing new operating rules for vessels and aircraft, the amendment gives clear advice on how to operate vessels and aircraft near marine mammals to prevent the animals being harassed, chased or stressed and makes provisions for the Minister to declare 'special interest' marine mammals (see Appendix 2). The resolution of inconsistencies between the NSW whale-watching regulations and those of the Commonwealth was particularly significant, as many whale-watching operations based in NSW encounter whales in both State (within 3 nautical miles (NM) of shore) and Commonwealth (3-200 NM) waters (see Chapter 5).

To date much of the focus of regulatory strategies in NSW has been on minimum approach distances as well as speed and angle of approaches. The Australian National Guidelines for Whale and Dolphin Watching 2005 contain

additional management considerations under 'Tier 2' which include regulating the number of whale-watching vessels through a licensing system, placing time limits on observations, limiting the number of trips per day, limiting the hours of operation, establishing no-approach times and incorporating research on biology, behaviour, seasonal requirements and habitat requirements of marine mammals. These have not been incorporated into state policy. Unlike the QLD, WA, SA and VIC governments which require whale-watching operators to hold a licence, NSW whale-watching businesses do not require a permit unless operating inside a Marine Park. Whale-watching currently occurs in five Marine Parks in NSW, namely Cape Byron Marine Park, Solitary Islands Marine Park, Port Stephens – Great Lakes Marine Park, Jervis Bay Marine Park and Batemans Marine Park.

CHAPTER 3: The behaviour of humpback whales during their southern migration on the NSW south coast.

3.1 ABSTRACT

Little is known of the behaviour of humpback whales during migration. This study documents the surface behaviour of the Antarctic Area V humpback whale population during their southward migration past the south coast of New South Wales (NSW). Behavioural observations were recorded from five commercial whale-watching vessels operating out of three ports (Narooma, Merimbula and Eden) and from two land observation sites (Green Cape and Montague Island) in the same area. Patterns of pod size and composition were similar to those previously observed for southward migrating whales. Surface-active behaviours were common in this study area with 70% of pods exhibiting such behaviour. This is higher than reported previously for this population on the winter nursery grounds. The most common surface-active behaviours were pectoral slaps, feeding lunges, fluke slaps, breaches and peduncle slaps. Mother-calf pods performed surface-active behaviours such as breaches and fluke slaps more often and spent more time at the surface than non-calf pods. Single whales had high frequencies of surface-active behaviours. The frequency of breaches and peduncle slaps was highest in rough conditions. In contrast, feeding frequency was highest in calm conditions. The findings of this study support previous research on humpbacks elsewhere that the common surface-active behaviours are associated with inter- and intra pod communication, and with play and development in calves. The prevalence of surface-active behaviours in this study indicates that social interactions amongst conspecifics are important during migration.

3.2 INTRODUCTION

The behaviour of humpback whales is well studied, especially on the northern hemisphere low-latitude breeding grounds (Bauer 1986, Baker & Herman 1989, Tyack & Whitehead 1983, Whitehead 1985, Mobley & Herman 1985, Glockner-Ferrari & Ferrari 1990, Clapham et al. 1992, Baker & Herman 1984) and high-latitude feeding grounds (Clapham et al. 1993, Watkins 1986, Corbelli 2006, Weinrich 1991, Weinrich 1995, Whitehead 1983, Dolphin 1987b, Dolphin 1987a, Weinrich et al. 1992b, Weinrich & Kuhlberg 1991). There is, however, little known of the behaviour of humpback whales during migration. Most whales in the northern hemisphere migrate through open ocean (Stone *et al.* 1987) making investigations difficult. In the southern hemisphere, however, the migration route of the Antarctic Area V population of humpback whales closely follows the east Australian coastline (Dawbin 1966, Paterson et al. 2002). Although fewer studies have been conducted on the behaviour of humpback whales in the southern hemisphere compared to northern hemisphere populations, some work has been done on the association patterns and behaviour of southward migrating whales (Brown & Corkeron 1995, Cato 1991) and on the behaviour of humpback whales in relation to tour vessels on the nursery grounds in Hervey Bay (Corkeron 1995).

Previous studies have shown that the migration of humpback whales is temporally segregated according to age-class. Non-breeding whales are first to leave the breeding areas and mother-calf pods the last (Chittleborough 1965; Dawbin 1966). This pattern has also been observed for humpback whales leaving Hervey Bay (Corkeron *et al*. 1994). It is not known if this pattern holds true throughout the humpback whales' southern migration as the pod composition of the Antarctic V population has not been documented further south than this.

Changes in short-term behaviour of cetaceans are frequently used as indicators of disturbance, especially from vessel traffic (Baker et al. 1983, e.g. Baker & Herman 1989, Bauer & Herman 1986, Bauer 1986, Blane & Jackson 1994, Corkeron 1995, Bejder *et al.* 1999, Williams *et al.* 2002, Lusseau 2003, Scheidat et al. 2004, Constantine *et al.* 2004, Williams *et al.* 2006, Constantine 2001a). Interpreting whale

behaviour and the long-term implications of short-term behavioural changes is extremely difficult. Contributing to the difficulty in understanding whale behaviour is that many surface-active behaviours (i.e. behaviours not associated with respiration or diving) are multifunctional, serving different purposes when displayed in different contexts. For example fluke slapping (also known as lobtailing) may be used as a mate avoidance technique by female whales during courtship (Baker & Herman 1984, Coleman 1994) or to dissuade nursing attempts when displayed by a mother towards a calf (Coleman 1994). It has also been suggested that fluke slapping may represent play or annoyance in calves (Coleman 1994). Fluke slapping has also been observed in feeding whales in southern New England waters and may assist foraging (Weinrich *et al.* 1992c).

Some attempts have been made to shed light on the specific functions of humpback whale aerial behaviour (Whitehead 1985, Bauer 1986, Coleman 1994, Baker & Herman 1984, Pryor 1986, Weinrich et al. 1992b). The common aerial displays in humpback whales are believed to have a communicative role as a form of signalling between mother-calf pairs, during courtship or as a show of strength or aggression during challenging. Some surface-active behaviours may also be used during play and aid the development of younger whales.

The purpose of this chapter is to 1) quantitatively describe the behaviour of southward migrating humpback whales and compare it with that of humpback whales during different stages of the breeding migration and with humpback whales from other populations around the world, 2) determine variation in the behaviour of whales as a function of pod size and composition and 3) perform a functional analysis of the most common aerial behaviours observed during the southward migration of the Antarctic Area V humpback whale population past the New South Wales (NSW) south coast.

3.3 METHODS

Behavioural observations were recorded from five commercial whale-watching vessels operating out of three ports on the NSW south-eastern coast - Narooma (36°13'S 150°08'E); Merimbula (36°53'S 149°55'E) and Eden (37°04'S 149°54'E); and from two land observation sites - Montague Island (36°15'S 150°14'E) and Green Cape (37°16'S 150°03'E).

3.3.1 Boat-based observations

Boat-based observations were made during a total of 98 whale-watching trips over 89 days, which included 30 trips over 27 days from 21 September to 7 November 2002, 31 trips over 28 days from 21 September to 8 November 2003 and 37 trips over 34 days from 24 September to 4 November 2005. The research time frame was chosen to capture the majority of the humpback whales' southern migration. Local operators generally began regular whale-watching cruises from the third week of September and continued until mid November. Sampling was not possible on each day during this period. On occasion the operator would make the decision to cancel a whale-watching cruise due to unfavourable sea conditions or a lack of passengers. Occasionally the whale-watching cruise was booked to capacity and so no seat was available on board the vessel for the researcher.

In order to maximise sampling opportunities, the largest whale-watching operator was chosen from each of the three main whale-watching ports on the far south coast of New South Wales. The operators involved in this study were dedicated to whale-watching tours in season and conducted one to 3 trips daily of 2.5 to 4 h duration (Table 3.1). They were the only dedicated operators out of Eden and Merimbula, and one of only two dedicated operators out of Narooma (Table 3.2). The vessels used in this study varied in size from 12 m to 16 m and were licensed to carry between 23 and 72 passengers (Table 3.1). Three of the vessels were catamarans and

two were monohulls, with engine capacities ranging from a single 500 hp to two 580 hp (Table 3.1).

Rates of occurrence of behaviours by the entire whale pod were obtained using a group-follow or survey protocol and continuous sampling technique (Mann 1999). The group-follow and survey protocol were optimal in this study for several reasons. Individuals could not be confidently and rapidly identified with each surfacing Pods were usually small (average group size was 2.5 individuals, maximum was six) and easily discriminated as they were usually travelling within two-body lengths of each other. Thus observers were able to see all whales if they surfaced simultaneously. On occasions when there was a large pod (≥ 4 whales) or a very active pod, digital video footage was taken to ensure that the timing of each behavioural event was determined accurately through later review.

Table 3.1. Summary of whale-watching operations involved in this study.

	Operator 1		**Operator 2**	**Operator 3**	
	Vessel 1	**Vessel 2**	**Vessel 3**	**Vessel 4**	**Vessel 5**
Vessel Length (metres)	16	13	16	12	12
Vessel type	Catamaran	Mono hull	Catamaran	Catamaran	Mono hull
Engine type Capacity	2 x 580hp inboard diesel	500 hp inboard diesel	2 x 300 hp inboard diesel	2 x 300 hp inboard diesel	2 x 300 hp inboard diesel
Passenger Numbers	72	23	47	37	27
Crew (not including skipper)	2	1	2	2	2
Trips per day	1-2 *	0-1**	1	0-3**	0-3**
Length of trip	3-4 h (2nd trip 2.5hrs)	2.5 h	3-4 h	3 h	3 h

*2nd trip subject to demand
** number of trips highly variable and dependent on passenger demand

Table 3.2. Number of dedicated and opportunistic whale-watching operations operating out of each of the three ports used in this study.

Port	Dedicated	Opportunistic[1]	Opportunistic[2]
Narooma	2	2	3
Merimbula	1	2	5
Eden	1	1	0

Dedicated = dedicated whale-watching operator in season (Sept-Nov)
Opportunistic[1]= fishing or diving charter which occasionally conducts whale-watching tours
Opportunistic[2] = fishing or diving charter which rarely conducts whale-watching tours

A pod was defined as one or more whales within 100 m of each other, generally moving in the same direction, and coordinating their behaviour (Corkeron 1995, Mobley & Herman 1985, Whitehead 1983). A calf was defined as a whale of <50% body length of another whale in close proximity approximately <1 whale length (Corkeron 1995, Bryden 1972, Chittleborough 1965).

Observations were made from the top deck of the whale-watching vessels (height approximately 5 m) and began once the focal pod was within 1000 m of the vessel. This distance was measured subjectively by the researcher (KAS). One thousand meters was used as the maximum distance at which observations would commence as behaviours were difficult to distinguish at distances greater than this. Most observations were made at distances < 1000 m as the vessel usually moved towards the pod quickly until reaching the 300 m caution zone.

If there was more than one pod in the vicinity of the vessel, the closest pod was chosen as the focal pod. Observations were continued until the pod was >1000 m from the vessel when practical. On the rare occasion when pods affiliated or disaffiliated, the observation for that pod was terminated before recommencing a new observation on the closest pod. Observations were usually terminated because it was time to return to port or the skipper of the vessel decided to move to another pod.

The observation of an individual in more than one pod could not be excluded in these instances but pseudo-replication was judged as minimal. It was further avoided by terminating and excluding from analysis observations in which the majority of individuals were suspected to be from a previously observed pod, and conducting analysis at a pod level.

Observations on board whale-watching vessels were recorded using a Sony digital mini-disc walkman (MZ –R900) with Sony tie-tack lapel microphone (ECM-T6) and JVC digital video recorder (GR-DVL1020). The mini-disc walkman recorded continuously throughout the duration of each observation. During play back of the track, the time elapsed was displayed so that onset of each behaviour was recorded to the nearest second. A hand-held Garmin II plus GPS receiver was used to track location, speed and direction of travel of the whale-watching vessel. A Brunton Outback digital compass was used to obtain a bearing of the whale. Distance from whale to vessel was either estimated subjectively by the observer or measured when practical using a Bushnell laser range-finder (Lytespeed 400) when the whale was ≤ 300 m. Distances >300m were always estimated subjectively by the researcher (KS). Thus the cutoff distance of 1000 m may have varied slightly between observations. The same researcher was used to for boat-based observations to exclude observer bias. Water depths were taken from the vessels' depth recorder when available or from nautical charts.

3.3.2 Land-based observations

Land-based observations were collected from the two land observation sites on the NSW south-eastern coast. Whale behaviour was only recorded at these sites when there were no unanchored vessels within 5 km of the focal pod. Land-based observations were made over the same period as boat-based ones, but included 2004 as well as 2002, 2003 and 2005. Observations were made by seven volunteers. In order to minimise observer bias the same volunteers were used in consecutive seasons when possible. Three observed for one season only, three volunteers observed for two seasons (2003 and 2005) and one volunteer observed for all four seasons. Most observations from Green Cape were made by the same observer. Each volunteer was trained by the researcher on how to identify and record humpback whale behaviour, and was given a key of behaviours he/she was likely to see. The behavioural descriptions given in the key were adapted from Corkeron (1995) and Weinrich *et al.* (1992) (see Appendix 3).

The observer marked the onset of each behaviour onto a tape recorder (Panasonic RQ-L11) for the duration of the observation. If the observer lost sight of the pod the tape continued recording for an additional 20 min. If the whales were not re-sighted after 20 min then the observation was terminated. The tape was transcribed to onset of each behaviour to the nearest second using a stop watch. The cassette recorder was fitted with a battery level indicator and the batteries were changed frequently to ensure the tape was running at the correct speed.

Other information recorded for each observation included: 1) time observation began; 2) bearing of pod when first sighted and when observation was terminated; 3) estimated distance pod was offshore (initially and at end of observation); 4) direction of travel (initially and if there was any change in direction during observation); 5) number of whales in the pod; and 6) presence or absence of a calf. Observations were terminated if a moving vessel approached within 5 km of the focal pod. Distance was estimated by observers.

Observations were made within approximately 2 km of the land-based site using binoculars of 8 x 30 magnification or higher. Observers were confident that within this range all surface activities could be accurately identified. Beyond this limit the sample may be biased towards the most visible surface activities and so observations were always terminated when observers were no longer confident that they were seeing all surface behaviours. To minimise bias towards active pods, observers were instructed to choose the pod closest to them and to remain with this pod even if there were other more active pods in the area.

3.3.3 Variable definitions and data analysis

Data collected from both land- and boat-based observation platforms were combined to assess the general surface behaviour of southward migrating whales of the Antarctic Area V population.

To test whether this temporal distribution observed in previous studies of humpback whales on the breeding and nursery grounds holds true further south, observations from all seasons (i.e. 2002 - 2005) were separated into six time periods:

1) 13 – 30 September, 2) 1 - 7 October, 3) 8 - 14 October, 4) 15 – 21 October, 5) 22 - 31 October and 6) 1 – 25 November. These time periods were divided into roughly weekly blocks. Although dates for September ranged from 13- 30 most observations (70%) occurred within the last week of September and although observation dates for November ranged from 1 to 25 November, most observations (71%) occurred in the first week of November.

Wind speed observations, recorded from weather stations at Narooma, Merimbula and Green Cape during the study period were obtained from the Australian Bureau of Meteorology (BOM). Because sea state observations were recorded at the Narooma weather station only, it was estimated by the researcher for observations made from vessels leaving Merimbula and Eden, and from the Green Cape land-based site.

Sea state was classified according to wave height as per BOM. The five categories observed were: 1) Calm = wave height 0- 0.1 m, 2) Smooth= wave height 0.1-0.5 m, 3) Slight = wave height 0.5-1.25 m, 4) Moderate = wave height 1.25-2.5 m 5) Rough = wave height 2.5-4 m.

Wind speed observations were sorted into five categories corresponding to those used in the Beaufort scale. The five categories observed were: 1) 0-6 km/h (0-1 on Beaufort scale), 2) 7-11km/h (2 on Beaufort scale) 3) 12-19 km/h (3 on Beaufort scale), 4) 20-29 km/h (4 on Beaufort scale) and 5) 30 – 50 km/h (5-6 on Beaufort scale).

A dive was defined by the occurrence of a fluke up, fluke down, peduncle arch or slip under. Dive rate (DR – dives min^{-1} $whale^{-1}$) was calculated from the total frequency of dives in an observation period divided by the length of that period in minutes and the number of whales observed. The duration of each submergence (TS) was calculated from the time a dive began to the next surface behaviour. All members of the pod typically synchronized their diving and submergence within a few seconds. Only TS >30 s were included in the analysis to ensure that TS was representative of the time all members of the pod were submerged. The percentage of time a pod spent submerged (%TS) was calculated as follows:

$$\%TS = \frac{\Sigma TS}{\text{ObservationTime}} \times 100$$

An overall mean dive time (MDT) was then calculated for each pod as follows:

$$\text{MDT} = \frac{\Sigma TS}{\text{(No. of dives)}}$$

Two variables were used to determine a whale's respiration patterns:

1) Surface time (ST) = total time pod spent at the surface during the observation period (s).

2) Number of blows (NB) = number of times a blow was observed during the observation period.

Mean blow interval per whale (MBI) was calculated as follows:

$$\text{MBI} = \frac{\text{ST}}{\text{NB}/\text{Pod size}}$$

For 21 mother-calf pods, individuals could be confidently identified with each surfacing. For these observations a mean blow interval per individual ($\text{MBI}_{\text{individual}}$) was calculated as the mean time between successive blows of an individual across each observation period.

Most statistical analyses were performed using SPSS for Windows V14.0 (SPSS Inc., Chicago). To further test for variation in the behaviour of whales as a function of pod size and composition analysis of similarity (ANOSIM) and similarity per cent (SIMPER) routines were performed using Plymouth Routines in Multivariate Ecological Research [Primer V5.2.9] software. Values were fourth root transformed and similarity was based on the Bray-Curtis measure. Mean values are presented with the standard error (SE). Behavioural frequencies per whale were calculated by dividing the number of observation of each behaviour by observation time and by the number of whales in the pod.

3.4 RESULTS

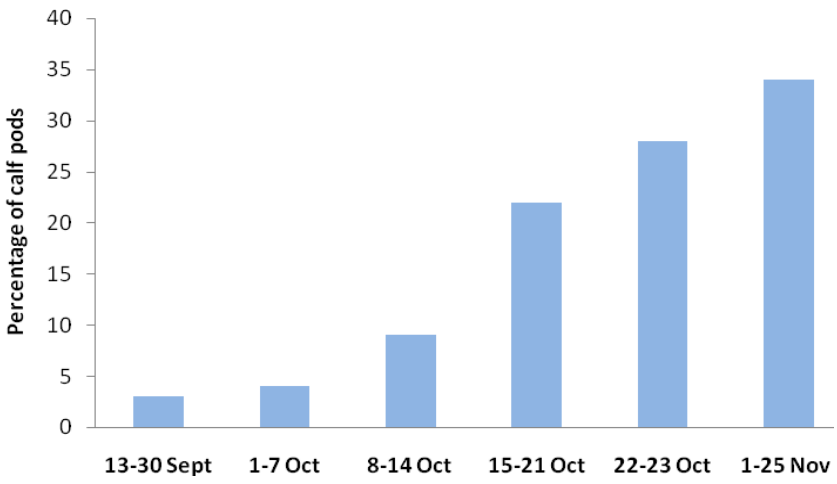
A total of 166.8 hours of observations of 350 humpback whale pods were analysed, with 120.8 hours of these collected on board whale-watching vessels over three seasons and 46 hours collected from the two land-based whale-watching sites over four seasons (see Chapter 5). All pods were within 17 km of shore (see Chapter 5). The average pod size was 2.3 ± 0.05 with a minimum of one and a maximum of six whales. One hundred and twenty-four pods (i.e. 35%) were calf pods (i.e. contained a mother-calf pair). Twenty-seven of these calf pods (i.e. 22%) were accompanied by an escort of unknown sex.

The majority of calf pods were observed from 15 October onwards (Figure 3.1a). Seventy-two per cent of pods observed in November were calf pods (Figure 3.1b).

There was a small variation in pod size throughout study period. Smallest pod sizes occurred in the second week of October and the largest in September and November (Table 3.3).

The duration of observations ranged from five to 115 minutes. The length of the boat-based of observations depended on the movements of the whale-watching vessel, whilst the length of land observations was dependant on the pod's movements.

a)



b)

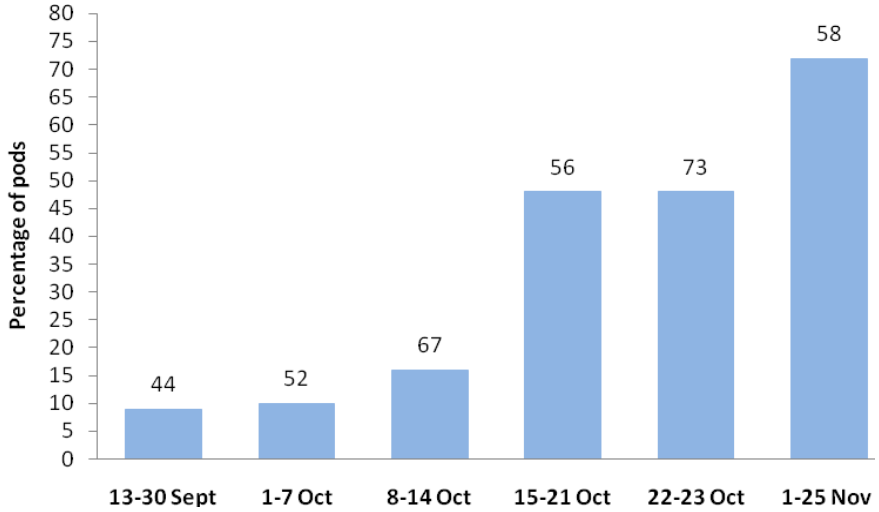


Figure 3.1 a) Percentage of humpback whale calf pods observed during six time periods from 2003 to 2005 (*n* = 124); **b)** Percentage of humpback whale pods that contained calves observed within each of the six time periods from 2003 to 2005 (sample sizes are shown above each bar).

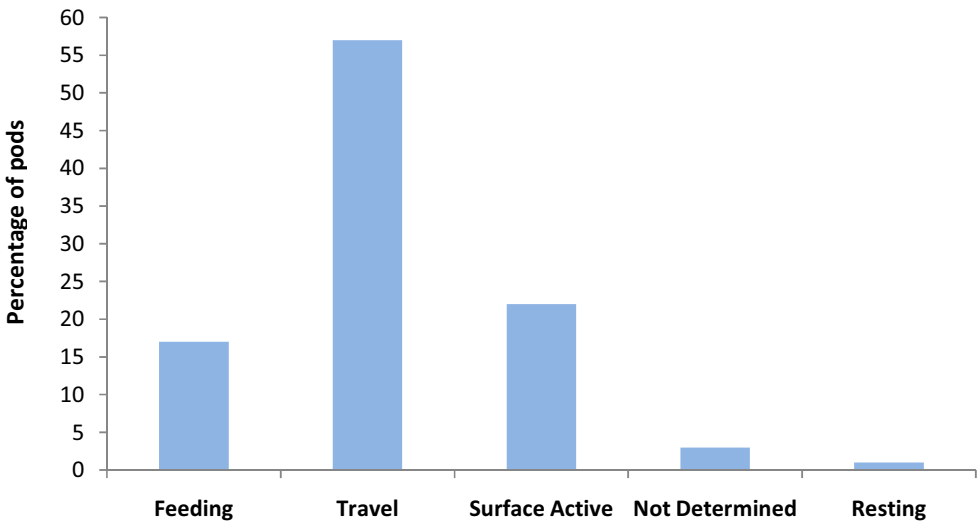
Table 3.3. Sizes of humpback whale pods during six time periods from 2002- 2005. The Kruskal-Wallis test statistic of the differences for pod size between each time period is shown.

	Mean ± SE	Minimum	Maximum	Mean Rank	*n*	*Test Statistics*
13-30 September	2.5 ± 0.2	1	6	186.7	44	$\chi^2 = 11.7$ df = 5 p = 0.004
01-07 October	2.1 ± 0.1	1	5	159.6	52	
08-14 October	2.0 ± 0.1	1	5	148.8	67	
15-21 October	2.3 ± 0.1	1	5	181.5	56	
22-31 October	2.3 ± 0.1	1	5	184.1	73	
01-25 November	2.43 ± 0.1	1	5	195.4	58	

3.4.1 Whale behaviour in general

The majority of pods were travelling (i.e. moving >1 knot) when first sighted (Figure 3.2a). Twenty-two per cent of all pods were surface-active pods (i.e. displaying aerial behaviours such as breaching, fluke or pectoral slapping, or fluke or pectoral waving) when first sighted (Figure 3.2a). The initial behaviour of 3% of pods was discounted and categorised as 'not determined' as they had members that had either affiliated or disaffiliated. Pods observed from whale-watching vessels were broken down into slow travelling (1 - 3 knots) and travelling (>3 knots). Vessel speed (determined by GPS) was used to estimate pod speed. The majority of travelling pods were moving at speeds greater than 3 knots (Figure 3.2b).

a)



b)

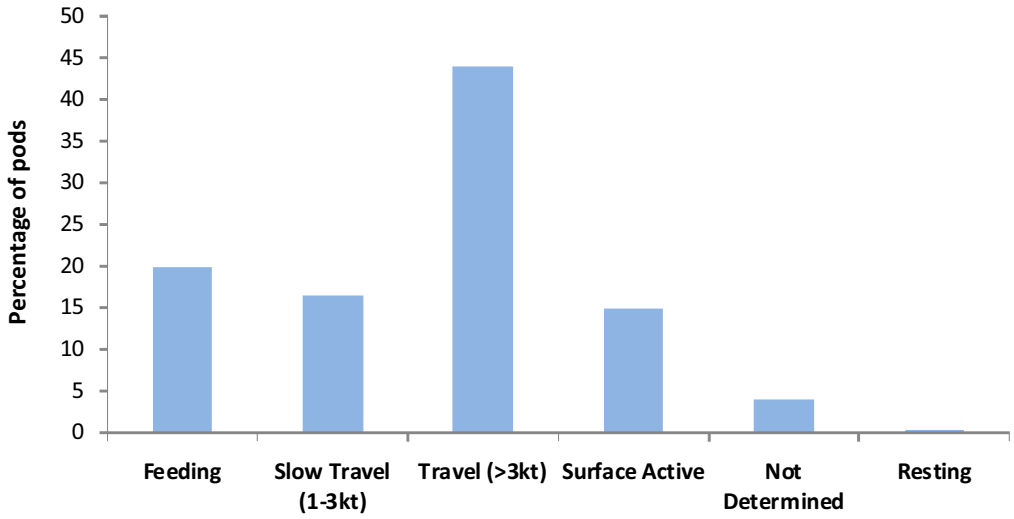


Figure 3.2. The surface behaviour of humpback whale pods when first sighted from a) land and whale-watching vessels combined (*n* = 206) and b) whale-watching vessels only.

Twenty-five surface behaviours were recorded in total (see Appendix 3 for behavioural definitions). 'Lying' and 'Hanging' were excluded from the analysis as they occurred too infrequently (i.e. <5 observations). The three most common surface behaviours, apart from those associated with respiration and diving, were fluke slap, breach and pectoral slap followed by peduncle slap and feeding lunge (Table 3.4). As an individual sampling protocol was not used in this study, true behavioural frequencies per whale could not be established. Instead behaviour rates were calculated by dividing the behaviour frequency per pod by the number of animals in the pod. The frequency of the five most common aerial behaviours was highest for pectoral slaps followed by feeding lunge and fluke slap (Table 3.4).

Breaches occurred in 92 pods (i.e. 26% of all pods) (Table 3.4). Other pods were sighted nearby during 44 of the 92 observations (i.e. 48%) in which breaches occurred. Although the behaviour of nearby pods was not quantified, 27 of these pods (i.e. 61%) were also seen breaching.

A total of 105 pods (30%) exhibited no other behaviour apart from that associated with diving and respiration. Of these pods, 66 were non-calf pods (29% of all non-calf pods, n = 226) and 39 (31% of calf pods n = 124) were calf pods. There was no significant difference in the relative proportion of calf pods and non-calf pods exhibiting no surface behaviour ($\chi^2 = 0.04$, df = 1, p = 0.84).

Table 3.4. Number and percentage of humpback whale pods observed displaying five surface-active behaviours with the mean and median frequency (expressed as number per minute of observation per whale), standard error and interquartile range (IQR) of each of the behaviours (n = 350).

Behaviour	Number of Pods	% of All Pods	Mean Frequency (per min/per whale)			
			Mean	SE	Median	IQR
Fluke Slap	93	27	0.3	0.1	0.1	0.2
Breach	92	26	0.2	0.05	0.1	0.2
Pectoral Slap	82	23	0.5	0.1	0.05	0.3
Peduncle Slap	66	19	0.1	0.03	0.04	0.1
Feeding Lunge	60	17	0.3	0.04	0.2	0.4

There was a strong correlation between the occurrence of breaches and rolls in mother calf pods but not for non-calf pods (all pods Spearman's rho = 0.11, p = 0.02; non-calf pods Spearman's rho = 0.002, p = 0.98; calf pods: Spearman's rho = 0.25, p = 0.005). A significant correlation was found between breaches and fluke slaps for all pods (Spearman's rho = 0.26, p <<0.001) and between breaches and pectoral slaps for all pods (Spearman's rho = 0.26, p <<0.001). The occurrence of breaches and peduncle slaps were also related but only for mother-calf pods (all pods: Spearman's rho = 0.19, p <<0.001; non-calf pods: Spearman's rho = 0.11, p = 0.05; calf pods: Spearman's rho = 0.30. p = 0.001.

3.4.2 Effects of pod size and composition on whale behaviour

Pod composition

Pods were separated into two groups based on the presence or absence of a calf. Mother-calf pods performed slip unders, rises, fluke slaps, porpoises, and breaches significantly more frequently than non-calf pods (Table 3.5). The only surface behaviour that occurred significantly more frequently in non-calf pods was fluke up (Table 3.5). The frequencies of breaches and rolls have been shown to decrease in the presence of vessels for calf pods only, whilst the frequency of pectoral waves have been shown to decrease in the presence of vessels for non-calf pods only (see Chapter 5). Thus an additional analysis of breach, roll and pectoral wave frequencies was included using observations in the absence of vessels only (i.e. control data). When using the control data, breaches remained more frequent for calf pods and differences in pectoral waves remained insignificant, but roll frequency was highest for calf pods. ANOSIM revealed differences in the composition of surface-active behaviours between calf and non-calf pods (R = 0.07, p = 0.004, average dissimilarity = 78.9%). Fluke slap, breach and pectoral slap contributed to most of the variation (Table 3.6).

There was no significant difference in DR between calf pods and non-calf pods (Table 3.7a). Mean Dive Time (MDT) and %TS has been shown to increase for calf pods in the presence of vessels (see Chapter 5). Thus for the purpose of this chapter,

analysis of MDT and %TS only included observations made in the absence of vessels. Per cent TS and MDT were higher for non-calf pods than calf pods (Table 3.7b).

MBI_{whale} was significantly longer for calf pods (Table 3.7a). For those 21 calf pods where individuals could be identified, $MBI_{individual}$ did not differ between a mother and its calf ($U = 180$, $z = -0.53$, $p = 0.60$).

Wilcoxon matched-pairs signed ranks test of the mean frequencies of each behaviour for all 21 individual mothers and 21 individual calves revealed that the calf displayed the following behaviours significantly more frequently than the mother: peduncle arch ($z = -3.53$, $p<<0.001$), rise ($z = -3.29$, $p = 0.001$), roll ($z = -2.366$, $p = 0.018$) and fluke flick ($z = -2.02$, $p = 0.043$). Mothers 'fluked up' more frequently than the calf ($z = -2.46$, $p = 0.014$). DR was higher for mothers than calves ($z = -3.523$, $p << 0.001$). There were no significant differences for slip under rate (SUR) or %TS between mothers and calves.

Pod size

Pods were separated into three groups according to size: 1 whale, 2 whales or $\geq$3 whales. ANOSIM and SIMPER analysis revealed no significant differences in the composition of surface-active behaviours (i.e. behaviours not related to respiration and diving) for pod size. The occurrence of the five most common aerial behaviours (apart from those associated with respiration and diving) were analysed for the three pod size categories using the Kruskal-Wallis Test. The frequencies of pectoral slaps, fluke slaps and breaches were lowest for pods of three or more whales (Table 3.8). Single pods had the highest fluke slap and breach rate.

Table 3.5. Mann-Whitney U analysis of differences in behavioural frequencies for humpback whale calf and non-calf pods. * significantly higher at 0.05 probability level.

Behaviour	Mean Behavioural Frequency (per min/ per whale)												Mann- Whitney U Test Statistics
	Non-calf pods						Calf pods						
	Mean	SE	Median	IQR	Mean Rank	*n*	Mean	SE	Median	IQR	Mean Rank	*n*	
Slip Under	0.2	0.02	0.1	0.2	139.0	196	0.4	0.04	0.2	0.6	186.3	117	U = 8053 z = -4.19 p <<0.001*
Rise	0.2	0.2	0.1	0.1	122.6	180	0.3	0.03	0.2	0.3	189.0	117	U = 5836 z = -6.52 p << 0.001*
Fluke Slap	0.3	0.1	0.1	0.2	41.9	59	0.3	0.1	0.1	0.3	54.0	39	U = 779 z = -2.13 P = 0.03
Porpoising	0.03	0.01	0.04	0.03	4.9	7	0.3	0.2	0.1	0.1	10.2	7	U = 6 z = -2.36 p = 0.02
Breach (all)	0.2	0.1	0.1	0.1	41.4	52	0.3	0.1	0.1	0.3	53.2	40	U = 774 z = -2.09 p = 0.04
Breach (control)	0.2	0.1	0.1	0.1	18.2	25	0.5	0.1	0.3	0.7	29.1	20	U = 129 z = -2.76 p = 0.06
Fluke Up	0.1	0.01	0.1	0.1	126.3	160	0.05	0.005	0.04	0.05	105.6	78	U = 5158 z = -2.17 p = 0.03
Feeding Lunge	0.4	0.05	0.2	0.4	31.8	51	0.2	0.05	0.2	0.2	23.4	9	U = 166 z = -1.31 p = 0.19

Behaviour	Mean Behavioural Frequency (per min/ per whale)												Mann- Whitney U Test Statistics
	Non-calf pods						Calf pods						
	Mean	**SE**	**Median**	**IQR**	**Mean Rank**	***n***	**Mean**	**SE**	**Median**	**IQR**	**Mean Rank**	***n***	
Roll (all)	0.05	0.01	0.03	0.05	39.3	180	0.1	0.04	0.05	0.1	47.4	117	U = 726 z = -1.51 p = 0.13
Roll (control)	0.04	0.01	0.03	0.02	9.9	9	0.1	0.03	0.1	0.11	16.7	19	U = 44 z = -2.04 p = 0.04
Pectoral Wave (all)	0.05	0.01	0.02	0.04	30.7	43	0.03	0.01	0.02	0.04	23.7	14	U = 226 z = -1.38 p = 0.17
Pectoral Wave (control)	0.1	0.02	0.04	0.1	17.5	23	0.03	0.01	0.02	0.04	13.8	9	U = 79 z = -1.01 p = 0.32

(all)= all observations, i.e. land and boat-based combined, (control) = observations made in the absence of vessels, i.e. land-based observations.

Table 3.6. Results of SIMPER routine including the average abundance of humpback whale surface-active behaviours for non-calf and calf pods, average dissimilarity and the percentage contribution to variation for each of the behaviours.

Behaviour	Average Abundance		Average Dissimilarity	% contribution
	Non-calf	Calf		
Fluke Slap	0.2	0.4	13.6	17.2
Breach	0.2	0.4	12.4	15.7
Pectoral Slap	0.3	0.2	11.4	14.4
Feeding	0.2	0.1	7.5	9.5
Roll	0.1	0.3	7.3	9.2
Side Fluke	0.1	0.1	6.6	8.4
Pectoral Wave	0.2	0.1	6.1	7.7
Peduncle Slap	0.1	0.2	5.5	6.9
Spy Hop	0.01	0.1	4.3	5.5

Table 3.7. Mann-Whitney U analysis of differences in **a)** Dive Rate (DR) and Mean blow interval per whale (MBI_{whale}) for all humpback whale non-calf pods and calf pods and **b)** Percentage of time pods spent submerged (%TS) and Mean Dive Time (MDT) for humpback whale non-calf pods and calf pods in the absence of vessels.

a)

Pods Response	DR (min)				*n*	Mean Rank	Test Statistics
	Mean	SE	Median	IQR			Mann-Whitney U = 13919
Non-calf pods	0.1	0.01	0.1	0.1	226	175.1	z = -0.10
Calf pods	0.1	0.2	0.1	0.1	124	169.2	p = 0.92
	MBI_{whale} (min)				***n***	**Mean Rank**	**Test Statistic**
	Mean	SE	Median	IQR			Mann-Whitney U = 10366
Non-calf pods	1.1	0.1	0.8	0.7	226	159.4	z = -0.38
Calf pods	1.5	0.1	1.1	0.8	122	202.5	p <0.001

b)

Pods Response	%TS				*n*	Mean Rank	Test Statistics
	Mean	SE	Median	IQR			Mann-Whitney U = 1882
Non-calf pods	43.5	2.9	42.5	48.9	90	78.6	z = -2.26
Calf pods	32.6	3.6	29.8	46.3	54	62.4	p = 0.02
	MDT (min)				***n***	**Mean Rank**	**Test Statistic**
	Mean	SE	Median	IQR			Mann-Whitney U = 1905
Non-calf pods	2.7	0.2	2.3	3.2	90	78.3	z = -2.17
Calf pods	1.8	0.2	1.9	2.7	54	62.8	p = 0.03

Table 3.8. Kruskal-Wallis analysis of differences in five aerial behaviours for humpback whale pods of 1, 2 and 3 or more whales including the mean and median frequency, standard error and interquartile range (IQR) of each of the behaviours.

Behaviour	Mean Behavioural Frequency (per min/per whale)						Test Statistics
	Mean	SE	Median	IQR	Mean Rank	*n*	
Pectoral Slap							
1 whale	0.7	0.4	0.1	1.0	46.5	12	$\chi^2 = 10.97$ df = 2, p = 0.004
2 whales	0.6	0.2	0.1	0.9	48.1	42	
≥ 3 whales	0.1	0.1	0.03	0.1	29.4	28	
Fluke Slap							
1 whale	1.6	0.9	0.5	2.0	62.8	8	$\chi^2 = 12.65$ df = 2, p = 0.002
2 whales	0.3	0.1	0.1	0.3	53.7	47	
≥ 3 whales	0.1	0.03	0.04	0.1	35.4	38	
Breach							
1 whale	0.4	0.2	0.2	0.2	60.3	14	$\chi^2 = 13.22$ df = 2, p = 0.001
2 whales	0.2	0.1	0.1	0.2	49.8	55	
≥ 3 whales	0.1	0.03	0.02	0.1	30.2	23	
Peduncle Slap							
1 whale	0.3	0.2	0.04	0.2	39.6	8	$\chi^2 = 1.33$ df = 2 p = 0.51
2 whales	0.1	0.03	0.05	0.1	33.7	41	
≥ 3 whales	0.1	0.03	0.02	0.1	30.2	17	
Feeding Lunge							
1 whale	0.4	0.1	0.2	0.8	29.5	10	$\chi^2 = 3.35$ df = 2, p = 0.86
2 whales	0.3	0.05	0.2	0.4	29.6	28	
≥ 3 whales	0.4	0.1	0.3	0.4	32.1	22	

Pod size and composition

Pods were broken down further into five groups according to size and composition: 1 whale (non-calf), 2 whales (non-calf), 3 or more whales (non-calf), mother-calf pod and mother-calf + escort (s). The frequency of pectoral slaps was lowest for non-calf pods of more than three whales and highest for non-calf pods of one and two whales (Table 3.9). Fluke slap frequency was also lowest for non-calf pods of more than three whales but was highest for single whales.

ANOSIM and SIMPER analysis of surface-active behaviours revealed a significant difference between the behaviour of pods of three or more whales without a calf and mother-calf pods (R = 0.09, p<<0.001, average dissimilarity = 84.7%). The activities contributing to the most variation were feeding (occurred more often in pods of ≥ 3 whales), fluke slap, breach, pectoral slap and roll (all of which occurred more often in mother-calf pods) (Table 3.10a).

The other pairwise comparisons revealed significant differences between single whales and pods comprising mother, calf + escort (R = 0.09, p = 0.02, average dissimilarity = 80.1). The behaviours contributing to the most variation included breach, fluke slap, pectoral slap and feeding which were all more common for single whales (Table 3.10b).

Effect of sea conditions and wind speed on whale behaviour

The frequencies of the five most common aerial behaviours were compared across sea conditions (Table 3.11). The frequency of breaches was highest in rough conditions and lowest in smooth conditions. The frequency of peduncle slaps increased with higher seas. Feeding frequency was highest in calm conditions. There were no significant differences in breach or peduncle slap frequency with varying wind speeds (breach: $\chi^2 = 5.67$, df = 4, p = 0.226; peduncle slap: $\chi^2 = 6.65$, df = 4, p = 0.155), however feeding frequency was highest when wind speed was between 0 – 6 km/h ($\chi^2 = 16.84$, df = 4, p = 0.002).

Table 3.9. Kruskal-Wallis analysis of differences in five common surface-active behaviours for humpback whale pods of 1) 1 whale (non-calf); 2) 2 whales (non–calf); 3) 3 or more whales (non- calf); 4) mother-calf; and 5) mother-calf + escort(s).

Behaviour	Mean Behavioural Frequency (per min/per whale)						Test Statistics
	Mean	SE	Median	IQR	Mean Rank	*n*	
Pectoral Slap							
1 whale (non-calf)	0.7	0.1	0.1	1.0	46.5	12	χ^2 = 12.59 df = 4, p = 0.01
2 whales (non-calf)	0.6	0.2	0.2	1.1	52.3	22	
≥3 whales (non-calf)	0.2	0.1	0.03	0.05	28.2	20	
Mother-calf	0.6	0.2	0.05	0.3	43.5	20	
Mother-calf + escort(s)	0.1	0.04	0.04	0.1	32.6	8	
Fluke Slap							
1 whale (non-calf)	1.5	0.9	0.5	2.0	62.8	8	χ^2 = 17.69 df = 4, p = 0.001
2 whales (non-calf)	0.2	0.1	0.1	0.3	48.0	22	
≥3 whales (non-calf)	0.1	0.03	0.03	0.1	29.4	24	
Mother-calf	0.4	0.1	0.1	0.3	58.7	25	
Mother-calf + escort(s)	0.2	0.05	0.1	0.2	45.6	14	
Breach							
1 whale (non-calf)	0.4	0.2	0.2	0.2	54.2	14	χ^2 = 2.50 df = 4, p = 0.64
2 whales (non-calf)	0.1	0.01	0.05	0.1	43.0	24	
≥3 whales (non-calf)	0.03	0.01	0.01	0.03	44.3	14	
Mother-calf	0.4	0.1	0.1	0.5	47.9	31	
Mother-calf + escort(s)	0.1	0.1	0.05	0.2	42.6	9	
Peduncle Slap							
1 whale (non-calf)	0.3	0.2	0.04	0.2	39.6	8	χ^2 = 3.66 df = 4, p = 0.45
2 whales (non-calf)	0.1	0.02	0.02	0.1	29.4	20	
≥3 whales (non-calf)	0.05	0.02	0.02	0.1	27.4	9	
Mother-calf	0.2	0.05	0.1	0.2	37.8	21	
Mother-calf + escort(s)	0.1	0.1	0.04	0.1	33.2	8	
Feeding Lunge							
1 whale (non-calf)	0.4	0.1	0.2	0.8	29.5	10	χ^2 = 9.55 df = 4, p = 0.05
2 whales (non-calf)	0.3	0.1	0.2	0.3	26.3	22	
≥3 whales (non-calf)	0.5	0.1	0.4	0.4	35.6	19	
Mother-calf	0.5	0.1	0.5	0.3	41.7	6	
Mother-calf + escort(s)	0.1	0.02	0.1	-	10.0	3	

Table 3.10. Results of SIMPER routine including the average abundance of surface-active behaviours, average dissimilarity and the percentage contribution to variation for each of the behaviours for **a)** humpback whale pods of 3 or more whales and mother-calf pairs and **b)** single humpback whale pods and mother-calf + escort pods.

a)

Behaviour	**Average Abundance**		**Average Dissimilarity**	**% contribution**
	≥ 3 whales	**Mother + calf**		
Feeding	0.3	0.1	0.7	13.5
Fluke Slap	0.2	0.3	0.8	13.4
Breach	0.1	0.3	0.9	13.9
Pectoral Slap	0.2	0.2	0.8	10.8
Roll	0.1	0.2	0.8	10.2
Peduncle Slap	0.1	0.2	0.7	7.4
Side Fluke	0.1	0.1	0.6	6.8
Pectoral Wave	0.1	0.1	0.6	5.6
Spy Hop	0.1	0.1	0.6	4.7
Fluke Swish	0.1	0.03	0.4	3.5
Porpoise	0.03	0.05	0.3	2.9

b)

Behaviour	Average Abundance		Average Dissimilarity	% contribution
	1 whale	Mother-calf + escort		
Fluke Slap	0.4	0.1	12.7	15.9
Breach	0.2	0.1	10.9	13.7
Pectoral Slap	0.3	0.03	8.9	11.1
Feeding	0.1	0.01	8.3	10.3
Peduncle Slap	0.1	0.04	7.3	9.1
Side Fluke	0.03	0.03	6.6	8.2
Roll	0.02	0.00	6.4	8.0
Pectoral Wave	0.03	0.01	4.5	5.6
Spy Hop	0.00	0.01	4.2	5.2

Table 3.11. Kruskal-Wallis analysis of differences in five common humpback whale surface-active behaviours for observations made during calm (n = 49), smooth (*n* = 90), slight (*n* = 112), moderate (*n* = 64) and rough (*n* = 16) sea conditions.

Behaviour	Mean Rank	Test statistics
Pectoral Slap		$\chi^2 = 2.39$ df = 4 p = 0.66
calm	168.1	
smooth	174.2	
slight	163.2	
moderate	157.1	
rough	168.5	
Fluke Slap		$\chi^2 = 6.63$ df = 4 p = 0.16
calm	148.9	
smooth	168.1	
slight	166.4	
moderate	166.3	
rough	202.7	
Breach		$\chi^2 = 14.07$ df = 4 p = 0.01
calm	166.4	
smooth	144.7	
slight	176.1	
moderate	168.0	
rough	205.9	
Peduncle Slap		$\chi^2 = 10.53$ df = 4 p = 0.03
calm	146.4	
smooth	163.1	
slight	164.1	
moderate	183.6	
rough	185.6	
Feeding Lunge		$\chi^2 = 9.15$ df = 4 p = 0.06
calm	190.4	
smooth	165.7	
slight	158.0	
moderate	162.1	
rough	165.0	

3.5 DISCUSSION

3.5.1 General observations

Pod size was similar to that observed previously for southbound humpbacks from the Antarctic Area V population (Brown & Corkeron 1995, Corkeron *et al.* 1994). Most calf pods were observed in late October through to mid and late November. This time period represents the end of the southward migration past the study area. This pattern has previously been observed for southward migrating whales (Corkeron *et al.* 1994) and coincides with the timing of their departure from the breeding area. The southward migration of humpback whales in the southern hemisphere is segregated according to age and sex class with mother-calf pods being the last class to leave the breeding area (Chittleborough 1965, Dawbin 1966, Dawbin 1997).

3.5.2 Surface active behaviours

Surface-active behaviours were common in this study area with 70% of pods exhibiting them. This is higher than reported by Corkeron (1995) who found 56% of pods on the nursery grounds in Hervey Bay were surface-active. The most common surface-active behaviours were pectoral slaps, feeding lunges, fluke slaps, breaches and peduncle slaps.

Interpreting whale surface behaviour is extremely difficult, given that behaviours can be multifunctional. All of the aerial displays are observed frequently in both high and low- latitude habitats, and are all conducted by animals of both sexes and all age classes from calves to adults (Clapham 2000). A summary of the proposed functions of common surface-active behaviours that varied in frequency with pod size and composition is follows. A detailed discussion of feeding is provided in Chapter 4.

Breach

There are many theories as to why whales breach. These are reviewed in Whitehead (1985). The most plausible functions of a breach, supported by research include the following.

1) *Communication*. Breaching is prevalent among single whales (Coleman 1994, Bauer 1986) and is most likely to occur during the joining and splitting of the group (Whitehead 1985). This has prompted authors to hypothesise that breaching is a form of short term signalling (e.g. a signal to another pod of a willingness to be escorted). Coleman (1994) found aerial behaviours were often repeated by the same pod and by other pods in the area, suggesting that surface behaviour could be a result of intra-pod and inter-pod communication or that it could be the result of pods responding to the same proximate factors. This pattern was also observed in the present study which supports these hypotheses.
2) *Play and development in calves.* Breaching may help with muscle development (Whitehead 1985, Bauer 1986, Coleman 1994) and could be related to nursing/suckling activity (e.g. breaching may represent calf excitement or calf frustration with denied suckling) (Coleman 1994).
3) *Challenging and courtship.* Breaching may be used by males as a dominance display or threat or may be used by females as part of mate avoidance (Coleman 1994, Bauer 1986, Whitehead 1985).
4) *Excitement or startle response.* Bauer (1986) reported humpback whales breaching in an apparent response to the pass by of rapidly moving vessels. Humpback whales in the present study area have also breached when in close proximity to fast travelling vessels (personal observations).

The available evidence, including that provided by this study, suggests the breaching is related to social activity with no one aspect standing out as the primary stimulus (Whitehead 1985). The findings of this study suggests that breaching is

particularly frequent for mother-calf pods and single whales and is most likely related to inter-pod communication as well as calf play and development.

Pectoral Slap

Pectoral slaps were common in mother-calf pods in this study. Coleman (1994) also found pectoral slaps prevalent in mother-calf pods, suggesting they are important in communication between mothers and calves. Pectoral slaps have been found to increase in frequency with pod size (Bauer 1986, Coleman 1994). This has led to the hypothesis that pectoral slaps are a threat or defensive display between individuals indicative of mate avoidance or male competition. The results of this study contrast with those of Coleman (1994) and Bauer (1986), with pectoral slaps more prevalent in non-calf pods of one or two individuals. However inter- and intra- pod communication and signalling are still the most plausible functions.

Fluke Slap

Baker and Herman (1984) propose that fluke slaps are used by females in response to the aggression and advances of competing males, although these authors point out humpback whales may also fluke slap in other contexts. This theory of fluke slaps being used in mate avoidance is supported by the present study in which fluke slaps were most prevalent in mother–calf escort pods. This is consistent with Coleman's (1994) proposed theory that fluke slapping is used by the female in mother-calf escort pods as a mate avoidance technique and to dissuade nursing attempts by the calf. Coleman also suggests that when displayed by a calf, fluke slaps may be a sign of frustration at failed nursing attempts or a form of play and development.

This study found that fluke slap displays were not as prolonged in mother-calf escort pods as they were in mother-calf pods suggesting that aggressive displays are shorter than those related to calf play or nursing activity. Fluke slap bout frequency was highest for single whales and, as with breaching, may be used as a signal of a desire to affiliate with a nearby pod. Correlation was found between fluke slaps and breaches, indicating they may be used in conjunction as a communication display. The trend of

decreasing bout frequency with increasing pod size was also observed by Coleman (1994).

Peduncle Slaps

In this study, the occurrence and frequency of peduncle slaps did not vary with pod size or composition. Coleman (1994) found that peduncle slaps were common in small adult pods as well as in mother-calf pods. Coleman reported that peduncle slaps are often performed by single whales and correlate with an individual's recent displacement from a pod. Peduncle slaps are common in competitive pods and are considered a threat display (Baker & Herman 1984, Tyack & Whitehead 1983). As with breaches and fluke slaps, peduncle slaps probably represent mate avoidance in females and frustration, play or muscle development in calves. Peduncle slaps and breaches often occurred together in mother-calf pods.

Peduncle slaps have been observed as an aggressive display towards vessels (Bauer 1986, Clapham 2000). In this study there was no difference in the occurrence of peduncle slaps in the presence or absence of vessels, but bouts were longer when no vessels were present (see Chapter 5). This suggests that peduncle slap displays associated with social activity are more prolonged than when used as an aggressive display towards vessels, although peduncle slaps displayed in the presence of vessels may not always be indicative of aggressive behaviour towards vessels.

Roll

Rolls appear to be related to play and excitement in calves. There was a strong correlation between rolls and breaches in mother-calf pods. Rolls were more common in calf pods than non-calf pods and were usually displayed by the calf in mother-calf pods. Rolls in humpbacks and other species of great whales have been interpreted as being involved in manoeuvring, courtship and play (Pryor 1986).

The importance of surface-active behaviours during migration

Humpback whales are one of the most social species of the baleen whales (Whitehead 1985). Not only are complex social dynamics apparent on the breeding grounds (Clapham et al. 1992, Tyack & Whitehead 1983, Baker & Herman 1984) but social associations and behavioural displays related to play, courtship, cooperative and competitive behaviour have also been noted on high-latitude feeding grounds (Clapham et al. 1993, Weinrich & Kuhlberg 1991, Weinrich 1995, Weinrich 1991, Weinrich et al. 1992b) and during migration (Brown & Corkeron 1995, Cato 1991). The common surface-active behaviours observed in this study (discussed above) are all believed to be associated with inter- and intra – pod communication, challenging and courtship, and play and development in calves. The prevalence of these surface-active behaviours supports the conclusions of Brown and Corkeron (1995, p. 177) that "…the migration of humpback whales is more than just a swim…" and suggests that social interactions and signalling amongst conspecifics is important during migration.

Many of the surface behaviours discussed above are used in mate avoidance. There is evidence to suggest that some mating and mate-guarding is taking place on the southward migration (Brown & Corkeron 1995, Cato 1991). Data collected from whaling stations in Australia suggests that ovulation peaks in June but can occur as late as November (Chittleborough 1965, Chittleborough 1958). Most females would be at the end of their oestrous cycle when passing through the study area between September and November and so are likely to ward off the advances of amorous males. The frequency of mating and mating attempts this far south is unknown.

The higher prevalence of surface behaviours towards the end of the southward migration than on the nursery grounds of Hervey Bay may be due, in part, to the development and capabilities of calves. Older calves may be more playful and better able to engage in energetically demanding surface behaviours. The occurrence of feeding in the study area may have also contributed to the higher incidence of surface behaviours than observed on the nursery grounds.

Relationship between surface-active behaviours and weather conditions

The frequency of breaches and peduncle slaps were found to increase in rougher conditions. This supports the findings of Whitehead (1995) who reported an increase in the frequency of breaches in stronger winds. The reason for the higher occurrence of some surface-active behaviours in higher seas is unclear. It has been suggested that breaching can assist breathing in rough weather (Whitehead 1995). Whitehead notes, however, that breathing is only likely to be a problem for whales when spray is being actively blown over the water surface. This occurs during wind speeds of > 72 km/h and the behaviour of whales has not been documented in these conditions (Whitehead 1985). Whales were observed at ≤ 50 km/h in this study and so ease of breathing cannot account for the increase in breaching in rough weather observed in this study either.

3.5.3 Respiration and diving behaviour

Dive rate did not differ between calf and non-calf pods, although dive rate was higher for mothers than calves within the pod. Calf pods were spending more time at the surface than non-calf pods. Others have also observed increased surface times for calves (Corbelli 2006, Mate & Urban 2006) and this is likely due to limited diving capabilities of young calves. Calf pods were less likely to fluke up than non-calf pods. These finding are consistent with those of Bauer (1986) and probably represent developmental immaturity in calves. The higher frequency of 'rises' (i.e. whale surfaces with no evidence of exhalation) in calf pods may represent observer error. Blows by calves can be small and some may have been missed (Bauer 1986).

3.6 CONCLUSION

Findings of this study support previous research on humpback whale populations in both the northern and southern hemisphere. Evidence suggests that the common surface-active behaviours observed in this study have important communicative and social functions. The high frequency of surface-active behaviours in this study area indicates that social interactions amongst conspecifics and the development of younger whales are important during migration.

CHAPTER 4: Observations of humpback whales (*Megaptera novaeangliae*) feeding during their southward migration along the coast of south-eastern NSW, Australia: Identification of a possible

4.1 ABSTRACT

There is anecdotal evidence of humpback whales (*Megaptera novaeangliae*) feeding in south-eastern New South Wales waters on their southward migration (Paterson 1987). This chapter reports the frequency of feeding whales observed from waters just north of Narooma (36°5' S 149°55' E) to just south of Eden (37°16'S 150°17'E). Observations were made from commercial whale-watching vessels from late September to early November in 2002, 2003 and 2005; and from two land-based whale-watching sites, Montague Island (36°15' S 150°14' E) and Green Cape (37°16' S 150°03' E), in the same period for 2002, 2003, 2004 and 2005. Feeding pods were seen on 24.5% of all whale-watching trips and during 14% of all observations made from land-based sites. Whales fed on schools of small pelagic fish, as well as the coastal krill species (*Nyctiphanes australis)*. The number of feeding pods observed in 2005 was more than four times that observed in the two previous years and most likely was due to the warmer current systems operating in the area in 2005. All observations from land-based sites were made when no vessels were in the vicinity of the focal pod. Feeding behaviour did not alter in the presence or absence of vessels. However the time between feeding lunges increased when the movements of the vessel were not consistent with NSW whale-watching regulations and when more than one vessel was present. Whilst many of the reports of humpback whales feeding in mid- to low-latitude waters in both the southern and northern hemisphere classify this behaviour as a rare opportunistic event, it is probable that south-eastern NSW is a significant supplemental feeding ground for migrating whales, especially when oceanographic conditions are optimal for food productivity.

4.2 INTRODUCTION

Humpback whales (*Megaptera novaeangliae*) in the southern hemisphere are said to rarely feed during their migration between high latitude feeding grounds (60-70° S) and low latitude breeding grounds (15°-20°S) (Chittleborough 1965, Brown & Lockyer 1984). Even so cases of opportunistic feeding by humpback whales during their migration have been documented. Dawbin (1956) first documented humpback whales from the Antarctic Area V feeding between New Zealand's North Cape and East Cape (34° – 38° S). Some of the stomach contents of humpbacks killed by whalers in this area contained krill, predominately the coastal krill species, *Nyctiphanes australis*. (Dawbin 1956, Dawbin 1966) also reported large numbers of humpbacks feeding in Foveaux Strait (46°20' S) during the whales' southern migration past the New Zealand coast. Upwellings occur in this location making it an area with high plankton production (Dawbin 1956). More recently, Gill *et al*. (1998) documented the first case of humpback whales feeding in mid-latitude Tasmanian waters (42°30' S – 43° S). These observations were made in October and November 1996, during the whales' southern migration. Zooplankton netted in water close to where the whales were feeding included *N. australis*. Even more recently, Stockin & Burgess (2004) made the first documented case of Group V humpback whales feeding on bait fish, most likely sardines (*Sardinops sagax*), on the northern migration in low-latitude waters (27° 02' S) around Moreton Island.

For some time the south-eastern New South Wales (NSW) coastline (35° S – 37° S) has been thought to be an opportunistic feeding ground for humpback whales during their southern migration to the Antarctic feeding grounds. Anecdotal evidence of whales feeding in south-eastern NSW waters has existed since 1986 (Paterson 1987). The first commercial whale-watching operation out of Eden (37° S 150° E) began in 1990 and it was then that the operators of the whale-watching vessel first witnessed humpback whales displaying surface feeding behaviours. They noted seeing whales lunging laterally through the water with mouths agape and ventral pleats distended. Feeding humpbacks have been seen by this local commercial operator every whale-watching season since, with the exception of 2001 (R.Butt, pers.comm.).

The south-eastern NSW coast is an area subject to high pelagic plankton productivity during spring when nutrient rich sub-Antarctic water is overlain with warmer East Australian Current (EAC) water (Hallegraeff & Jeffery 1993, Bax *et al.* 2001). This leads to upper water-column stability and upwellings of nutrients, which is conducive for phytoplankton blooms. In addition, the topographic features may enhance nutrient uplifting at the continental shelf break in this area (Bax *et al.* 2001). These productive events, although sporadic and brief, are used by fish for breeding and feeding and create a diverse marine ecosystem (Prince 2001).

This chapter reports on the occurrence of humpback whales from the Antarctic Area V population feeding along the south-eastern coast of NSW. It includes observations made from waters just north of Narooma to just south of Eden (36°5'S - 37°16'S) over three seasons. It also investigates the importance of south-eastern NSW waters as a supplemental feeding ground for humpback whales and the implications for management of the area.

4.3 METHODS

The methods used for humpback whale behavioural observations in this study are the same as those outlined in Chapter 3.

Plankton samples was taken on 6 October 2005 at 37°04'57'' S, 150°00'19'' E and on 14 October 2005 at 37°05'34'' S, 149°59'43'' E. Samples were collected by towing a 300 µm mesh net for 2 minutes at 3.5 km h^{-1} less than 1 m below the surface close to where whales had been observed feeding. The samples were preserved in 10% formaldehyde in unbuffered seawater.

On 1 October 2005 a faecal sample was scooped out of the water with a clean plastic container. Once the faecal matter had settled to the bottom, excess water was decanted off and the sample preserved in 70% alcohol. Total DNA was purified from the faecal matter using a faecal DNA extraction kit (Bio101). The total DNA was then tested for the presence of krill DNA using the PCR method described by Jarman *et al*. (2002).

4.4 RESULTS

Boat-based observations were made during 98 whale-watching trips over 89 days and included 30 trips over 27 days from 21 September to 7 November 2002, 31 trips over 28 days from 21 September to 8 November 2003 and 37 trips over 34 days from 24 September to 4 November 2005 (Table 4.1). The duration of observations ranged from five to 115 minutes (Table 4.2). The length of the boat-based observations depended on the movements of the whale-watching vessel, whilst the length of land observations was dependant on the pod's movements (i.e. observations were terminated if the pod moved >2 km from the observation site) or the intrusion of moving vessels into the observation zone.

Table 4.1. Summary of effort including observation frequency of humpback whales from both whale-watching vessels and land-based observation sites.

	Whale-watching vessels	Land-based observation sites	Total
Days of observations	89	64	153
Total pods observed	217	144	361
Feeding pods observed	41	20	61
Total hours of behavioural observations	121	46	167

Humpback whales were observed feeding on 24 whale-watching trips on 22 separate days (i.e. 24.5% of the total trips made during the study period). The frequency of these feeding observations varied between years: 7% of trips (n = 30) in 2002, 10% of trips (n = 31) in 2003 and 49% of trips (n = 37) in 2005. The total number of feeding pods observed from the whale-watching vessels was 41 out of a total of 217 pods (i.e. 19 %). Rigorous behavioural data were collected for 40 of these feeding pods (detailed behavioural data was not collected for one pod due to equipment failure). All feeding pods were within 16 km from shore (the whale-watching vessels rarely went further out to sea than this) (Figure 4.1).

In 64 days of land-based observations, the total number of feeding pods observed from both sites combined was 20 out of a total of 144 pods (i.e. 14%) (Table 4.1). From the combined observations, feeding pods contained one to six whales but the majority (55%) comprised two individuals (mean = 2.5) (Table 4.2). The average depth of water where the whales were feeding was 61 m and the deepest was 86 m

(Table 4.2). However, whales were at or near the surface most of the time. For 96% of the observation time the interval between surface behaviours was less than 1 min (*n* = 7814). Because individual whales could not be identified confidently each time they surfaced, dive duration was not established for individuals. However, whales in a pod typically moved in a synchronized manner and so were usually below surface and above surface at approximately the same time.

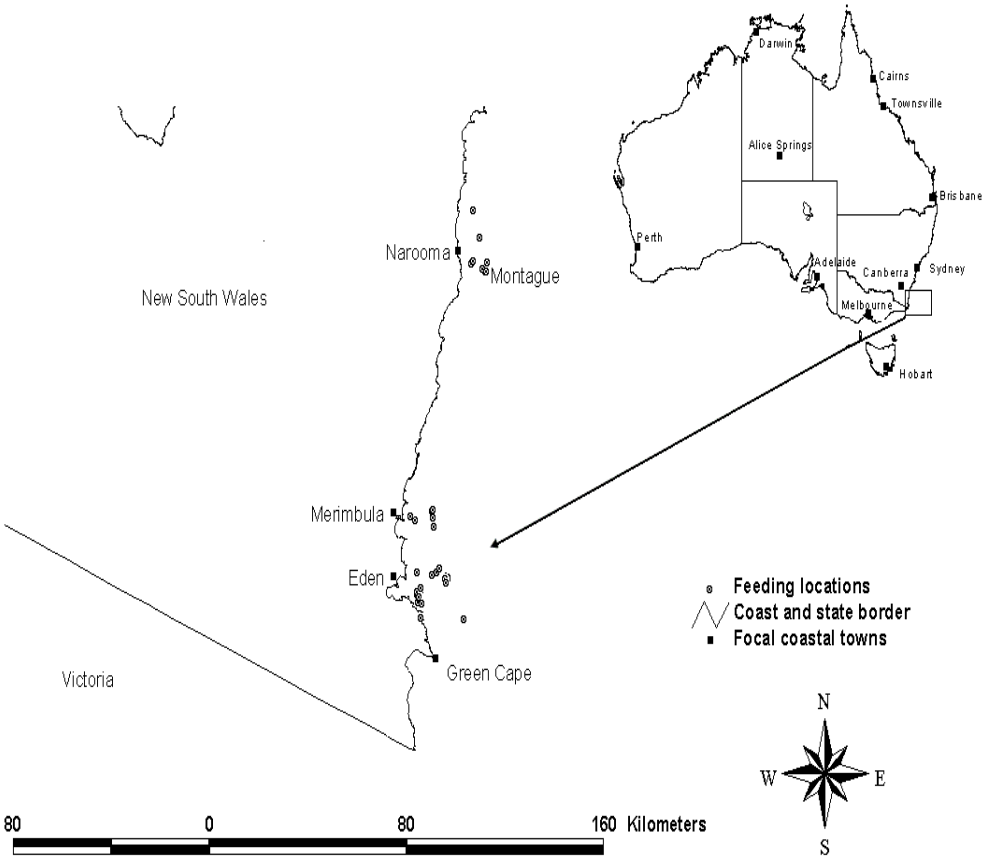


Figure 4.1. Map showing the geographical location of all feeding humpback whale pods observed from whale-watching vessels during the 2002, 2003 and 2005 study seasons.

Table 4.2. Summary of observations of all feeding humpback whale pods observed from whale- watching vessels and land-based observation sites during the 2002, 2003, 2004 and 2005 study seasons.

	Minimum	Maximum	Mean	SE	*n*
Pod Size	1	6	2.5	0.2	60
Number of lunges (per observation)	1	75	16	2.5	60
Feeding lunge frequency (per min/per pod)	0.02	9.1	0.9	0.2	60
Feeding frequency (per min/per whale)	0.01	1.8	0.4	0.1	60
Observation time (min)	5	100	32	3	60
Water depth (m)	26	86	61	2.5	39

Feeding whales typically lunged laterally through the surface of the water with their mouths agape at an approximately 45° angle and their ventral pleats fully extended. Occasionally, whales lunged sideways just below the surface. Often individuals from the same pod moved in a synchronized manner, frequently changing direction and sometimes moving in small circles (usually about one to two body lengths in radius). Whales often lunged simultaneously and in close proximity to one another. Feeding lunges were typically followed by a blow (i.e. exhalation at the surface) and then a peduncle arch or a slip under (i.e. whale slips back beneath the surface).

Generally, the presence of the whale-watching vessel did not appear to influence feeding behaviour. On approach, whales often frequently changed direction, which resembled avoidance behaviour. But once the whales started lunge-feeding, it became clear that the frequent changes in direction were more likely a foraging strategy than a response to the whale-watching vessel. Whales would often lunge close to the vessel. Forty –two per cent (n = 564) of feeding lunges were performed less than 100 m from the vessel and 57% of these lunges were performed less than 50 m from the vessel.

During the majority of whale-watching trips, the approach and movements of the vessel whilst watching the whales complied with the NSW whale-watching regulations. On 16 of 24 whale-watching trips, the vessel was either sitting idle or moving at a no-wake speed parallel to the whales at 100 m or greater separation, which is consistent with the regulations. During the other eight whale-watching trips, the vessel approached closer than the 100 m approach limit and/or travelled into the whales' path.

The mean feeding lunge frequency per pod was 0.93 per min (SE = 0.18) and the maximum was 9.12 per min (Table 4.2). Because an individual sampling protocol was not used in this study, an actual lunge frequency for individual whales could not be established, but instead 'feeding lunge frequency per whale' was calculated by dividing the lunge frequency per pod by the number of whales in the pod. For mother/calf pods, the calf was excluded from the analysis because only the mother and/or escort performed feeding lunges. The mean feeding frequency per whale (Table 4.2) was 0.37 per min (SE = 0.05). There was no significant difference in feeding lunge frequency if a vessel was present or not (Table 4.3) and vessel proximity did not affect the feeding lunge frequency (Table 4.4).

Table 4.3. Differences in humpback whale feeding lunge frequency and mean feeding lunge interval in the presence and absence of vessels.

		n	Mean	Mean Rank	SE	Test Statistics
Feeding lunge frequency (per min/ per whale)	Vessel Present	40	0.3	28.8	0.1	Mann-Whitney U =330 z = -1.10 p = 0.27
	Vessel Absent	20	0.4	34.0	0.1	
Mean feeding lunge interval (s)	Vessel Present	39	94	30	14	Mann-Whitney U = 336 z= -0.56 p = 0.57
	Vessel Absent	19	67	28	11	

Most pods (73%) were still feeding when the whale-watching vessel left the area, and the remaining 11 pods had stopped feeding >5 min before the vessel left. The termination of feeding behaviour by six of these pods (15 % of all feeding pods) was likely in response to the whale-watching vessel. Two pods stopped feeding and approached the vessel to <5 m, apparently to investigate it. Four pods stopped feeding when the vessel was travelling less than 50 m from the pod and they may have been disturbed by the vessel's proximity. On one of these occasions the vessel travelled through the baitfish ball that the whale was feeding on. On another occasion when the vessel approached within 70 m, the pod stopped feeding and both mother and calf began fluke slapping and peduncle slapping.

Seventy-six per cent (*n* = 625) of the intervals between each feeding lunge (FLI) were ≤ 60 s. These were not calculated for individuals and so the high number of FLIs ≤

60 s can in part be attributed to pods of more than one whale lunging either simultaneously or only a few seconds apart. Even so, 52% of FLIs were between 6 and 60 s. Long FLIs (> 5 min) were rare, occurring in 26 out of 625 FLIs (i.e. 4%). The presence of the whale-watching vessel probably contributed to the break in feeding lunges on at least nine of these 26 occasions. On six occasions, the whales came close to the vessel, often circling, before heading further away to feed. On the other three occasions, the vessel was still moving towards the pod and was within 50-80 m of it. On two of these occasions, the vessel had cut into the path of the whales at 80 m.

Although there was no difference in mean FLI in the presence or absence of a vessel (Table 4.3), mean FLI was significantly longer when the vessel's movements were not consistent with whale-watching regulations (Table 4.4). A potential confounding factor in these analyses is uncontrolled variation in pod size. A full factorial general linear model of vessel movement (fixed factor – consistent or inconsistent with regulations) with pod size (random factor) was used for variance estimation by the restricted maximum likelihood method. The results showed essentially no contribution by pod size (~ 0) to the variance in mean FLI and only 4.5% contribution to the variance from the interaction between pod size and vessel movement. On five of the 11 occasions that the vessels movements were not consistent with the regulations, the pod had a break in feeding longer than 5 minutes.

Table 4.4. Mann-Whitney U analysis of differences in humpback whale feeding lunge frequency and mean feeding lunge interval when the movements of the whale-watching vessel were and were not consistent with NSW whale-watching regulations.

	Vessel movements	*n*	Mean	Mean Rank	SE	Test Statistics
Feeding lunge frequency (per min/ per whale)	Consistent	29	0.4	21.6	0.1	Mann-Whitney U = 127 z = -0.984 p = 0.34
	Not Consistent	11	0.7	17.6	0.1	
Mean feeding lunge interval (seconds)	Consistent	28	81	17	17	Mann-Whitney U = 81 z = -2.278 p = 0.02
	Not Consistent	11	127	27	24	

During nine pod observations more than one vessel was present. For six of these nine observations two vessels were watching the pod. On two occasions there were

three vessels and on another there were four vessels watching the pod. Mean FLI was significantly longer when more than one vessel was watching the pod (Table 4.5). Ten of the 26 occasions (38%) where FLI was >5 min occurred whilst more than one vessel was watching the pod.

Table 4.5. Mann-Whitney U analysis of differences in humpback whale feeding lunge frequency and mean feeding lunge interval when only one whale-watching vessel was present and when more than one whale-watching vessel was present.

		n	Mean	Mean Rank	SE	Test Statistics
Feeding lunge frequency (per min/ per whale)	1 vessel	31	0.4	22.1	0.1	Mann-Whitney U = 89 z = -1.636 p = 0.10
	>1 vessel	9	0.2	14.9	0.1	
Mean feeding lunge interval (s)	1 vessel	30	82	18	16	Mann-Whitney U = 70 z = -2.167 p = 0.03
	> 1 vessel	9	132	27	27	

The presence of krill in the upper water column was noted on five occasions during 2005 only. On two of these occasions (6 October 2005 and 14 October 2005) a plankton sample was taken and the krill identified as *Nyctiphanes australis*. Salps, probably horned or blue salp (*Thalia democratica)* (Iain Suthers, personal comm.), were noted on six occasions during 2005, but were not seen during 2002 and 2003. During 2005, whales fed on baitfish on six separate occasions. On 7 October 2005, the baitfish were identified by the skipper of the vessel as jack mackerel (*Trachurus declivis*), also known as cowanyoung or horse mackerel, a small surface-schooling pelagic fish abundant in south-eastern Australian waters (Williams & Pullen 1993). Other small schooling fish common to the study area include redbait *(Emmelichthys nitidus),* pilchards *(Sardinops neopilchardus)*, sandy sprat or whitebait (*Hyperlophus vittatus*), blue mackerel or slimy mackerel (*Scomber australasicus)* and yellowtail scad (*Trachurus novaezelandiae*) (Williams & Pullen 1993, Kailola *et al.* 1993, Young *et al.* 2001).

On 7 October 2005, whales observed feeding on *T. declivis* were utilizing a slightly different feeding technique from that described above. Whales moved slowly through the water with their mouth open at an approximately 60 - 90° angle so that the upper jaw was extended vertically from the water (Figure 2). The whales skimmed the surface of the water column for extended periods (typically 4 to 5 s, maximum 17 s),

which is longer than a typical lateral lunge feed when the mouth is usually open for 2 s. A video clip taken of a whale feeding in this manner can be seen at http://www.aquaticmammalsjournal.org/Video/index.htm

Figure 4.2. A humpback whale with its mouth open at 90° skimming the surface of the water whilst feeding on baitfish off Narooma, south-eastern NSW on 7 October 2005 (photograph K. Stamation).

Five of the 41 feeding pods comprised mother-calf pairs. At the time when mother/calf pods migrate through the study area (October – November) the calves are assumed to be between 12 – 16 weeks of age. Typically, calves stayed near the mother while she fed, often rising beside her as she lunged with her mouth open (Figure 3a). On 16 October 2005, a calf rose vertically from the water column, opening and closing its mouth in the air with its ventral pleats slightly distended (Figure 3b). The calf appeared to be mimicking its mother's feeding lunges; the calf often displayed this behaviour shortly after the mother had performed a lateral lunge feed. This behaviour was observed 19 times over the 75-min observation period on 16 October 2005. For a video clip sample of this behaviour see http://www.aquaticmammalsjournal.org/Video/index.htm

Defecation was observed on three occasions, once on 26 September 2005 and twice on 1 October. The faecal sample collected on 1 October contained Krill DNA, confirming that the whales had fed on krill recently.

Figure 4.3a. A humpback whale calf rising beside its mother whilst the mother is lateral lunge feeding off Merimbula, south-eastern NSW, on 16 October 2005 (photograph W. Reynolds).

Figure 4.3b. The same calf as in Figure 3a rising vertically out of the water whilst opening its mouth with ventral pleats partially extended, off Merimbula, south-eastern NSW, on 16 October 2005 (photograph W. Reynolds).

4.5 DISCUSSION

There are many reports of humpback whales feeding in mid- to low-latitude waters during migration, not only for the Area V population of humpbacks in Australian and New Zealand waters (Dawbin 1956, Gill *et al.* 1998, Stockin & Burgess 2005) but also for the North Pacific (Gendron & Urban 1993) and North Atlantic Ocean populations (Baraff *et al.* 1991, Swingle *et al.* 1993). Whilst most of these reports probably represent opportunistic feeding events, the behaviour was relatively common on the NSW south coast. The NSW south coast may therefore be a significant feeding ground for humpback whales on their southward migration, especially when the oceanographic conditions are optimal for productivity.

Migration places large energetic demands on the whales; especially on pregnant, lactating and post-lactating females (Brown & Lockyer 1984). By the time the whales reach south-eastern NSW waters it has been several months since they left their Antarctic feeding grounds. It thus makes physiological sense that humpback whales use this area as a supplemental feeding ground when they encounter large prey patches. The increase in the number of feeding pods in 2005 may be explained by changes in the East Australian Current (EAC) system. AVHRR SST (Sea surface temperature) data show that during the 2005 study period there was a strong warm current off the shelf that was often 2° C warmer than the currents in the same area during the 2002 and 2003 seasons.

Humpback whales have two main feeding techniques. Lateral lunge feeding (feeding lunges without the use of a bubblenet) and bubblenetting (creating a ring or cloud of bubbles before lunging up through its centre). All pods in this study used the lateral lunge feeding technique. The use of bubble clouds to trap prey is most common in the North Atlantic when humpbacks feed on small schooling fish and also has been seen in the North Pacific (Weinrich *et al.* 1992c). In this study, feeding pods commonly consisted of two individuals, like observations of feeding whales in other areas (Weinrich & Kuhlberg 1991, Gill et al. 1998). (Dolphin 1987a, Dolphin 1987b) found that dive duration correlated with depth. Pods were typically spending less than one minute

below the surface and so prey must have been at or close to the surface layer. This is consistent with observations made by Gill *et al*. (1998).

In this study many pods clearly displayed cooperative foraging which has mostly been documented within fish schools (Weinrich & Kuhlberg 1991). Foraging in a group may be more efficient on large mobile fish schools as they can be corralled more easily and some fish may inadvertently swim into the mouth of an adjacent whale whilst fleeing a neighbouring one (Baker *et al.* 1982, Whitehead 1983, Weinrich & Kuhlberg 1991). However in this study, cooperative feeding was observed within both fish schools and krill patches.

This study reports a humpback whale calf imitating its mother's lateral lunge feeding on the southern breeding migration. Dawbin (1966) described similar displays by southbound calves in Foveaux Strait, New Zealand. Dawbin reported calves swimming with their mouths open through dense plankton swarms and suggested that calves could be consuming substantial amounts of solid food, in addition to milk. The calf observed in this study, however, did not appear to be successful in its lunge feeding technique. The calf was estimated to be between 12 and 16 weeks of age and it may have been its first attempts at lateral lunge feeding. Although the weaning age is typically 10-12 months (Clapham 2000), unweaned calves have been observed feeding independently at 5-6 months in the western North Atlantic (Clapham & Mayo, 1987). These calves probably begin learning the bubble cloud feeding technique through mimicry of their mother early in the weaning process (Clapham & Mayo 1987).

It can be difficult to assess whether feeding whales are responding to the presence of a whale-watching vessel. Although typical avoidance responses in cetaceans are categorized as increased swimming speed and frequent changes in direction (Bauer & Herman 1986, Baker & Herman 1989, Bejder et al. 1999, Au & Green 2000, Nowacek *et al.* 2001, Williams et al. 2002, Scheidat et al. 2004), both are also characteristic of foraging behaviour. Vessel effects were tested through a control versus impact comparison (Bejder & Samuels 2003). Collecting adequate control data sets can be difficult especially in areas of high vessel traffic (Bejder & Samuels 2003). However in this study remote land-based vantage points provided an ideal platform to observe feeding whales in the absence of vessels.

Results from this study suggest that feeding lunge intervals (i.e. the time between successive feeding lunges in a pod) are a more sensitive indicator of disturbance than feeding lunge frequency (i.e. the number of feeding lunges by each whale per minute). Unlike frequency measures, feeding lunge intervals are sensitive to changes in the timing of feeding behaviour within an observation block and thus a better estimator of feeding activity. With this measure, the presence of one whale-watching vessel did not significantly change feeding behaviour relative to that in the absence of a vessel, as long as the vessel was sitting idle or travelling at a no-wake speed at 100 m or greater separation away and parallel to the pod. Even so, a vessel can affect some pods as whales stopped feeding for more than 5 min and approached the idle vessel in 10% of observations.

However, the presence of more than one whale-watching vessel consistently impacted on the pod's feeding behaviour with longer intervals between feeding lunges relative to one vessel present. These results are consistent with those of (Krieger & Wing 1986) who found that feeding humpbacks seldom responded if the vessel moved into the area at a slow constant speed and that the reaction of the whales depended on, among other factors, the cumulative effect of more than one vessel.

Likewise, vessels (single or multiple) that moved in a manner inconsistent with current whale-watching regulations significantly increased a pod's feeding lunge interval. This has important implications for management. Commercial operators and recreational vessel users should be educated on how to manoeuvre vessels around feeding whales. The prey of humpback whales form schools or dense patches, which may be disrupted by moving vessels. Skippers need to be aware of the location of prey patches and make every attempt not to drive through and disturb these aggregations. Feeding whales often change their direction of travel, which makes it harder for the skipper to predict where they will surface next. It is therefore recommended that operators stay at a conservative distance from all pods (e.g. 300 m) and observe the pod for several surfacings before moving to the 100 m approach limit. The skipper should wait for all members of the pod to surface before manoeuvring the vessel to ensure that they do not approach within 100 m.

The commercial operators who participated in this study were very experienced, each having operated in the area for more than 16 years and generally followed the above recommendations. The experience of these operators should be used in developing education programs for new operators and recreational vessel users. It is also recommended that a limit of one whale-watching vessel within 300 m of a feeding pod be set.

South-eastern NSW waters are the only area where migrating humpback whales from the Antarctic Area V are known to feed regularly. Future management of the whale-watching industry should take into consideration the needs of feeding whales. It is important that both commercial whale-watching operators and recreational vessel users are educated on the importance of complying with the whale-watching regulations. If small schooling fish and *N. australis* are considered a significant food resource for humpback whales in this area, then their nutritional requirements may need to be considered in the management of the local small pelagic fisheries (e.g. the jack mackerel fishery) and in any future plans for the exploitation of *N. australis* stocks.

CHAPTER 5: The behavioural responses of humpback whales to whale-watching vessels during their southern migration on the NSW south coast and implications for management.

5.1 ABSTRACT

Whale-watching in Australia is expanding rapidly, but little is known of its impact on the humpback whale population especially during the whales' southward migration. This study assesses the short-term responses of members of the Antarctic Area V humpback whale population to whale-watching vessels during their southward migration past the south coast of New South Wales (NSW). Behavioural observations were recorded from five commercial whale-watching vessels operating out of three ports (Narooma, Merimbula and Eden) and a control data set was collected from two land observation sites (Green Cape and Montague Island) in the same area. Responses of humpback whales to vessels were highly variable. Whilst some individuals showed obvious signs of horizontal avoidance, others approached vessels and initiated interactions. The avoidance responses of southward migrating humpbacks were consistent with typical avoidance strategies used by humpbacks elsewhere. Calf pods were more sensitive to the presence of vessels than non-calf pods. There were increases in dive time and the overall percentage of time spent submerged of whales in the presence of vessels, but no associated changes in respiration intervals. Some surface behaviours were suppressed in the presence of vessels. Whales showed some behavioural changes when vessels were operating in accordance with whale-watching regulations compared with pods in the absence of vessels. In addition, pods that showed no obvious horizontal responses to vessels showed changes in diving and surface activity when compared with pods in the absence of vessels. Although, exposure to commercial vessels in this area at the time of the study was low, cumulative effects through increased exposure to vessel traffic could prove detrimental. In the absence of adequate long-term data, management of the humpback whale-watching industry should adopt a precautionary approach. Management strategies should be aimed at managing adverse impacts of whale-

watching on whales, by limiting whales' exposure to vessels, increasing operators' awareness and improving knowledge of the long term implications of vessel interactions through ongoing monitoring of the humpback whale population and whale-vessel interactions.

5.2 INTRODUCTION

As the popularity of whale-watching grows so too does the concern over the impact it is having on the whales being watched (Tilt 1987, Beach & Weinrich 1989, Forestell & Kaufman 1990, Orams 1999, Corkeron 2004, Corkeron 2006). The accumulating evidence suggests that close approach by tourist vessels can change the behaviour of cetaceans (Baker et al. 1983, Baker & Herman 1989, Bauer & Herman 1986, Bauer 1986, Blane & Jackson 1994, Corkeron 1995, Bejder et al. 1999, Constantine 2001b, Williams et al. 2002, Lusseau 2003, Scheidat et al. 2004, Constantine et al. 2004, Williams et al. 2006, Corbelli 2006) and can lead to long-term impacts at the local population level (Bejder et al. 2006b, Lusseau 2005).

Orientation away from the vessel, increased swimming speeds, prolonged submergence and changes in respiration behaviour have all been found to be indicators of disturbance in humpback whales around the world. Examples are the North Pacific humpback population at both their feeding grounds in Alaska (Baker et al. 1983, Baker & Herman 1989) and their summer wintering grounds in Hawaii (Bauer & Herman 1986, Bauer 1986, Au & Green 2000); the North Atlantic humpback population on their feeding grounds at Cape Cod (Watkins 1986) and Canada (Corbelli 2006); and the south-eastern Pacific humpback population at their summer wintering grounds in Ecuador (Scheidat *et al.* 2004). Some studies have reported greater sensitivity to disturbance by vessels in pods containing calves than non-calf pods (e.g. Bauer 1996; Bauer and Herman 1986). A recent study of humpback whales along around the Abrolhos Archipelago, Brazil found changes in the behaviour of mother and calves within distances of 100-300 m. Calves exhibited less active behavioural events and spent less time resting (Morete *et al.* 2007).

Some research has been done on the behavioural responses of the south-eastern Pacific population of humpback whales to whale-watching in Hervey Bay, Queensland (Corkeron 1995). However, no research has been done on the responses of travelling humpback whales to whale-watching vessels. In south-eastern NSW whales move through open, rough waters, whereas further north they are more sedentary in calmer waters (Muloin 1998). Furthermore, humpback whales in south-eastern NSW are towards the end of their southern migration and may be nutritionally stressed. Some humpbacks will feed opportunistically in these waters and this is the only area on the eastern Australian migration route where humpback whales are known to feed (see Chapter 4). Thus without quantitative measures of the responses of these whales to tour vessels it is difficult to predict the effects of whale-watching on humpbacks in this area.

The aims of this study were to firstly determine the frequencies and locations of encounters between whale-watching vessel and humpback whales in south-eastern NSW, particularly the frequencies of encounters with mother-calf pairs. Secondly, to determine the responses of humpback whales on their southern migration in open water to the approach and following of whale-watching vessels by testing the following hypotheses: i) migrating humpback whales remain submerged longer and show less surface behaviour when in the presence of vessels; ii) tour vessels elicit characteristic avoidance behaviour from migrating humpback whales; iii) the degree of such avoidance behaviour is a function of the whales' distance from vessels with a response threshold at the 100m approach limit (200m for mother-calf pods); and v) humpback whale pods that contain calves show greater disturbance responses than non-calf pods when in the presence of vessels. Thirdly, to apply the findings towards the development of best-practice guidelines and regulations for the sustainable management of whale-watching in NSW.

5.3 METHODS

This study used a combination of 'within effect comparisons' (Bejder & Samuels 2003) where only those whales in the presence of whale-watching vessels were assessed for their response and a 'control versus impact comparison' using shore based observations as the control (Bejder & Samuels 2003). The latter method used a between subjects design. This type of study design was used by Corkeron (1995) in his research on the impacts of vessels on humpback whales in Hervey Bay.

The methods used for boat-based and land-based humpback whale behavioural observations in this study are the same as those outlined in Chapter 3. In this study land-based observations are used as the control data set of whale behaviour as observations were made when there were no vessels within 5 km of the focal pod (with the exception of anchored fishing vessels). Data sets were chosen where the discrimination of the whales' behaviour was equivalent.

A pod's initial behaviour when first sighted was categorised as travelling (i.e. moving >1 knot), surface-active (i.e. displaying aerial behaviours such as: breaching, fluke or pectoral slapping; or fluke or pectoral waving), feeding (i.e. performing feeding lunges) or resting (i.e. whale remains near the surface with no visible behaviours other than blowing for > 60 sec). The initial behaviour of 3% of pods was discounted and categorized as 'not determined' as they had members that had either affiliated or disaffiliated.

A pod's reaction was categorized as either 'approach', 'avoidance' or 'no response' based on the criteria provided in Table 5.1. Pods' responses were categorised as 'not determined' if the following applied:

1) Feeding pods that did not meet avoidance or approach criteria, but were within 100 m of the whale-watching vessel.

2) The researcher was not confident that pod behaviour met any of the above three response criteria (usually because observation was too brief).

3) The frequency of certain surface behaviours such as breaching, fluke slapping and pectoral slapping changed obviously. Such behavioural changes may not have been related to the presence of the vessel and so they were all categorized as 'not

determined'. 4) Pod behaviour met criteria for avoidance or approach but the researcher was not confident that behaviour was in response to the presence of the vessels as they may have been responding to another stimulus in the area; e.g. other humpback whales or other marine life. For example, during an observation of a mother-calf pod the whales moved away from the vessel, increased their swimming speed and frequently changed direction. Another humpback whale (assumed to be a male) was in the area and appeared to be pursuing the female. Therefore this observation was categorized as 'not determined'.

In the case of a feeding whale, reduction between a whale and the vessel alone was not a criterion to determine whether a feeding whale was responding to the presence of the vessel. Often whales would continue feeding whilst reducing the distance between themselves and the vessel. Frequent change in direction was excluded as a criterion for avoidance for feeding pods as this is characteristic of foraging behaviour. Given the difficulty in interpreting behavioural changes in some feeding pods, those that did not meet the avoidance or approach criteria were categorised as 'not determined' rather than 'no response'.

For an avoidance response an increase in the whale's swimming speed was determined by the measure of the amount by which the boat needed to change speed (measured by GPS) to maintain the same relative position to the whale.

The length of approach was calculated from the time when the pod's change in direction towards the vessel was observed to when it was observed moving away from the vessel.

Table 5.1. Categories used to define humpback whale pods' observable responses to the whale-watching vessel.

Response Category	Definition	
	Non-feeding Pods	**Feeding Pods**
Approach	Reduction of the distance between whales and vessel, the latter maintaining a constant direction or being motionless (whales within 100 m of the vessel) (after Ritter 2003)	An interruption in feeding > 5 min and a reduction of the distance between whales and vessel, the latter maintaining a constant direction or being motionless (whales within 100 m from the vessel).
Avoidance	Movement away from the vessel, increasing speed and/or frequent changes in direction	Movement away from the vessel and an interruption in feeding > 5min
No response	No apparent response to the approach by the vessel. Animal maintains a fixed distance and direction and no observable changes in frequency of surface behaviours.	No apparent response to the approach by the vessel. Animal maintains a fixed distance and direction and no observable changes in frequency of surface behaviours.

5.3.1 Dive variable definitions

A dive was defined by the occurrence of a fluke up, fluke down, peduncle arch or slip under. Dive rate (DR – dives min^{-1} $whale^{-1}$) was calculated from the total frequency of dives in an observation period divided by the length of that period in minutes and the number of whales observed. The duration of each submergence (TS) was calculated from the time a dive began to the next surface behaviour. All members of the pod typically synchronized their diving and submergence within a few seconds. Only TS >30 s were included in the analysis to ensure that TS was representative of the time all members of the pod were submerged. The percentage of time a pod spent submerged (%TS) was calculated as shown in Chapter 3.

The following variables were used to determine a whale's respiration patterns: surface time (ST) = total time pod spent at the surface during the observation period, and number of blows (NB) = number of times a blow was observed during the observation period. Mean blow interval per whale (MBI_{whale}) was calculated as shown in Chapter 3.

5.3.2 Vessels' movements in relation to NSW whale-watching regulation

Since vessels approached calf pods within the 200 m limit, but generally maintained a distance of 100 m during many observations, analyses were performed on two separate data sets. First, '100 m limit for all pods', in which vessels' movements were categorized as 'consistent' or 'not consistent' with NSW whale-watching regulations for non-calf pods (i.e. using 100 m as the approach limit for both non-calf and calf pods). Vessels movements were classified as 'not consistent' if they approached closer than 100 m or if they restricted the path of the whales, which are both contrary to NSW whale-watching regulations. Second, '100 m limit for non-calf pods; 200 m limit for calf pods', in which vessel movements were classified as 'consistent' or 'not consistent' based on the 100 m approach limit for non-calf pods and the 200 m approach limit for calf pods specified in the NSW Regulations. As with the first data set, vessels were also classified as 'not consistent' if they restricted the path of the whales.

5.3.3 Statistical analyses

Most statistical analyses were performed using SPSS for Windows V14.0 (SPSS Inc., Chicago). In addition, to further test the hypothesis that migrating humpback whales show less surface behaviour when in the presence of vessels analysis of similarity (ANOSIM) and similarity per cent (SIMPER) routines were performed using Plymouth Routines in Multivariate Ecological Research [Primer V5.2.9] software. These routines were performed for all behaviours not associated with respiration and diving. Values were fourth root transformed and similarity was based on the Bray-Curtis measure. Mean values are presented with the standard error (SE). Behavioural

frequencies per whale were calculated by dividing the number of observation of each behaviour by observation time and by the number of whales in the pod.

5.3.4 Design limitations

The study site provided a good opportunity to observe humpback whale behaviour in the absence of vessels. Using a land-based vantage point eliminated any possible disturbance that may have been introduced through the use of a research vessel. Using whale-watching vessels as observation platforms for observing vessel-whale interactions, rather than independent research vessels has several advantages. It is a low cost way of collecting a large sample of observations and can be especially useful in studies of the effects of commercial whale-watching on the target species. It eliminates potential sources of bias that may be introduced by the addition of a research vessel. An additional vessel has the potential to influence the behaviour of cetaceans through cumulative effects of more than one vessel. Furthermore, observing human-whale interactions from on-board commercial vessels provides the researcher with an insight into the operators' needs and attitudes as well as the expectations and satisfaction of whale-watchers. Understanding these perspectives is crucial when developing strategies for the sustainable management of wildlife tourism. Examples of the successful use of whale-watching vessels as a research platform include Constantine (2001) in her study on the effects of swim-with dolphin operations in the Bay of Islands, New Zealand; Birtles *et al.* (2002) who looked at human interactions with dwarf minke whales on the northern Great Barrier Reef, Australia; and (Scarpaci *et al.* 2005) in their study of the impacts of swim-with seal operations in Port Phillip Bay, Australia.

There were, however, some limitations with the study design. The Researcher was restricted to time constraints imposed by the operator, they could not determine the route and duration of observations or how the vessel is manoeuvred around the whales. In addition, using a whale-watching vessel as an observation platform does not allow for Before-During-After (BDA) comparisons (Bejder & Samuels 2003). Despite these limitations whale-watching vessels were determined to be the most suitable platform

to observe whale-vessel interactions for this study. Theodolite tracking from land vantage points has been used in many studies of vessel-cetacean interactions (Williams et al. 2002, Bejder et al. 1999, Baker & Herman 1989, Scheidat et al. 2004, Corbelli 2006) and can be an excellent alternative to boat-based observation platforms. However, this method was not considered viable for the present study due to a lack of vantage points from which to view vessels watching whales.

Another limitation with this design is the inability to eliminate effects of individual variation which is best achieved in a within subject design in which the same individuals are used in control and treatment conditions (Williams et al. 2002, Nowacek et al. 2001). However, in this study it was assumed that control pods (no vessels present) were representative of treatment pods (vessels present), as there was no difference in pod composition (i.e. group size and the presence of a calf) between the two groups (see below). The possibility of pseudo-replication from this type of design must be considered. Migrating whales seem to pass through the study area quite quickly and the chances of obtaining repeated measures within a season and between seasons are not likely to be high. The same vessels were used between and within seasons but they did not follow any fixed route. The vessels routes varied considerably between trips due to inherent variability in weather conditions and the opportunistic nature of whale-sightings. These introduced a significant degree of randomness in space and time of whale encounters.

A further limitation on this study design is the difficulty in finding a 'true control' with no variation in topographic features from the impact site. Control observations were made within 2 km of shore from Green Cape and Montague Island, where the average water depth was shallower by 8 m than for the impact study area (i.e. 52 m for boat-based observations and 44 m for land-based observations). Despite this, the majority of the boat-based observations were conducted in the same water depth range as the control observations. Furthermore, based on dive duration, whales were typically diving within the 21 – 40 m range for both control and impact observations (see below under 'Behaviours associated with respiration and diving') and hence the variation in water depth is unlikely to have contributed to changes in the diving behaviours observed between the control and impact pods.

5.4 RESULTS

A total of 166.8 hours of observations were analysed with 120.8 hours of these collected on board whale-watching vessels over the three seasons and 46 hours of these collected from the two land-based whale-watching sites over four seasons (Table 5.2). The average pod size was 2.3 with a minimum of one and a maximum of six whales (Table 5.2). Pods containing calves (referred to as calf pods) were encountered on 35% of all observations (Table 5.2). Whale behaviour varied with pod size and composition (see Chapter 3), but no significant differences were found in calf pod encounter rates between land- and boat-based observations ($\chi^2 = 0.46$, df = 1, p = 0.50) or for pod size between land and boat-based observations (U = 14677, z = -0.18, p = 0.85). All pods were within 17 km of shore (the whale-watching vessels rarely went farther out to sea than this) (Figure 5.1). The water depth for boat-based observations ranged from 18 m to 117 m with an average of 52 m. Water depth for land-based observations ranged from 27 to 62 m with an average of 44 m. Fifty-eight per cent of boat-based observations were conducted in the same water depth range as the control observations, of the remainder 31% of vessel-based observations were in water > 62 m and 11% in water < 27 m.

The duration of observations ranged from 5 to 115 minutes (Table 5.3). The length of the boat-based observations depended on the movements of the vessel, whilst the length of land observations was dependant on the pod's movements (i.e. observations were terminated if the pod moved >2 km from the observation site) and the intrusion of moving vessels into the observation zone.

Although whale behaviour varied with sea conditions (see Chapter 3), there was no significant bias in the frequency of observations under various sea states (5 categories from calm to rough) ($\chi^2 = 7.41$, df = 4, p = 0.12, $n_{boat} = 201$, $n_{land} = 130$) or wind speeds (5 categories in the Beaufort scale) ($\chi^2 = 8.10$, df = 4, p = 0.09, $n_{boat} = 205$, $n_{land} = 130$).

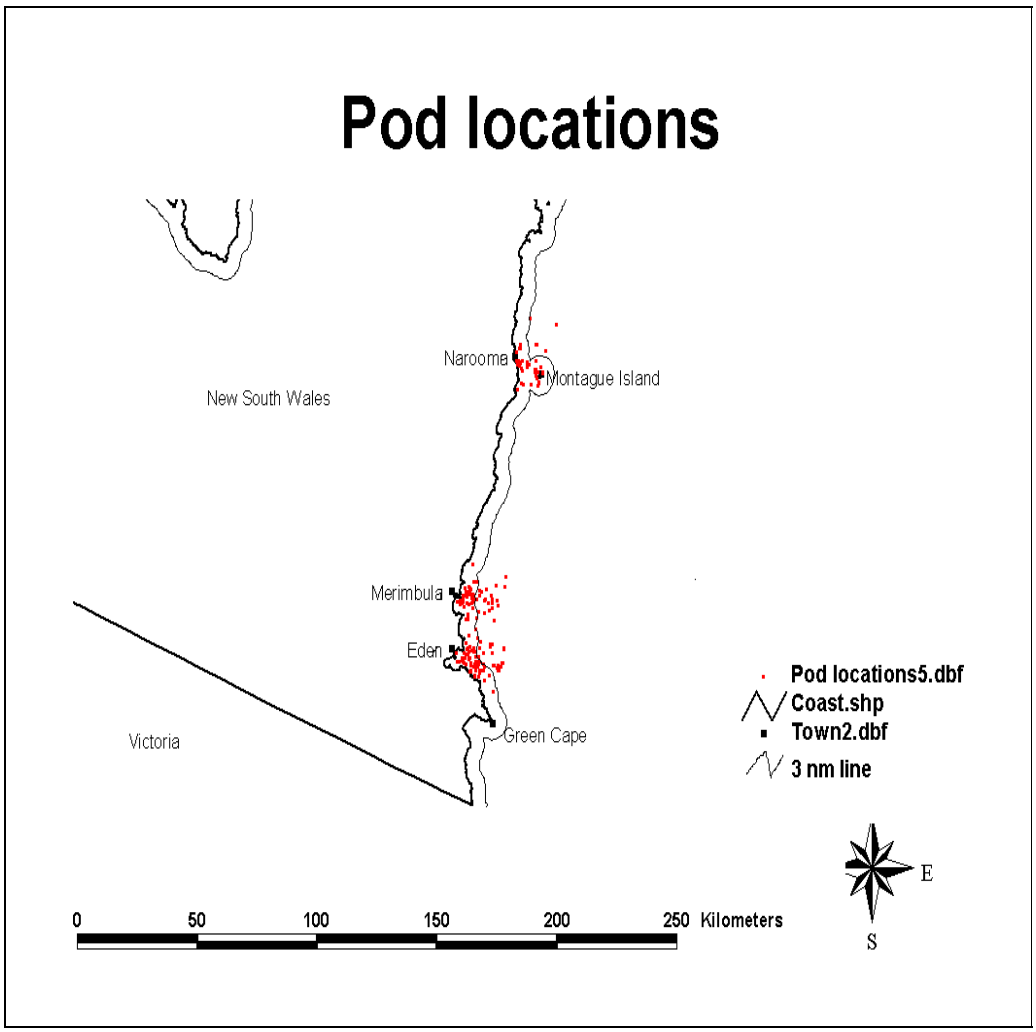


Figure 5.1. Locations of humpback whale pods observed from whale-watching vessels

Table 5.2. Summary of observation effort as well as pod encounter rate, mean pod size and pod composition for vessel-based observations, land-based observations and all observations combined.

	Vessel Observations	Land Observations	Total Observations
Number of observations	89	68	157
Number of whale-watching trips	94	-	-
Whale encounter rate from vessel	94%	-	-
Number of hours of observation	120.8	46.0	166.8
Number of pods	206	144	350
Number of non-calf pods	136	90	226
Number of mother/calf pods	70	54	124
Mother/calf encounter rate	34%	38%	35%
Mean pod size	2.3 ± 0.06	2.3 ± 0.08	2.3 ± 0.05
Min pod size	1	1	1
Max pod size	6	5	6

Table 5.3. Mean, minimum and maximum lengths of observation (minutes) of humpback whale pods from a whale-watching vessel or from land. See Table 3.1 for details of operators.

	Mean	Minimum	Maximum
All vessel-based observations (n = 206)	34.7	5.3	114.7
Operator 1 (n = 80)	35.9	5.8	96.7
Operator 2 (n = 87)	36.4	5.3	114.7
Operator 3 (n = 39)	28.5	5.5	99.7
Land-based observations (n = 144)	19.1	5.6	86.0

5.4.1 Observable responses to whale-watching vessels

Almost half of the pods had no observable response to the vessels' presence and almost one quarter of pods had a whale-initiated interaction with the vessel (Figure 5.2). Most approaches were brief (less than 5 minutes), although 15% of them lasted longer than 20 minutes (Figure 5.3). The median approach time was 6.5 min, Interquartile range (IQR) = 10.25 (*n* = 62). Twelve pods approached the vessel more than once in the same observation. The maximum time an approaching pod stayed with the vessel was 64 minutes. Seventeen per cent of pods made an obvious attempt to avoid the vessel by increasing their swimming speed and or changing their direction of travel away from the vessel. Seventy-six per cent of all responses occurred within 20 minutes of the vessel moving within 1000 m of the pod (Figure 5.4). The mean time for a response was 14 minutes (median = 10.5 min, IQR = 11.5, *n* = 84). An avoidance response took significantly longer to register (median = 14 min, IQR = 13, *n* = 33) than an approach response (median = 9 min, IQR = 14, *n* = 47) (U = 568.5, z = -2.03, p = 0.04). There was no relationship between the pods' initial behaviour when

first sighted (i.e. feeding, travelling or surface active) and their response to the whale-watching vessel (resting pods were excluded from the analysis as observations were too infrequent) ($\chi^2 = 5.35$, df = 4, p = 0.25, *n* = 169).

Whale-watching vessels spent significantly less time with pods that showed no observable response to the vessel than they did with pods approaching or avoiding the vessel (Table 5.4). Whale-watching vessels spent most time with pods that avoided the vessel, although this was not significantly different to the time spent with pods that approached the vessel (Mann-Whitney U = 675, z = -1.33, p = 0.18). There were no differences in pods' responses to the three operators ($\chi^2 = 1.72$, df = 2, p = 0.42), to the vessel type (catamaran vs monohull) ($\chi^2 = 1.51$, df = 2, p = 0.47) or to the engine capacity of the vessels ($\chi^2 = 3.27$, df = 2, p = 0.19).

Pods that approached the vessel were more likely to fluke swish than those that avoided the vessel (Table 5.5a). Pods that approached the vessel were more likely to trumpet blow, fluke swish, spy hop and float on their back than those that did not respond to the vessel (Table 5.5b). Blow rates and roll frequency were higher for pods avoiding the vessel than pods that showed no response, although this was not significant at the Bonferroni adjusted p-value threshold (Table 5.7c).

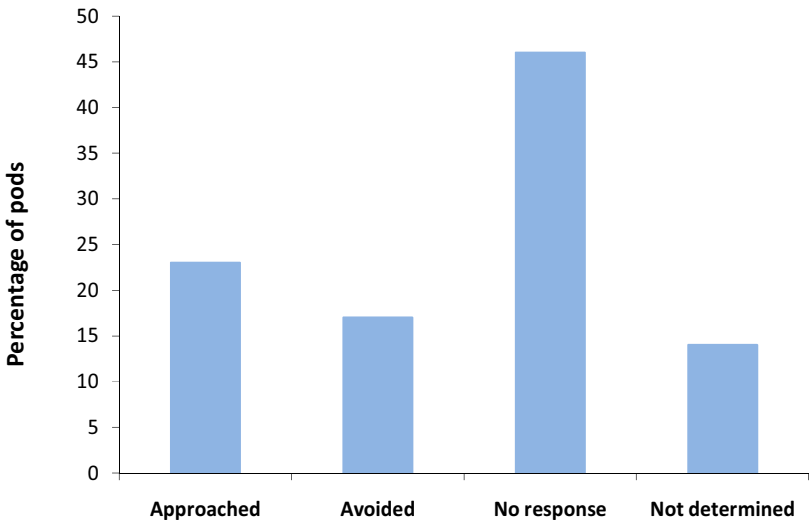


Figure 5.2. Percentage of humpback whale pods approaching, avoiding or not responding to whale-watching vessels (*n* = 206). The residual is responses that could not be determined (see text for reasons).

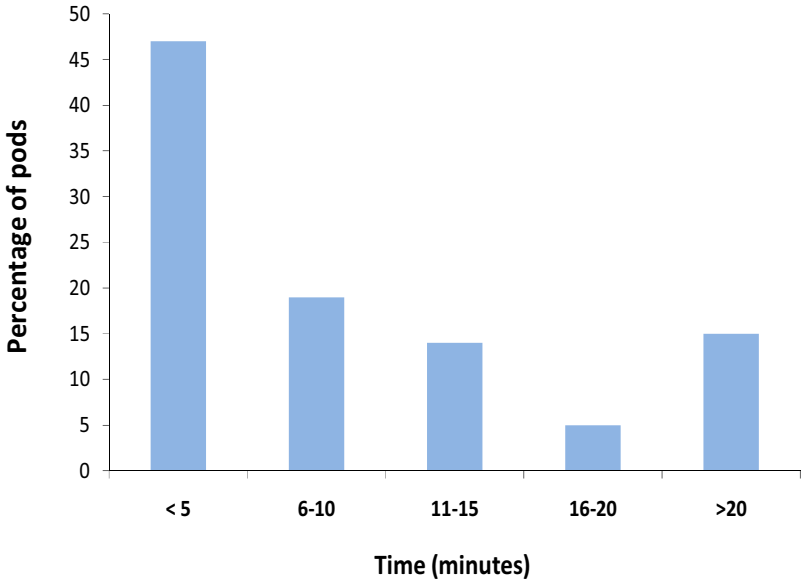


Figure 5.3. Length of humpback whale-initiated approaches to whale-watching vessels (*n* = 62).

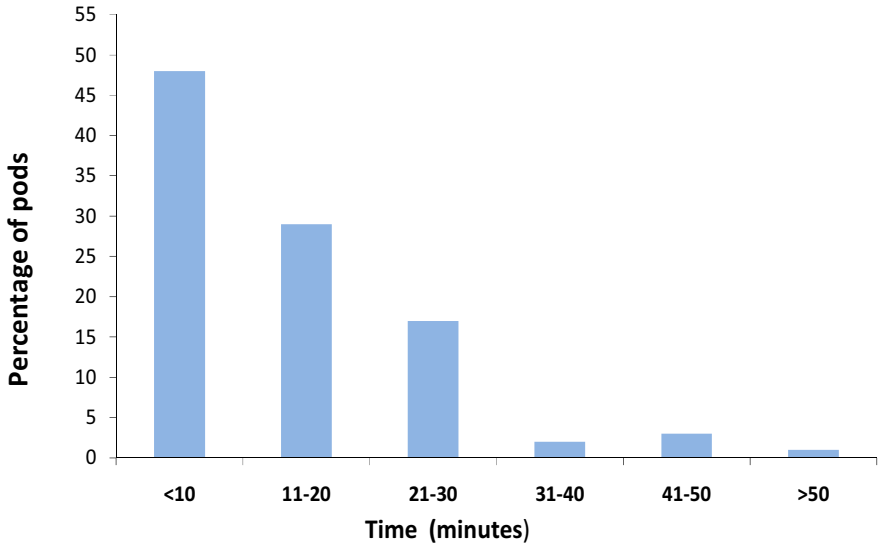


Figure 5.4. Length of time humpback whale pods took to make an obvious response to whale-watching vessels (*n* = 84).

Table 5.4. Kruskal-Wallis analysis of differences in time spent whale-watching for pods that approached, avoided and showed no response to whale-watching vessels.

Pods Response	Time Spent with Pod (minutes)						Mean Rank	Test Statistics
	Mean	SE	Median	IQR	Max	*n*		
All pods	36	1.8	28	40	115	206		
Approached	42	3.5	41	31	100	48	103.07	$\chi^2 = 25.32$
Avoided	52	5.2	49	36	98	34	116.46	df = 2
No response	27	2.4	19	52	115	94	70.95	p <<0.001

Table 5.5. Mann-Whitney U analysis of significant differences in frequencies of surface behaviours for **a)** humpback whale pods that approached (*n* = 48) and humpback whale pods that avoided (*n* = 34) the whale-watching vessels, *significant at p <0.01 (Bonferroni adjusted) **b)** humpback whale pods that approached (*n* = 48) and humpback whale pods that showed no response (*n* = 94) the whale-watching vessels, *significant at p < 0.01 (Bonferroni adjusted) and **c)** humpback whale pods that avoided (*n* = 34) and humpback whale pods that showed no response (*n* = 94) to the whale-watching vessels, *significant at p < 0.02 (Bonferroni adjusted).

a)

Behaviour	Mean Rank		Test Statistics
	Approach	Avoided	
Trumpet Blow	46.22	34.84	Mann-Whitney U = 589 z = -2.65 p = 0.01
Fluke Swish	46.43	34.54	Mann-Whitney U = 579 z = -3.22 p = 0.001*
Spy Hop	45.29	36.15	Mann-Whitney U = 634 z = -2.48 p = 0.01
Back Float	44.24	37.63	Mann-Whitney U = 684 z = -2.178 p = 0.03
Fluke Wave	43.77	38.29	Mann-Whitney U = 643 z = -2.48 p = 0.01
Pectoral Wave	44.52	37.24	Mann-Whitney U = 671 z = -2.30 p = 0.02
Roll	45.13	36.38	Mann-Whitney U = 642 z = -2.17 p = 0.03

b)

Behaviour	Mean Rank		Test Statistics
	Approach	No Response	
Trumpet Blow	89.94	65.70	Mann-Whitney U = 1503 z = -4.81 p <<0.001*
Fluke Swish	86.04	67.55	Mann-Whitney U = 1707 z = -3.83 p <<0.001*
Spy Hop	83.35	68.82	Mann-Whitney U = 1805 z = -3.03 p = 0.002*
Back Float	79.55	70.63	Mann-Whitney U = 1900 z = -3.18 p = 0.001*
Fluke Down	83.41	68.79	Mann-Whitney U = 1790 z = -2.75 p = 0.01
Peduncle Arch	84.09	68.47	Mann-Whitney U = 1706 z = -2.38 p = 0.02

c)

Behaviour	Mean Rank		Test Statistics
	Avoided	No Response	
Blow	53.35	68.53	Mann-Whitney U = 1219 z = -2.04 p = 0.04
Roll	55.76	67.66	Mann-Whitney U = 1301 z = -2.11 p = 0.03

All but two of the 19 pods that approached the vessel and gave a trumpet blow were non-calf pods. Fifteen of the seventeen non-calf pods included two to four whales. Both of the calf pods that were observed trumpet blowing contained escorts (one of the pods contained two escorts). All but three of the 15 pods that approached the vessel and fluke swished were non-calf pods. Eight out of the 12 non-calf pods contained two to three whales. The three calf pods that performed fluke swishes did not contain escorts. A correlation existed between trumpet blows and fluke swishes for non-calf pods (all pods: Spearman's rho = 0.13, p = 0.01; non-calf pods Spearman's rho = 0.12, p = 0.08; calf pods: Spearman's rho = 0.16, p = 0.07). Nine of the 15 pods that approached the vessel and fluke swished were also observed trumpet blowing.

Both percentage time submerged and mean dive time were greater for whale pods that avoided than those that approached the whale-watching vessel (Table 5.6). Dive rate and MBI $_{whale}$ did not differ significantly with the pods' response to the whale-watching vessel (DR $\chi^2 = 0.43$, df = 2, p = 0.81; MBI $_{whale}$ $\chi^2 = 1.85$, df = 2, p = 0.40).

The percentage time submerged was significantly higher for pods showing no observable response to the vessel than for control pods (from land-based observations in the absence of vessels). The MDT was also higher for 'no response' pods than for control pods, but the difference was not significant (Table 5.7). The MBI was significantly shorter for 'no response' than for control pods (Table 5.7). There was no significant difference in dive rate between 'no response' pods and control pods (U = 6199, z = -1.10, p = 0.27).

Table 5.6. Kruskal-Wallis analysis of differences in the percentage of time pods spent submerged for humpback whale pods that approached, avoided and showed no response to whale-watching vessels.

Pods Response	**%TS**				***n***	**Mean Rank**	**Test Statistics**
	Mean	SE	Median	IQR			
Approached	50	3.1	56	85.7	48	86.8	$\chi^2 = 6.64$ df = 2 p = 0.04
Avoided	64	3.2	71	77.2	34	107.4	
No response	51	3.2	55	96.8	94	78.4	
	MDT (min)				***n***	**Mean Rank**	**Test Statistic**
	Mean	SE	Median	IQR			
Approached	2.7	0.2	2.6	1.8	48	80.6	$\chi^2 = 10.99$ df = 2 p = 0.004
Avoided	4.3	0.4	3.2	3.2	34	114.4	
No response	3.1	0.3	2.8	3.1	94	83.2	

Table 5.7. Mann-Whitney U analysis of differences in the percentage of time humpback whale pods spent submerged (%TS), Mean Dive Time (MDT) and Mean Blow Interval per Whale ($MBI_{whale)}$ for pods that showed no response to whale-watching vessels and control pods (in the absence of vessels).

Pods Response	**%TS**				***n***	**Mean Rank**	**Test Statistics**
	Mean	SE	Median	IQR			
No response	51	3.2	55	96.8	94	134.7	Mann-Whitney U = 5336 z = -2.76 p = 0.001
Control	39	2.3	36	50.9	144	109.6	
	MDT (min)				***n***	**Mean Rank**	**Test Statistic**
	Mean	SE	Median	IQR			
No response	3.1	0.3	2.8	3.1	94	113.4	Mann-Whitney U = 5802 z = -1.87 p = 0.06
Control	2.4	0.2	2.1	2.6	144	123.4	
	MBI_{whale} (min)				***n***	**Mean Rank**	**Test Statistic**
	Mean	SE	Median	IQR			
No response	0.9	0.1	0.8	0.5	94	107.2	Mann-Whitney U = 5615 z = -2.06 p = 0.04
Control	1.3	0.1	0.9	0.9	142	125.1	

5.4.2 Surface-active behaviours in the presence and absence of vessels

One hundred and forty-two pods (69%) and 103 pods (72%) were surface-active (i.e. displayed behaviours other than those associated with diving and respiration) in the presence of whale-watching vessels and in the absence of whale-watching vessels, respectively. Although there was no significant difference in the proportion of surface-active pods observed from vessels or from land ($\chi^2 = 2.72$, df = 1, p = 0.60), there was a bias toward surface-active pods when first sighted from land (Figure 5.5).

Behaviour frequencies were compared between observations when vessels were present and those when vessel were absent. Only pods displaying that specific behaviour were included in the analysis. The frequency of peduncle slaps and side flukes were significantly higher when vessels were absent (Table 5.8a). Some of the behaviours associated with respiration and diving were also more frequent in the absence of vessels namely: rise, slip under and fluke down (Table 5.8b). None of the 23 behaviours occurred significantly more frequently when vessels were present.

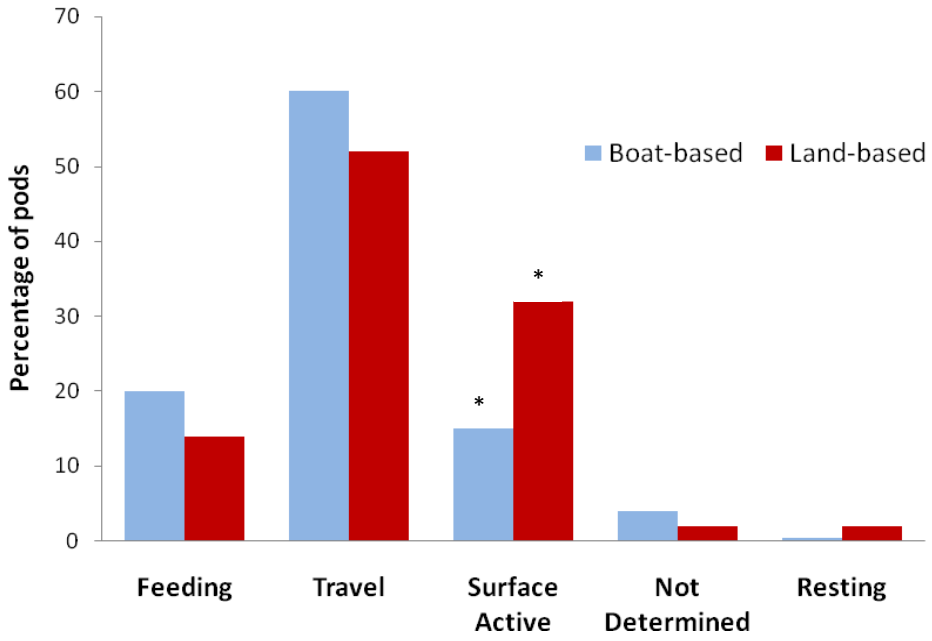


Figure 5.5. Behaviour of humpback whale pods when first sighted in boat-and land-based observations. Vessel (n = 206), Land (n = 144); $\chi 2$ = 13.60, df = 2, p = 0.001. * significant residual at p = 0.05 ('Not determined' and 'Resting' categories were excluded from analysis).

ANOSIM revealed significant differences in the frequencies (per minute of observation) with which behavioural repertoires common to both contexts were performed in the presence and absence of a vessel (R = 0.066, p = 0.001, average dissimilarity = 82.42). The behaviours that contributed most of the variation were fluke slap, breach, pectoral slap and feeding (Table 5.9). Except for feeding lunge, the average frequency of these behaviours was significantly higher when vessels were absent. These differences were significant for both calf and non-calf pods (non-calf pods R = 0.1, p <<0.001, average dissimilarity = 83.16; calf pods R = 0.04, p = 0.01, average dissimilarity = 80.01).

There was no difference in DR (Table 5.8b), but MDT was significantly higher for pods in the presence of whale-watching vessels (Table 5.10). The percentage of time submerged (%TS) was higher for pods in the presence of whale-watching vessels (Table 5.10). The intervals between blows were not significantly different when a vessel was present or absent (Table 5.11).

Table 5.8. Mann-Whitney U analysis of frequencies of **a)** surface-active behaviours (not associated with respiration and diving) *significant at p<0.003 (Bonferroni adjusted) and **b)** behaviours associated with respiration and diving for humpback whales in the presence and absence of vessels *significant at p<0.006 (Bonferroni adjusted).

a)

Behaviour	Mean Behavioural Frequency (per min per whale)												Test Statistics
	Vessel						No Vessel						
	Mean	SE	Median	IQR	Mean Rank	*n*	Mean	SE	Median	IQR	Mean Rank	*n*	
Breach	0.1	0.02	0.05	0.1	39.0	47	0.3	0.1	0.1	0.2	54.3	48	U = 706 z = -2.74 p = 0.01
Pectoral Wave	0.02	0.005	0.02	0.02	21.8	25	0.1	0.01	0.04	0.04	34.7	32	U = 219 z = -2.91 p = 0.004
Pectoral Slap	0.5	0.2	0.03	0.2	35.7	39	0.4	0.1	0.1	0.3	46.7	43	U = 613 z = -2.09 p = 0.04
Roll	0.08	0.03	0.03	0.1	38.6	57	0.1	0.02	0.05	0.1	51.9	28	U = 549 z = -2.32 p = 0.02
Peduncle Slap	0.1	0.03	0.02	0.1	28.1	44	0.2	0.1	0.1	0.1	44.3	22	U = 246 z = -3.24 p = 0.001*
Side Fluke	0.03	0.005	0.02	0.03	17.0	24	0.1	0.02	0.1	0.1	33.3	26	U = 109 z = -3.94 p << 0.001*
Fluke Slap	0.4	0.2	0.1	0.2	42.6	42	0.3	0.1	0.1	0.3	50.6	51	U = 888 z = -1.41 p = 0.16
Feeding	0.3	0.1	0.2	0.3	28.8	42	0.4	0.1	0.3	0.5	33.9	20	U = 333 z = -1.05 p = 0.29

Behaviour	Mean Behavioural Frequency (per min per whale)												Test Statistics
	Vessel						No Vessel						
	Mean	SE	Median	IQR	Mean Rank	*n*	Mean	SE	Median	IQR	Mean Rank	*n*	
Fluke Wave	0.02	0.003	0.01	0.02	11.7	20	0.03	0.01	0.02	0.04	16.8	4	U = 23 z = -1.32 p = 0.21
Fluke Swish	0.1	0.05	0.02	0.04	13.4	25	0.03	-	-	-	17.0	1	U = 9 z = -0.47 p = 0.64
Head Lunge	0.02	0.01	0.02	0.02	4.6	7	0.1	0.01	0.1	0.05	9.8	6	U = 4 z = -2.43 p = 0.01
Porpoising	0.2	0.1	0.05	0.04	7.2	11	0.05	0.2	0.1	-	8.7	3	U = 13 z = -0.54 p = 0.59
Surface Float Back	0.1	0.04	0.02	0.04	9.6	3	0.05	0.02	0.02	0.1	10.9	6	U = 33.5 z = -0.48 p = 0.63
Fluke Flick	0.02	0.01	0.01	0.01	-	8	-	-	-	-	-	0	- - -
Surface Float Front	0.1	0.04	0.03	0.05	-	13	-	-	-	-	-	0	- - -

b)

Behaviour	Mean Behavioural Frequency (per min/ per whale)												Test Statistics
	Vessel						No Vessel						
	Mean	SE	Median	IQR	Mean Rank	*n*	Mean	SE	Median	IQR	Mean Rank	*n*	
Blow	0.6	0.03	0.5	0.4	162.3	206	0.6	0.04	0.5	0.4	192.2	143	U = 12112 z = -2.72 p = 0.01
Rise	0.2	0.01	0.1	0.2	130.9	182	0.3	0.04	0.2	0.4	177.6	115	U = 7179 z = -4.56 p <<0.001*
Slip Under	0.1	0.01	0.1	0.1	132.5	190	0.5	0.05	0.3	0.8	193.9	125	U = 7137 z = -5.88 p << 0.001*
Peduncle Arch	0.1	0.01	0.1	0.1	126.9	167	0.1	0.01	0.1	0.1	155.1	108	U = 7172 z = -2.86 p = 0.04
Fluke Down	0.02	0.004	0.01	0.02	31.9	45	0.05	0.01	0.04	0.1	53.9	38	U = 401 z = -4.15 p << 0.001*
Fluke Up	0.1	0.01	0.05	0.1	116.2	147	0.1	0.01	0.1	0.1	124.8	91	U = 6209 z = -0.93 p = 0.35
Dive	0.2	0.01	0.1	0.1	155.2	189	0.2	0.01	0.1	0.1	168.2	131	U = 11374 z = -2.17 p = 0.22
Trumpet Blow	0.1	0.02	0.03	0.04	19.0	35	0.05	0.02	0.03	-	25.7	3	U = 34 z = -1.00 p = 0.32

Table 5.9. Results of SIMPER routine including the average abundance of humpback whale surface-active behaviours in the presence and absence of vessels, average dissimilarity and the percentage contribution to variation for each of the behaviours.

Behaviour	Average Abundance		Average Dissimilarity	% contribution
	Vessel	No Vessel		
Fluke Slap	0.2	0.3	11.7	14.2
Breach	0.2	0.3	11.2	13.6
Pectoral Slap	0.2	0.3	10.5	12.7
Feeding	0.2	0.1	10.2	12.3
Roll	0.2	0.1	7.4	8.9
Peduncle Slap	0.1	0.1	6.6	7.9
Side Fluke	0.1	0.1	5.7	6.9
Pectoral Wave	0.1	0.1	5.4	6.5
Spy Hop	0.1	0.1	3.9	4.8
Fluke Swish	0.1	0.0	2.6	3.1

Table 5.10. Mann-Whitney U analysis of mean dive time and percentage of time submerged for humpback whale pods when vessels were present (*n* = 206) and absent (*n* = 144).

	Mean Dive Time (MDT) (minutes)							Test Statistic
	Mean	SE	Median	IQR	Min	Max	Mean Rank	
Vessel present	3.0	0.2	2.8	2.4	0	13.2	188.1	Mann-Whitney U = 12241 z = -2.79 p = 0.005
Vessel Absent	2.4	0.2	2.1	2.6	0	8.3	157.5	
	Percentage Time Submerged (%TS)							**Test Statistic**
	Mean	**SE**	**Median**	**IQR**	**Min**	**Max**	**Mean Rank**	
Vessel present	48	2.0	53	47.4	0	97	192.2	Mann-Whitney U = 11395 z = -3.70 p << 0.001
Vessel Absent	36	2.4	33	52.9	0	94	151.6	

Table 5.11. Mann-Whitney U analysis of mean blow interval of all humpback whale pods, non-calf pods and calf pods in the presence and absence of vessels.

	Mean Blow Interval (MBI_{whale}) (minutes)						Test Statistic
	Mean	**SE**	**Median**	**IQR**	**Mean Rank**	***n***	
All pods							
Vessel present	1.2	0.1	0.9	0.7	171.6	206	Mann-Whitney U = 14036 z = -0.64 p = 0.52
Vessel Absent	1.3	0.1	0.9	0.9	178.7	142	
Non-calf pods							
Vessel present	1.0	0.1	0.8	0.7	111.0	136	Mann-Whitney U = 5775 z = -0.72 p = 0.47
Vessel Absent	1.2	0.1	0.8	0.9	117.3	90	
Calf pods							
Vessel present	1.5	0.2	1.1	0.76	62.0	70	Mann-Whitney U = 1788 z = -0.17 p = 0.87
Vessel Absent	1.5	0.2	1.1	0.92	60.9	52	

To test the hypothesis that pods containing calves will show greater disturbance responses than pods without calves, non-calf and calf pods were examined separately. Analysis revealed that only pods containing calves showed a significant change in blow rate (Figure 5.6), slip under rate (Figure 5.7), percentage of time spent submerged (Figure 5.8) and in mean dive time (Figure 5.9) when in the presence of a whale-watching vessel. Blow intervals were unchanged for both calf pods and non-calf pods in the presence and absence of a whale-watching vessel (Table 5.11). Breach and roll frequency were higher in the absence of vessels for calf pods only and pectoral wave frequency was higher in the absence of vessels for non-calf pods only (Table 5.12).

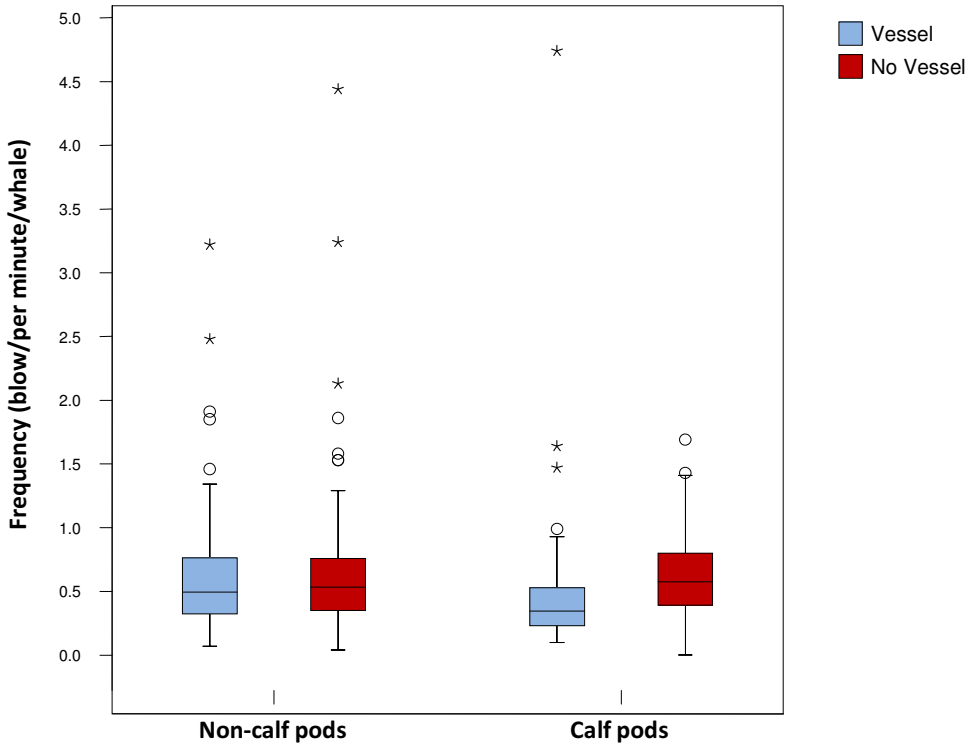


Figure 5.6. Blow frequency for humpback whale non-calf pods when vessels were present (*n* = 136) and absent (*n* = 90); and for humpback whale calf pods when vessels were present (*n* = 70) and when vessels were absent (*n* = 54). ○= outliers, * = extreme cases.
Non-calf pods: Mann-Whitney U = 5830, z = -0.60, p = 0.547
Calf pods: Mann-Whitney U = 1219, z = -3.38, p = 0.001

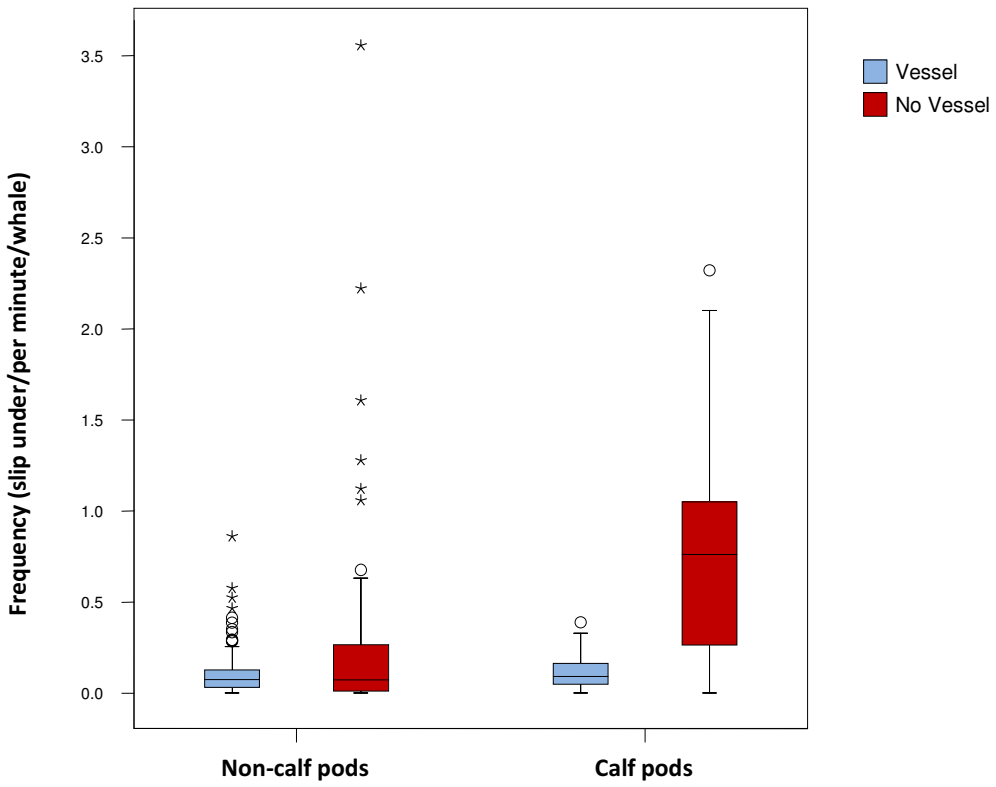


Figure 5.7. Slip under rate for humpback whale non-calf pods when vessels were present (*n* = 136) and absent (*n* = 90); and for humpback whale calf pods when vessels were present (*n* = 70) and absent (*n* = 54). ○ = outliers, * = extreme cases.
Non-calf pods: Mann-Whitney U = 6077, z = -0.09, p = 0.93
Calf pods: Mann-Whitney U = 624, z = -6.38, p <<0.001

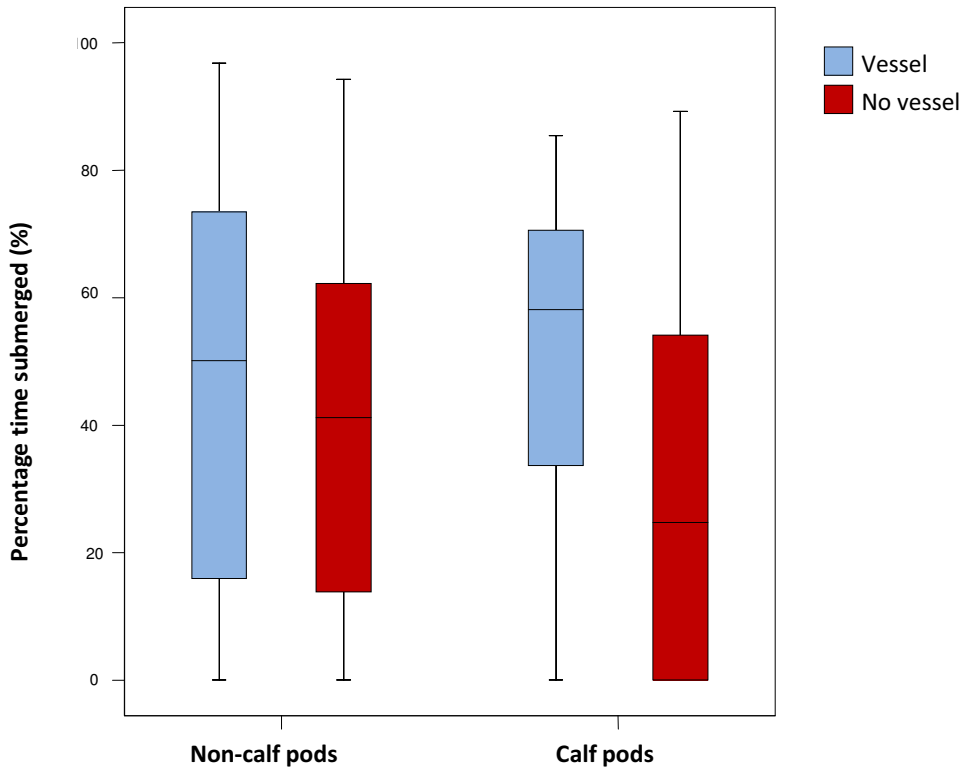


Figure 5.8. Percentage of time pods spent submerged for humpback whale non-calf pods when vessels were present (*n* = 136) and absent (*n* = 90) and for humpback whale calf pods when vessels were present (*n* = 70) and absent (*n* = 54). ○ = outliers, * = extreme cases.
Non-calf pods: Mann-Whitney U = 5359, z = -1.58, p = 0.11
Calf pods: Mann-Whitney U = 1090, z = -4.04, p <<0.001.

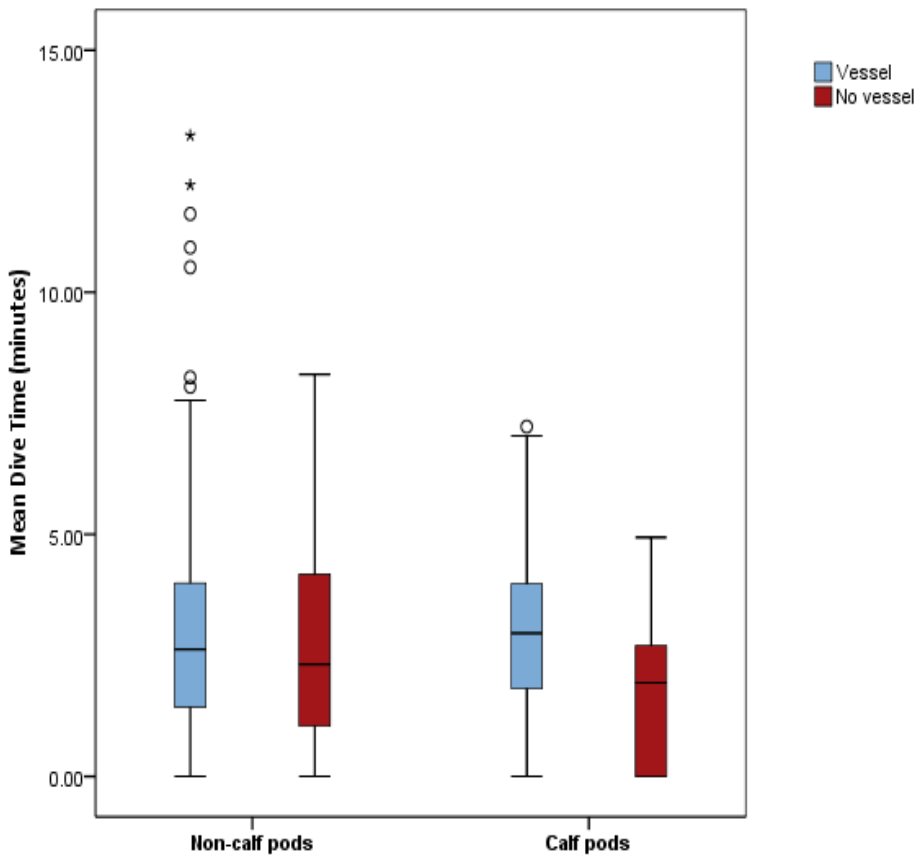


Figure 5.9. Mean dive time (MDT) for humpback whale non-calf pods when vessels were present (*n* = 136) and when vessels were absent (*n* = 90) and for humpback whale calf pods when vessels were present (*n* = 70) and when vessels were absent (*n* = 54). ○ = outliers, * = extreme cases.
Non-calf pods: Mann-Whitney U = 57440, z = -0.79, p = 0.43
Calf pods: Mann-Whitney U = 1152, z = -3.73, p = <<0.001

Table 5.12. Mann-Whitney U analysis of breach, roll and pectoral wave frequencies in the presence and absence of vessels for humpback whale non-calf and calf pods separately.

	Mean Behavioural Frequency (per min per whale)						
	Non-calf pods						
	Mean	**SE**	**Median**	**IQR**	**Mean Rank**	***n***	**Test Statistics**
Breach							
Vessel present	0.1	0.02	0.1	0.1	24.2	27	Mann- Whitney U = 275 z = -1.14 p = 0.26
Vessel Absent	0.2	0.1	0.1	0.1	29.0	25	
Roll							
Vessel present	0.1	0.01	0.03	0.1	23.3	37	Mann- Whitney U = 159 z = -0.21 p = 0.83
Vessel Absent	0.04	0.01	0.03	0.02	24.3	9	
Pectoral wave							Mann- Whitney U = 120 z = -2.68 p = 0.01
Vessel present	0.03	0.01	0.02	0.02	16.5	20	
Vessel Absent	0.1	0.02	0.04	0.1	26.8	23	
	Calf pods						
	Mean	**SE**	**Median**	**IQR**	**Mean Rank**	***n***	**Test Statistics**
Breach							
Vessel present	0.1	0.04	0.05	0.1	15.2	20	Mann-Whitney U = 93 z = -2.89 p = 0.04
Vessel Absent	0.5	0.1	0.3	0.7	28.9	20	
Roll							
Vessel present	0.1	0.1	0.03	0.1	16.1	20	Mann-Whitney U = 112 z = -2.19 p = 0.03
Vessel Absent	0.1	0.03	0.1	0.1	24.1	19	
Pectoral slap							
Vessel present	0.01	0.01	0.01	0.02	5.2	5	Mann-Whitney U = 59 z = -1.77 p = 0.08
Vessel Absent	0.03	0.01	0.02	0.04	8.8	9	

Effect of vessel compliance with whale-watching regulations on whale behaviour

During 160 of the 206 (78%) boat-based observations, the vessel was either sitting idle or moving at a no-wake speed parallel to the whales at 100 m or greater distance. This is consistent with the regulations for non-calf pods. During the other 46 (22%) observations, the vessel moved in closer than the 100 m approach limit and/or travelled into the whales' path. During this study, the minimum approach distance for pods containing calves in NSW waters was 200 m (National Parks and Wildlife Regulation 2002). Vessels moved in closer than the 200 m approach distance during 62% per cent of encounters with calf pods. In 2006 (after this study was completed), the minimum approach distance for mother calf pods was amended to 300 m (NSW National Parks and Wildlife Amendment (Marine Mammals) Regulation 2006). Only 14% of the interactions with mother calf pods in this study occurred with the vessel moving at 300 m or greater separation during the entire observation.

There was a striking difference between the reactions of whales to vessels maintaining regulation distances, and vessels approaching closer than these distances. Whales were more likely to avoid a vessel moving within the 100 m minimum approach limit and more likely to approach a vessel that was maintaining an approach distance of 100 m or more (all pods 100 m limit: $\chi^2 = 19.06$, df = 2, $p << 0.001$) (Figure 5.10a). The relationship was not as strong for vessels maintaining a 200 m minimum approach limit from calf pods (non-calf pods 100m limit; calf pods 200 m limit: $\chi^2 = 6.03$, df = 2, $p = 0.05$) (Figure 5.10b). Calf pods were more likely to avoid vessels that were closer than the 100 m approach limit ($\chi^2 = 7.97$, df = 3, $p = 0.05$) but there was no relationship between a calf pod's response and vessels closer than 200 m ($\chi^2 = 0.24$, df = 2, $p = 0.88$). There was no significant difference in dive rate, MDT or %TS between samples when the vessel did or did not operate in accordance with whale-watching regulations (Table 5.13).

Pods were separated into calf pods and non-calf pods, and behaviour around vessels closer than 200 m and 100 m respectively were examined. Slip under rate was highest for calf pods when the vessel was closer than 200 m (Table 5.14). There was no significant difference in blow rate, dive rate, %TS, MDT or MBIwhale for either calf

pods or non-calf pods when vessels were closer than or greater than the approach limits (Table 5.14).

Observations made whilst a vessel was further away than the regulatory minimum approach distances were compared with control observations (when vessels were absent). The mean %TS was lower by 12% for control observations and the mean MDT was shorter by an average of 40 s for control observations (Table 5.15). ANOSIM revealed no significant differences in behavioural repertoire when vessels were complying or non-complying with NSW whale-watching regulations ($R = 0.01$, $p = 0.38$).

Effect of number of whale-watching vessels on whale behaviour

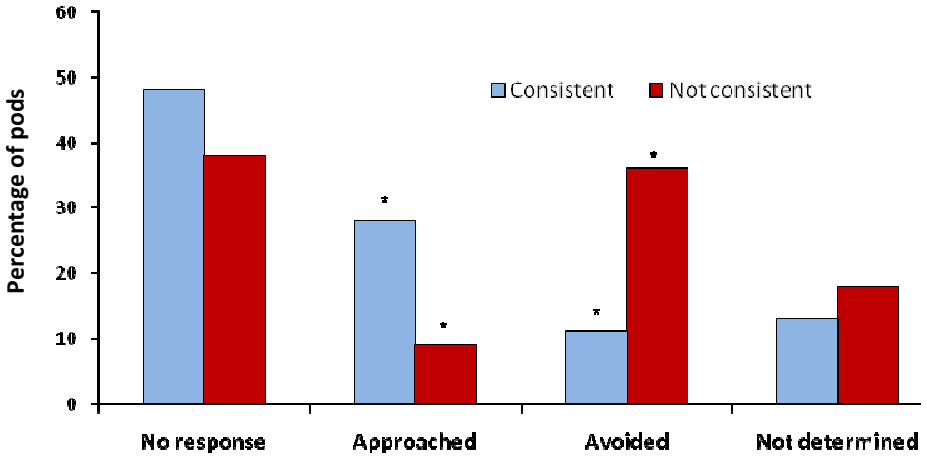
During 65 (32%) of boat-based observations, more than one whale-watching vessel was within 300 m of the focal pod. During 18 (9%) of boat-based observations more than three vessels were within 300 m of the focal pod. For analysis purposes pods were separated into two groups of 1 vessel present or > 1 vessel present. Due to the small sample size separating pods into more than these two groups (e.g. 1 vessel, 2 vessels, 3 vessels and so on) was not practical.

Blow, feeding lunge, pectoral slap, pectoral wave and side fluke frequency were significantly lower when more than one vessel was present (Table 5.16). Behaviour composition did not differ with the number of vessels present ($R = 0.01$, $p = 0.37$).

There was no significant effect of number of vessels on blow rate, slip under rate, dive rate, %TS, MDT or MBI_{whale} on non-calf pods or on calf pods when analysed separately (Table 5.17).

Effect of operators and vessel types on whale behaviour

A sample of 80 observations were made from operator 1's vessels (78 from boat 1, 2 from boat 2), 87 from the vessel of operator 2 and 39 from operator 3's vessels (19 from boat 1, 20 from boat 2). No differences were found for dive rate, %TS, MDT or MBI_{whale} between operators (Table 5.18). Vessels were separated into two groups based on engine capacity (i.e. 2 x 580 hp or 2 x 300 hp). No differences were found for dive rate, %TS, MDT or MBI_{whale} (Table 5.19).



b)

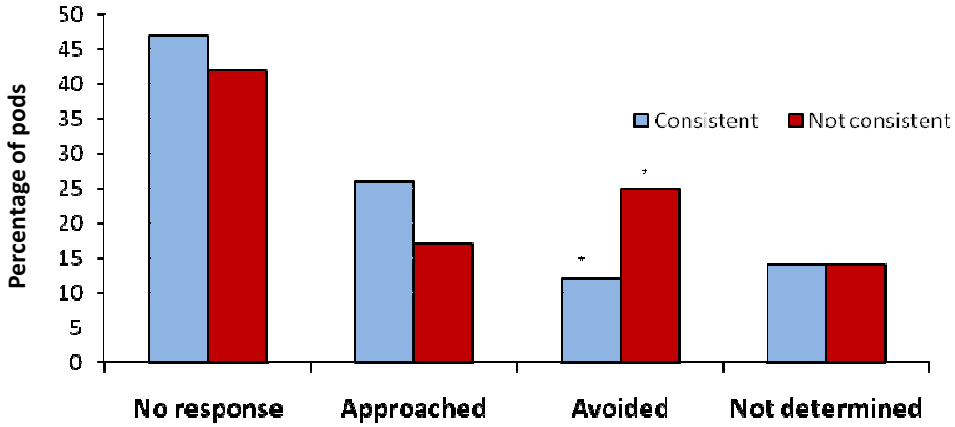


Figure 5.10. Responses of humpback whale pods to whale-watching vessels that were operating **a)** consistent (*n* = 160) and not consistent (*n* = 46) with NSW whale-watching regulations for non-calf pods (i.e. using minimum approach distance of 100 m for all pods) and **b)** consistent (*n* = 137) and not consistent (*n* = 67) with NSW whale-watching regulations for non-calf and calf pods (i.e. using minimum approach distance of 100 m for non-calf pods and 200 m for calf pods).* significant residual at p = 0.05.

Table 5.13. Mann-Whitney U analysis of dive behaviour of humpback whale pods when approach distances of vessels were and were not consistent with NSW whale-watching regulations for non-calf pods (all pods 100 m limit); and of behavioural frequencies of pods when approach distances of vessels were and were not consistent with NSW regulations for calf and non calf pods (non calf 100 m limit; calf pods 200 m limit).

Behaviour	Consistent (all pods 100 m limit)						Not consistent (all pods 100 m limit)						Test Statistics
	Mean	SE	Median	IQR	Mean Rank	*n*	Mean	SE	Median	IQR	Mean Rank	*n*	
Dive Rate (per min/per whale)	0.2	0.02	0.1	0.1	96.7	145	0.1	0.01	0.1	0.2	89.6	44	Mann–Whitney U = 2950 z = - 0.75 p = 0.45
MDT (min)	3.0	0.2	2.6	2.4	102.7	160	3.1	0.37	2.9	2.4	106.4	46	Mann–Whitney U = 3548 z = -0.37 p = 0.71
%TS	48	2.3	51	44.0	104.6	160	46	4.27	57	52.0	99.8	46	Mann –Whitney U = 3511 z = - 0.475 p = 0.63
Behaviour	**Consistent (non calf 100 m limit; calf pods 200 m limit)**						**Not consistent (non calf 100 m limit; calf pods 200 m limit)**						**Test Statistics**
	Mean	**SE**	**Median**	**IQR**	**Mean Rank**	***n***	**Mean**	**SE**	**Median**	**IQR**	**Mean Rank**	***n***	
Dive Rate (per min/per whale)	0.1	0.01	0.1	0.1	96.5	124	0.1	0.02	0.1	0.1	92.1	65	Mann –Whitney U = 3838 z = -0.54 p = 0.592
MDT (min)	3.0	0.2	2.7	2.5	102.5	137	3.0	0.3	2.9	2.2	105.4	69	Mann –Whitney U = 4593 z = -0.33 p = 0.74
%TS	48	2.5	51	56.5	104.4	137	48	3.243	56	41.0	101.8	69	Mann –Whitney U = 4607 z = -0.27 p = 0.77

Table 5.14. Mann-Whitney U analysis of behaviour of humpback whale non-calf pods when vessel approach was consistent with (*n = 1*10) and not consistent with (*n = 2*6) NSW whale-watching regulations; and of behaviour of humpback whale calf pods when vessel approach was consistent (*n* = 27) and not consistent (*n = 4*3) with the NSW whale-watching regulations for calf pods.

		Non-calf pods		Calf pods	
Behaviour	**Vessel movements**	**Mean Rank**	**Test Statistics**	**Mean Rank**	**Test Statistics**
Blow (per min/ per whale)	Consistent	66.4	Mann-Whitney U = 1200 z = -1.27 p = 0.20	33.9	Mann-Whitney U = 538 z = -0.51 p = 0.61
	Not consistent	77.4		36.5	
Slip Under (per min/ per whale)	Consistent	66.4	Mann-Whitney U = 1200 z = -1.27 p = 0.20	26.8	Mann-Whitney U = 344 z = -2.85 p = 0.004
	Not consistent	77.3		41.0	
Dive Rate (per min/ per whale)	Consistent	67.8	Mann-Whitney U = 1357 z = -0.40 p = 0.69	39.1	Mann-Whitney U = 483 z = -1.18 p = 0.24
	Not consistent	71.3		33.2	
%TS	Consistent	69.0	Mann-Whitney U = 1376 z = -0.30 p = 0.76	38.1	Mann-Whitney U = z = -0.84 p = 0.40
	Not consistent	66.4		33.9	
MDT (min)	Consistent	69.0	Mann-Whitney U = 1364 z = -0.36 p = 0.77	34.5	Mann-Whitney U = 553 z = -0.33 p = 0.74
	Not consistent	66.4		36.1	
MBI_{whale} (min)	Consistent	69.2	Mann-Whitney U = 1352 z = -0.43 p = 0.67	32.9	Mann-Whitney U = 509 z = -0.86 p = 0.39
	Not consistent	65.5		37.2	

Table 5.15. Mann-Whitney U analysis of behavioural frequencies of humpback whale pods when vessel approach was consistent with NSW whale-watching regulations (non calf 100 m limit; calf pods 200 m limit) (*n* = 137) and when no vessels were present (*n* = 144).

Behaviour	Consistent (non calf 100 m limit; calf pods 200 m limit)					No Vessel					Test statistics
	Mean	SE	Median	IQR	Mean Rank	Mean	SE	Median	IQR	Mean Rank	
Dive (per min per whale)	0.1	0.01	0.1	0.1	137.0	0.1	0.01	0.1	0.1	144.8	Mann-Whitney U = 9311 z = -0.81 p = 0.42
Slip Under (per min per whale)	0.1	0.01	0.1	0.1	120.1	0.4	0.05	0.2	0.6	160.9	Mann-Whitney U = 7005 z = -4.21 p <<0.001
%TS	48	2.5	51	56.5	157.5	36	2.4	33	52.9	125.3	Mann-Whitney U = 7605 z = -3.32 p = 0.001
MDT (min)	3.0	0.2	2.7	2.5	152.7	2.4	0.2	2.1	2.6	129.9	Mann-Whitney U = 8266 z = -2.35 p = 0.02

Table 5.16. Mann-Whitney U analysis of behavioural frequencies of humpback whales when one vessel was present and when more than one vessel was present.

Behaviour	Mean Behavioural Frequency (per min/ per whale)												Test Statistics
	1 vessel						>1 vessel						
	Mean	SE	Median	IQR	Mean Rank	*n*	Mean	SE	Median	IQR	Mean Rank	*n*	
Blow	0.6	0.04	0.5	0.4	109.6	141	0.5	0.1	0.4	0.3	90.2	65	U = 3718 z = -2.17 p = 0.03
Feeding Lunge	0.4	0.1	0.2	0.4	25.6	34	0.1	0.02	0.10	0.2	14.9	11	U = 98 z = -2.351 p = 0.02
Pectoral Slap	0.7	0.3	0.1	0.8	24.6	25	0.1	0.1	0.01	0.03	11.8	14	U = 60 z = -3.37 p <<0.001
Pectoral Wave	0.03	0.01	0.02	0.03	16.1	16	0.01	0.003	0.01	0.01	7.6	9	U = 23 z = -2.77 p = 0.06
Side Fluke	0.04	0.01	0.03	0.04	14.7	17	0.01	0.004	0.01	0.01	7.1	7	U = 22 z = -2.38 p = 0.02

Table 5.17. Mann-Whitney U analysis of behaviour of humpback whale non-calf pods when one vessel was present (*n* = 97) and when more than one vessel was present (*n* = 39); and of behaviour of humpback whale calf pods when one vessel (*n* = 44) and more than one vessel (*n* = 26) was present.

		Non-calf pods		Calf pods	
Behaviour	**Vessel movements**	**Mean Rank**	**Test Statistics**	**Mean Rank**	**Test Statistics**
Blow	1 vessel	71.4	U = 1611 z = -1.35 p = 0.18	37.4	U = 489 z = -0.10 p = 0.31
	> 1vessel	61.3		32.3	
Slip Under	1 vessel	71.5	U = 1598 z = -1.4 p = 0.16	34.7	U = 537 z = -0.43 p = 0.67
	> 1vessel	61.0		36.9	
Dive	1 vessel	65.4	U = 1594 z = -1.43 p = 0.15	34.2	U = 515 z = -0.67 p = 0.49
	> 1vessel	76.1		37.7	
%TS	1 vessel	65.4	U = 1593 z = -1.44 p = 0.15	34.0	U = 504 z = 0.83 p = 0.41
	> 1vessel	76.1		38.1	
MDS	1 vessel	66.5	U = 1700 z = -0.92 p = 0.36	34.6	U = 533 z = -0.47 p = 0.63
	> 1vessel	73.4		37.0	
MBI_{whale}	1 vessel	70.4	U = 1706 z = -0.89 p = 0.37	35.0	U = 549 z = -0.28 p = 0.78
	> 1vessel	63.7		36.4	

Table 5.18. Kruskal-Wallis analysis of dive behaviour of humpback whale pods being watched by operator 1 (*n* = 80), operator 2 (*n* = 87) and operator 3 (*n* = 39).

Behaviour	Operator	Mean Rank	Test Statistics
Dive	1	97.7	χ^2 = 1.71 df = 2 p = 0.42
	2	109.6	
	3	101.6	
%TS	1	109.1	χ^2 = 1.39 df = 2 p = 0.50
	2	101.8	
	3	95.9	
MDS	1	107.7	χ^2 = 0.76 df = 2 p = 0.68
	2	99.7	
	3	103.3	
MBI_{whale}	1	96.0	χ^2 = 2.12 df = 2 p = 0.35
	2	107.8	
	3	109.4	

Table 5.19. Mann–Whitney U analysis of dive behaviour of humpback whale pods being watched by vessels with 2 x 300 hp engines (*n* = 126) and vessels with 2 x 580 hp engines (*n* = 78).

	Engine Capacity	Mean Rank	Test Statistics
Dive	2 x 300 hp	106.00	Mann-Whitney U = 4473 z = -1.07 p = 0.282
	2 x 580 hp	96.9	
%TS	2 x 300 hp	99.6	Mann-Whitney U = 4544 z = -0.90 p = 0.37
	2 x 580 hp	107.2	
MDS	2 x 300 hp	100.3	Mann-Whitney U = 4637 z = -0.68 p = 0.50
	2 x 580 hp	106.1	
MBI_{whale}	2 x 300 hp	107.1	Mann-Whitney U = 4337 z = -1.41 p = 0.16
	2 x 580 hp	95.1	

5.5 DISCUSSION

5.5.1 The observable responses of whale pods to whale-watching vessels

The results of this study indicate that the observable responses of migrating humpback whales to whale-watching vessels are variable. While almost half of the pods observed showed no obvious change in their ongoing behaviour, others changed their speed and/or direction of travel to either avoid the vessel or to initiate an interaction with the vessel. There may have been additional vertical avoidance (i.e. changes in dive duration) as there were occasions when pods spent long periods submerged, either when or shortly after the vessel was positioned to begin observations. However, as pods were not observed prior to the vessel approaching them, it could not be established whether this was typical behaviour regardless of the vessel. Thus the narrow criteria used may have underestimated avoidance behaviour.

Although vertical avoidance was not directly measured under the observable response criteria, analysis of control–impact data revealed that pods were spending longer periods submerged in the presence of vessels. Pods that avoided vessels through increased swimming speed and/or changes in direction also increased their time spent submerged and decreased their respiration rates. Dive time was 1.5 minutes (or more) longer for pods avoiding vessels than for pods approaching vessels. Avoidance responses of humpback whales observed in the present study seem to be consistent with those observed for other populations and during different stages of the migratory cycle.

Only 17% of pods showed signs of obvious avoidance of the whale-watching vessel. However some pods showing no obvious signs of avoidance still demonstrated changes in diving and surface activity when compared to pods with no vessel present. When both approach and avoidance responses of pods are combined, forty per cent of pods encountered altered their behaviour in an obvious way.

This raises the question of whether approach responses by the whales can be considered positive interactions with whale-watching vessels or simply another indicator of disturbance. Ritter (2003: Page 35) defines disturbance as “A negative influence, in this relation something that interferes with the natural behaviour of

cetaceans and has a detrimental outcome". Some authors suggest that any vessel-related response signifies human interference because it is a reaction to the vessel that would not occur if the vessel was not there (Ritter 2003). However, it is not clear from short-term studies whether these responses have a detrimental outcome for the whales involved. Approaches are likely to have negative long-term effects if they reduce the time spent foraging, resting, socializing or suckling, or lead to increased incidents of vessel strikes (Janik & Thompson 1996, Constantine 2001b).

In this study, many calf pods approached vessels which may have interrupted other activities important for their development like socialising and play. There was evidence from this study that approaches by pods interrupted foraging. Feeding pods were seen on 24.5% of all whale-watching trips and in 10% of these observations, pods suspended feeding to approach the whale-watching vessel (see Chapter 4). Since resting whales were rarely observed and suckling was not measured, there was no evidence for an impact of whale-watching vessels under the conditions of this study on whale resting or suckling times. However, resting whales are motionless at the surface and display minimal blows and so this may be a sightability factor. Aerial surveys would be required to investigate this further. Avoidance of traditional near-shore resting areas by mother-calf pods with an increase in vessel traffic has been noted in Hawaii (Salden 1988, Glockner-Ferrari & Ferrari 1990). It is important that the current distribution of mother-calf pods is fully understood so that any shifts in this distribution relative to vessel traffic can be identified.

Interruptions to behaviour through vessel interactions are not likely to be prolonged, as most approaches by pods were brief, lasting less than 10 minutes. However, these brief interruptions are potentially one of multiple encounters with whale-watching vessels. Given the large size and extent of the whale-watching industry and that the migration route of this humpback whale population follows the east Australian coast closely (Dawbin 1966, Paterson et al. 2002), the chance that an individual whale will encounter several vessels during its migration is high. Thus, there is the potential for a cumulative effect of frequent interruptions and changes to behavioural states. Further research into the frequency and duration of whale encounters during the entire migration would be required to assess this.

Vessels stayed with a pod that was showing obvious signs of avoidance for an average of 52 minutes (and a maximum of 115 minutes), and most avoidance responses occur within 20 minutes of the vessel approaching within 1000 m of the pod. Some operators believe that if they stay with a pod long enough, the whales will become accustomed to the vessel and are likely to approach their boat, but none of the pods in this study that showed an avoidance response subsequently approached the vessel.

Pursuing pods displaying avoidance behaviour could have biological consequences for whales. Humpback whales on the southern end of their southward migration have limited energy reserves (Brown & Lockyer 1984). The energetic cost associated with avoiding vessels could prove detrimental to the health of individual whales. Repeated exposure to vessel traffic could see a shift in migration pathways to suboptimal areas to escape the energetic costs associated with avoiding vessels, which would be detrimental to the whale-watching industry. This effect could only be detected through long-term monitoring of the population.

Humpback whales in this study were not sensitive to small differences in vessel size and engine capacity. Reactions of humpback whales to vessels have been shown to vary with the levels and complexity of underwater sounds they produced as well as the size and shape of the vessel (Au & Green 2000). Although acoustic measurements were not performed on vessels in the present study, all vessels were similar in size (12 – 16 m) and were powered by inboard motors of similar engine capacity (ranging from 300 – 580hp).

5.5.2 Whale behaviour in the presence and absence of vessels

Behaviours associated with respiration and diving

Pods spent longer submerged and blew less frequently when in close proximity to whale-watching vessels. Calf pods were more sensitive to the presence of vessels than non-calf pods. Only those pods containing calves showed changes in respiration rates and time spent submerged. Bauer (1986) in his study of humpback whales in Hawaii also found calf pods more susceptible to vessel disturbance than non-calf pods.

However, Corkeron (1995) in his study of vessel impacts on humpback whales on their nursery grounds in Hervey Bay found no changes in blow rates for either non-calf or calf pods when a vessel was present.

In this study there was no difference in the number of dives per minute in the presence or absence of a vessel but there was a significant increase in the duration of time spent below the surface in the presence of a vessel. Thus the percentage of time spent submerged and the mean duration of submergence are better indicators of response to vessels than dive rate.

Blow intervals are thought to be a sensitive indicator of disturbance in humpback whales and have been found to change in response to vessels (Corbelli 2006, Baker & Herman 1989). However several factors influence the duration of blow intervals. (Dolphin 1987a) in his study of 'undisturbed' foraging humpbacks showed that the duration of blow intervals was dependent on the depth and duration of the dive. Longer and deeper dives exceeding 6 min and 61 m, respectively, had an increase in blow intervals, presumably to maximise gas exchange. Adding to the difficulty in interpreting blow intervals was variation in the duration between blows over the surfacing period. During short shallow dives, blow intervals were longer in the first half of the surface period than they were in the second half. This pattern was reversed in dives exceeding 6 minutes and 61 m depth.

Determining suitable biological indicators and providing defensible and credible standards for whale-watching is difficult when the long-term consequences of short-term changes are unknown. It is important when using behavioural responses as indicators of disturbance that a lack of response is not automatically equated with a lack of sensitivity to the disturbance (Beale & Monaghan 2004, Bejder *et al.* 2006a). The fact that whales did not adopt a more pronounced vertical avoidance strategy and showed no apparent physiological changes may be because they are not in any condition to do so and it may not mean that they will not suffer effects of increased vessel traffic. Beale and Monaghan (2004) found in their study of turnstones that those animals that were most likely to respond to disturbance were actually the least likely to suffer any fitness consequences associated with the disturbance. This may also explain

why almost half the pods in this study showed no obvious signs of a horizontal avoidance response.

Exposure of pods to commercial whale-watching vessels in this study was low. Only one to two dedicated whale-watching vessels operated out of each port and each operator usually conducted one to two trips daily. Only one vessel was present during 68% of boat-based observations. If low exposure can affect short-term behaviour, then greater exposure from additional boats has the potential to exacerbate behavioural effects with probable long term implications. Monitoring of whale-vessel interactions as a function of the number of boats operating is needed to ensure this does not occur. So far the only information on the diving parameters and the associated physiological changes of humpback whales available is that of foraging adult humpbacks in the colder feeding grounds of Alaska. Future research into the diving behaviour and energy expenditure of individual migrating humpback whales, including mothers and calves would be required in order to assess the energetic costs of vessel interactions.

Whales were more likely to avoid vessels that were closer than the approach distances specified in the NSW regulations and more likely to approach vessels that were operating consistent with NSW regulations. Given that customer satisfaction is fundamental to ensuring the long-term sustainability of the industry, and close viewing correlates with high visitor satisfaction (see Chapter 6 & 7); it is in the operators' best interests to comply with the existing NSW whale-watching regulations for vessels approaching whale pods.

A recent study of the behavioural responses of humpback whales to vessels in Canadian waters has shown changes in respiration behaviour with an increase in vessel numbers and when vessels repeatedly violated the current code of practice (Corbelli 2006). The code of practice used in Corbelli's study area is very similar to the NSW marine mammal regulations; both have a minimum approach distance of 100 m. In the present study, however, there were no changes in the respiration and diving behaviours of whales when the vessel was not operating in accordance with regulations or when more than one vessel was present. Further investigations could be undertaken by using experimentally controlled approach distances.

Surface-active behaviours (behaviours not associated with respiration or diving)

Surface-active behaviours (i.e. behaviours not associated with respiration or diving) were common in this study area, with 70% of pods exhibiting such behaviour. This is higher than reported by Corkeron (1995) who found 56% of pods in Hervey Bay were surface-active. The most common surface-active behaviours were pectoral slaps, feeding lunges, fluke slaps, breaches and peduncle slaps. Although attempts were made to minimise observer bias towards surface-active pods, a greater number of pods observed from land were surface-active when first sighted. Nevertheless, the overall proportion of surface active pods for land and boat observations was the same.

The presence of vessel did not impact significantly on the frequency of most surface active behaviours. These are believed to have important social functions associated with inter- and intra pod communication, challenging and courtship, and play and development in calves (see Chapter 3).

Fluke flicks, surface floats front, fluke swishes, fluke waves and trumpet blows occurred in response to vessels. Fluke flicks and surface floats front only occurred in the presence of vessels. Fluke swishes and trumpet blows would not have been easily detected from land-based observation sites. Even so, their association (along with fluke waves) with whale-initiated approaches provides evidence that these behaviours are associated with close proximity to vessels.

In this study, fluke flicks occurred during eight observations and in five of these the vessel approached closer than 100 m. However on one of these occasions the fluke flick was directed towards a seal and so was probably not in response to the closely approaching vessel. A fluke flick was performed only once during all but one of the eight observations. Fluke flicks are thought to be a form of startle response as they are rarely observed other than in response to biopsy procedures (Weinrich *et al.* 1992a), and occasionally in response to close approaches by vessels (Weinrich et al. 1992a, Watkins 1981). In this study fluke flicks were performed by calves in six of the eight pods and so they may also represent aggression or play by calves.

Fluke swishes and trumpet blows are thought to represent agonistic behaviours amongst males competing for access to oestrous females and often occur in large pods (Baker & Herman 1984, Watkins 1986, Tyack & Whitehead 1983). Trumpet blows and fluke swishes have also been observed in response to biopsy strikes (Weinrich *et al.* 1992a) and to close approach of vessels (Corbelli 2006, Bauer 1986) and may represent a behavioural response to harassment. Trumpet blows and fluke swishes in this study often occurred together and were typically seen in non-calf pods of two to four whales. This supports the suggestion that these behaviours represent aggression displays amongst competing males. There were occasions, however, when fluke swishes and trumpet blows were obviously directed at the vessels with individual whales approaching the vessel (or sides of the vessel) separately.

In this study the strong association of these behaviours with close proximity to vessels may be interpreted as aggression by male pods towards a perceived threat (i.e. the vessel) and not towards each other. Brown and Corkeron (1995) found that some males on their southward migration form stable bonds during migration and co-operatively show aggression towards other males in a group but not towards each other. Without knowing the age and sex composition of pods in this study, functional explanations of these behaviours (and their association with vessels) would be speculative.

5.6 CONCLUSIONS

Responses of southward migrating humpback whales were highly variable. Whilst some showed obvious signs of horizontal avoidance, others approached vessels often initiating brief interactions. The avoidance responses of southward migrating humpbacks were consistent with typical avoidance strategies used by humpbacks elsewhere, but the degree of response depended on pod composition**.** Calf pods were more sensitive to the presence of vessels than non-calf pods.

Whilst there were increases in dive time and the overall percentage of time spent submerged when in the presence of vessels, there were no associated changes in respiration intervals. Some surface behaviours were suppressed in the presence of

vessels. Even when vessels were operating in accordance with whale-watching regulations, whales showed some behavioural changes when compared to pods in the absence of vessels. Pods that showed no obvious horizontal responses to vessels showed changes in diving and surface activity when compared to pods in the absence of vessels.

Exposure to commercial whale-watching vessels in this area at the time of this study was low. If low exposure can affect short-term behaviour then increased exposure could have long-term implications. Cumulative effects through increased exposure to vessel traffic could be detrimental. Humpback whales on the southern end of their southward migration have limited energy reserves and repeated exposure to vessel traffic could see a shift in migration pathways to suboptimal areas to escape the energetic costs associated with interacting with vessels.

In the absence of adequate long-term data, management of the humpback whale-watching industry should adopt a precautionary approach to ensure that the short term impacts noted in this study do not translate to long term impacts at a population level. To date much of the focus of regulatory strategies has been on minimum approach distances. Focus should now be directed towards management strategies aimed at eliminating unnecessary exposure to vessels, monitoring the duration and number of whale-vessel interactions, increasing operators' awareness and improving knowledge of long-term effects of vessel interactions. Suggestions for appropriate management measures based on these findings are given in Chapter 9.

CHAPTER 6: Expectations, experience and satisfaction of land-based whale-watchers in New South Wales, Australia

6.1 ABSTRACT

Although land-based whale-watching is a popular low impact form of whale-watching, little is known about what land-based whale-watchers expect and how this compares to their actual experiences, nor is there much information available on what factors influence their satisfaction. A sample of 1569 land-based whale-watchers was surveyed over three years from 2002 to 2004 at Cape Solander (near Sydney, Australia). People come to Cape Solander to watch humpback whales (*Megaptera novaeangliae*) pass by from May through to August as the whales make their northern migration to their breeding grounds. Information was gathered on the whale-watchers' demographics, expectations, experience and satisfaction. Land-based whale-watchers at Cape Solander were typically well-educated, middle aged and lived in or around Sydney. Most had watched whales before, but had a low to moderate knowledge of whales and wanted to learn more as part of their whale-watching experience. Cape Solander whale-watchers were only moderately satisfied with their experience. They had high and often unrealistic expectations of a land-based whale-watching experience. Factors influencing their satisfaction included the degree to which expectations were met, proximity of whales, numbers of whales, the extent of whale behavioural displays and the level of information on whales available to them. Recommendations for management of the area provided in this section are aimed at increasing land-based whale-watchers' satisfaction through moderating their expectations whilst at the same time helping to increase whale-watchers' knowledge of whales and their conservation needs.

6.2 INTRODUCTION

So far this thesis has considered the biological conservation perspective in which the ecological impacts of whale-watching on humpback whales were examined. In order to develop a framework for the management of whale-watching activities it is essential to also consider the human dimensions of whale-watching. As Duffus and Dearden (1993: page 149) state "To ignore either is to invite conflict that will result in the degradation of the resource base..."

The success of sustainable wildlife tourism management relies on striking a balance between the provision of quality visitor experiences and minimising (or eliminating) the negative impacts of the activity. Thus managers must have knowledge of the characteristics, expectations, motivations, and satisfaction of the visitor market in order to provide quality experiences and influence visitor behaviour to promote positive outcomes such as an increase in conservation awareness.

Land-based whale-watching is the most popular platform in four of the five states for which data is available (IFAW 2004). The latest whale-watching figures for NSW are for 2003 when 319,706 people participated in boat-based whale-watching and 616,924 participated in land-based whale-watching in 2003 (IFAW 2004).

It is likely that land-based whale-watching is popular because it is more accessible, more comfortable, less restrictive and less expensive than boat-based whale-watching. The greatest benefit of land-based whale-watching, from a conservation point of view at least, is that it offers a less intrusive alternative of whale-watching than boat-based whale-watching. Although it should be noted that whilst the direct impact on the whales themselves from land-based whale-watching is unlikely, there is the evidence of land-based whale-watchers damaging surrounding cliff areas and trampling on fragile vegetation (Hearne 1996, Reid 1993, Reid 1995).

Despite its popularity little is known of the attitudes, expectations and satisfaction of land-based whale-watchers. In order to manage land-based whale-watching successfully it is imperative that the people-whale relationship is fully understood. The importance of understanding the human dimension of wildlife

encounters has been recognised by many (Muloin 2000, Duffus & Dearden 1993, Muloin 1998, Orams 2000, Reynolds & Braithwaite 2001, Moscardo et al. 2001, Moscardo & Saltzer 2005, Smith et al. 2006).

Some knowledge of this kind has been published for boat-based whale-watchers (Valentine et al. 2004, Neil et al. 2003, Orams 2000, Muloin 1998, Muloin 2000, Smith et al. 2006, Corbelli 2006) and for boat-based dolphin watchers (O'Neill *et al.* 2004), but the land-based whale-watcher is less understood. Reid has profiled land-based whale-watchers at the Head of the Great Australian Bight (Reid 1995) and at Encounter Bay in South Australia (Reid 1993). However further studies on the expectations of people who go land-based whale-watching and how these expectations may influence satisfaction are required.

In general wildlife tourists often have unrealistically high expectations of wildlife viewing (Green & Higginbottom 2001, Moscardo et al. 2001, Higginbottom et al. 2001b). The way in which people build their knowledge of and attitudes towards wildlife will strongly influence their expectations of future wildlife encounters (Newsome *et al.* 2005). Many tourists will draw on external information sources when deciding on a destination, the activities they will engage in once there and their expectations of what the area has to offer (Newsome *et al.* 2005). This is particularly true for first time tourists who have no previous experience to base their expectations upon (Moscardo *et al.* 2001; Reid and Reid 1993). Thus images and texts used in marketing programmes and advertising can influence and shape peoples' expectations and these images often promote unrealistic expectations (Green and Higginbottom 2001; Newsome *et al.* 2005). There are countless examples of advertising and promotion of wildlife tourism featuring images of inappropriate behaviour around wildlife. Some such examples are given by Frost (1999 in Green and Higginbottom 2001) and include a diver patting large fish on the Great Barrier Reef, people standing next to a seal at Seal Bay, Kangaroo Island and images of the Penguin Parade in Phillip Island with no hint of stands and fences used to control visitor access.

It is important to consider visitor expectations in the management of wildlife tourism as it can be an important predictor of satisfaction with the experience. The relationship between expectations and satisfaction has been described by van Raaij

(1986: page 5) "satisfaction is related to the difference between expectations and actual 'performance'. Unconfirmed expectations or an unfair balance of costs and benefits create dissatisfaction." Similarly, (Ryan 1995) noted that where performance meets or exceeds expectations, satisfaction is deemed to be an outcome. Education measures which promote realistic expectations have been recommended as a way of increasing satisfaction amongst wildlife tourists and as an indirect means of managing visitor behaviour (Moscardo et al. 2001, O'Neill et al. 2004, Hammit et al. 1993, Green & Higginbottom 2001).

This chapter: (1) provides a profile of people who go whale-watching at Cape Solander in NSW; (2) ascertains the expectations of land-based whale-watchers and tests the hypothesis that whale-watchers have high, and often unrealistic expectations of their whale-watching experiences; and (3) determines the level of satisfaction with the Cape Solander land-based whale-watching experience and what factors may contribute to visitor (dis)satisfaction.

6.3 STUDY SITE

Most land-based whale-watching in NSW focuses on humpback whales (*Megaptera novaeangliae*) which are the most commonly 'watched' whales worldwide because of their tendency to migrate close to shore, their predictable timing and because of their frequent activity at the surface (Hoyt 2001). The Group V humpback whale population migrates north along the NSW coast in the austral winter to their calving grounds in the waters of the Whitsunday Islands and beyond, and back south again in spring to their feeding grounds in Antarctic waters. There are fourteen national parks along the NSW coast (stretching from southern NSW around Eden to northern NSW around Byron Bay) that offer vantage points to watch whales. Cape Solander, in the Botany Bay National Park, is one such vantage point. Cape Solander is part of the South Headland at the entrance of Botany Bay and is located approximately 15 km south of Sydney. The entrance to the Botany Bay National Park is in the southern Sydney suburb of Kurnell.

Most land-based whale-watching around Sydney occurs during the whales' northern migration when they tend to be closer to shore (typically within 3 km) than they are on their passage southwards. The sandstone cliffs at Cape Solander are up to 40 m above sea level and offer good views of humpbacks passing from May through to August. Whale numbers passing Cape Solander peak from mid to late June (Nicholls *et al.* 2000) .

Land-based whale-watching at Cape Solander has experienced substantial growth in recent years with a 74% increase in visitation from 2000 to 2002 (NPWS 2005, unpublished data). In 2000 the mean daily number of vehicles purchasing tickets to enter the park was 77; this increased to 292 in 2002 and to 327 in 2003. In 2004 (the final year of this study) this figure dropped to 244 and may have been due to a combination of factors including relatively lower levels of media publicity, improvement in public transport (i.e. fewer people entering the park in private vehicles) and the possibility of some people choosing boat-based whale-watching rather than land-based whale-watching (IFAW 2005).

Visitors who park at Cape Solander can watch whales passing from their vehicles, although most people use the rock platform as an observation deck. There is a 4 km walking track from the Cape Solander car park to the Cape Bailey Lighthouse which many visitors use. This walk offers spectacular views of the coastline and chances of seeing whales from the many vantage points along the way.

In 2003 (during the second year of the study), the National Parks and Wildlife Division of the NSW Department of Conservation (DEC) (now DECC) made a number changes to the area in order to meet the demand of the increasing numbers of whale-watchers. A small wooden viewing platform was constructed above the rock platform and this provided some shelter, but became overcrowded quickly during busy times. A large information sign was erected near the viewing platform. This was designed by NPWS and the International Fund for Animal Welfare (IFAW) and contained information on: common humpback whale behaviours and their distinguishing features; a map of their migration patterns; figures of recent humpback whale counts at Cape Solander; whaling and the proposed South Pacific Whale Sanctuary; and some information on how people can help with the protection of whales in Australia.

There is a small car park located at Cape Solander, but during busy times it fills quickly and people must park 2 km away at the larger car park near the National Park's Discovery Centre. In 2003 a free shuttle bus service transported people from the Discovery Centre car park to Cape Solander. This service operated continuously (usually between the hours of 10:00 and 16:00) on most weekends throughout June and July. A toilet was also installed at the southern end of the Cape Solander car park in 2003.

NPWS introduced talks by Discovery Rangers (full-time or casual staff involved in guiding and public education) on the viewing platform in 2003. The usual duration of these talks was 10-15 minutes and they were conducted about every half hour during the busy times of the day, typically between 10:00 and 16:00. These talks provided general information on the biology of the humpback whales, their migration patterns, distinguishing features, general behaviours and what to look for whilst whale-watching at Cape Solander.

In each year of this study, there was a team of whale-watching volunteers located at the viewing platform counting whales on the annual migration and recording distances whales were offshore for the NPWS whale-monitoring program (commenced 1995). These volunteers were accessible to the public and some whale-watchers asked them questions about humpback whales and their migration. While most volunteers were quite knowledgeable about humpback whales and did their best to answer any questions, they had not received any formal training in this area. There was a white-board near the volunteer's table which provided updated information on the time of the last whale sighting, total number of sightings for the year to date and the total number of sightings for the day.

The Discovery Centre had some information on the local environment and local history as well as some photographs of Cape Solander whale sightings on display.

6.4 METHODS

Whale-watchers at Cape Solander were surveyed on 35 days in total during the peak of the humpback whales' northern migration past Sydney in June and July of 2002, 2003 and 2004. Table 6.1 provides a list of survey dates and days for each year of the study. Cape Solander visitation was highest on weekends (NPWS 2005, unpublished data). Of the 35 sample days, 22 were on weekends and 3 were public holidays. Thus there may be a slight bias towards domestic visitors if inter-state and international visitors were more inclined to visit during the week.

A total of 3500 questionnaires were distributed and 1569 returned during the 2002, 2003 and 2004 whale-watching seasons (2002: *n* = 551; 2003: *n* = 499; and 2004: *n* = 519) yielding a return rate of 43% in 2002, 37% in 2003, 58% in 2004, and an overall return rate of 45%. Some people left out answers to some of the questions and so the sample size varies from question to question. The questionnaire was quite long (37 questions, 13 pages) and this could be why many questionnaires were incomplete.

Table 6.1. Dates and days on which Cape Solander whale-watchers were surveyed during 2002, 2003 and 2004.

2002		2003		2004	
Date	**Day**	**Date**	**Day**	**Date**	**Day**
08.06.02	Saturday	07.06.03	Saturday	05.06.04	Saturday
09.06.02	Sunday	08.06.03	Sunday	07.06.04	Monday*
10.06.02	Monday*	09.06.03	Monday*	12.06.04	Saturday
22.06.02	Saturday	11.06.03	Wednesday	13.06.04	Sunday
23.06.02	Sunday	14.06.03	Saturday	14.06.04	Monday
25.06.02	Tuesday	15.06.03	Sunday	19.06.04	Saturday
27.06.02	Thursday	16.06.03	Monday	20.06.04	Sunday
28.06.02	Friday	21.06.03	Saturday	26.06.04	Saturday
29.06.02	Saturday	22.06.03	Sunday	27.06.04	Sunday
30.06.02	Sunday	23.06.03	Monday	01.07.04	Thursday
		24.06.03	Tuesday	03.07.04	Saturday
		29.06.03	Sunday	04.07.04	Sunday
		30.06.03	Monday		

* = public holiday.

Most questionnaires for the survey were handed out at the ticket booth (manned by NPWS and not by research personnel), at the entrance of the Botany Bay

National Park. Cars must stop at the ticket booth to pay an entry fee to the park. If the occupants were going whale-watching they were given a single copy of the questionnaire with little or no additional information. Some questionnaires were also given out at Cape Solander, if researchers or NPWS whale monitoring program volunteers were approached and asked for one. In 2002, the primary researcher was stationed at the NPWS whale monitoring program volunteer table and was easily identified by a UNSW jumper. NPWS volunteers were also easily identified by a NPWS jumper. In 2003 and 2004, the researcher or assistant (usually NPWS whale monitoring program volunteers) travelled on the shuttle bus to explain the survey and handed out the questionnaire to anyone interested upon arrival at Cape Solander. This method encouraged more participation as people were given a detailed explanation of the research, in contrast to the lack of information at the ticket booth. When they arrived at the ticket booth there was often a long queue stretching beyond the entrance to the Park and the people manning the booth had very little time to explain the study to them. In 2003 and 2004 there were also copies of the survey in the Discovery Centre, with a display of the research objectives next to them. Boxes were set up for the questionnaires to be returned at Cape Solander, the Discovery Centre and near the exit of the Park.

The questionnaire contained both open and closed questions, including some Likert-scale and multiple choice type questions. Where possible questions were based on other research for direct comparison e.g. Neil *et al*. (2003), NSW Department of Environment and Conservation (2003) and (Moscardo & Saltzer 2005). The questionnaire contained a total of 37 questions and it was expected to take 10-15 minutes to complete. Four questions sought information on the background of the visit to the Botany Bay National Park (e.g. why they were visiting the park and type of travel party), two questions sought information on the frequency of previous visits to the park and other wildlife areas and three questions sought information on respondents expectations for their whale-watching experience. There was one question requiring respondents to self- assess their knowledge of whales, other wildlife and the local area. Eight questions sought information on what respondents saw and did whilst at the park, two questions were used to determine what whale-watchers had learnt during their

visit and six questions gauged levels of satisfaction with their whale-watching experience. Four questions sought information on visitors' future behaviour (e.g. if they are likely to return and if they are likely to recommend land-based whale-watching to others) and finally seven questions were used to obtain a demographic profile of whale-watchers. A copy of the land-based whale-watcher questionnaire is provided in Appendix 4 (the results of question 30 on the questionnaire are not discussed in this chapter, but are included in Chapter 8). As an incentive for participation in the survey, all respondents were given an entry form into a draw to win one Annual All Park Pass which entitles the holder free entry for their vehicle to all National Parks in NSW for one year. This prize was drawn annually.

In June 2002 a pilot test was conducted to see if participants could effectively answer questionnaires pre and post the whale-watching experience. Such before/after surveys have been effective on board whale-watching boats, when there is a captive audience. The pilot test revealed that most participants were inclined to complete the before and after questionnaires together, and after the experience. To overcome this problem the two questionnaires were combined into one. This meant rewording some questions so that those aimed at determining expectations were clearly asking for visitors' expectations before arriving, not once they had been at Cape Solander.

Non-parametric analyses were performed on the data using Statistical Package for Social Sciences (SPSS for Windows V14.0; SPSS Inc., Chicago).

6.5 RESULTS

6.5.1 Visitor profile

Most whale-watching participants (61%, *n* = 1534) at Cape Solander were female. Most were aged between 35 and 54 years of age with the 35-44 age group having the largest representation followed by the 45-54 age group (Table 6.2). Most were well educated and 50% (*n* = 1532) of people surveyed had a university degree, diploma or higher degree. Forty-seven per cent (*n* = 1540) were employed as executives/managers, teachers/lecturers or 'other professionals' (Table 6.2). Cape

Solander whale-watchers were in groups of mainly immediate family members (i.e. parents and children) (35%, *n* = 1552), adult couples (33%), or friends or relatives (26%).

Table 6.2. Demographic profile of whale-watchers at Cape Solander.

	%	*n*
Gender		1534
Female	61	
Male	39	
Age		1477
35-44	27	
45-54	21	
55-64	15	
30-34	11	
25-29	9	
65 or over	8	
15-19	5	
20-24	4	
Schooling		1532
University degree, diploma or higher degree	50	
Completed secondary school	20	
Trade or technical qualifications	20	
Some secondary school	8	
Primary school	1	
No formal schooling	0.5	
Occupation		1540
Executive/manager	13	
Retired/pensioner	12	
Teacher/Lecturer	10	
Other professional	24	
Clerical	9	
Home Duties	8	
Student	7	
Skilled Tradesperson	4	
Sales/Service	4	
Technical	4	
Unemployed	1	
Driver/Machinery operator	1	
Labourer	1	
Artist/Designer/writer	1	
Self employed	0.3	
Other	1	
Travel Party Composition		1552
Family (parents and children)	35	
Adult couple	33	
Friends/relatives	26	
Unaccompanied	5	
Other	1	

The MAIN reason for visiting the Botany Bay National Park

Eighty-six per cent (*n* = 1558) of respondents were at Botany Bay National Park specifically to watch whales. Other reasons people gave for their visit to the Park included: to go on one or more of the walking tracks, to take in the views, to have a picnic or barbeque, to visit the historical sites or to visit the Discovery Centre.

Respondents' place of residence

Ninety- seven per cent (*n* = 1445) of respondents were from NSW with 88% living within 50 km of the Sydney CBD. Two per cent were overseas visitors (from the UK, other parts of Europe, USA, Canada, India, Israel and Nicaragua) and 2% were from interstate. Of those people who lived within 50 km of Sydney, most came from south west Sydney (Figure 6.1). Of those people that resided within 50 km of the Sydney CBD the average distance they lived from Kurnell was 16 km. Fifty-two per cent lived between 11-20 km from Kurnell, 24% between 4-10 km from Kurnell, 13% 21-30 km from Kurnell, 9% more than 31 km from Kurnell and 1% of respondents lived in Kurnell.

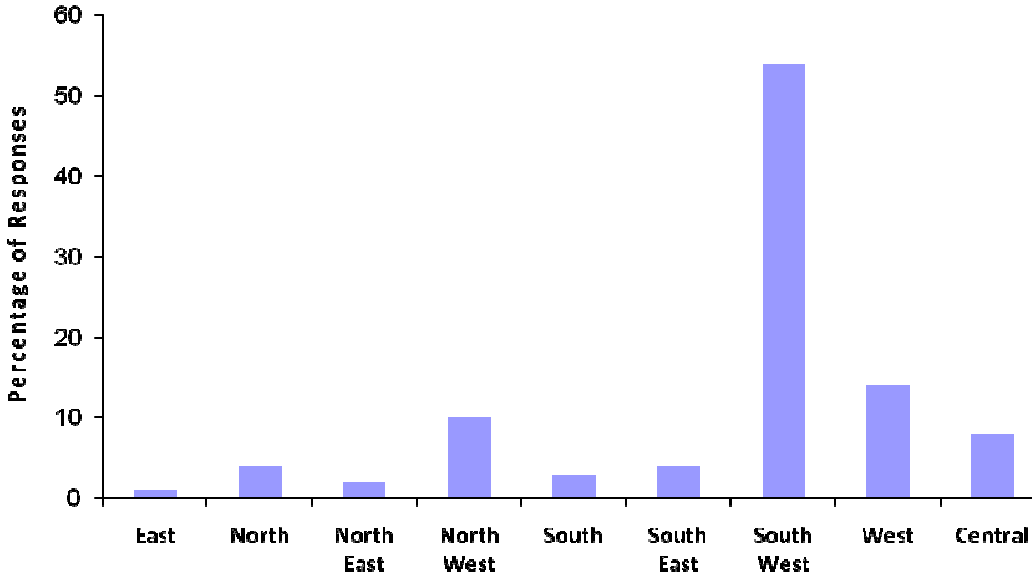


Figure 6.1 Percentage of Sydney based respondents residing in each area of Sydney (*n* = 1273).

Frequency of people donating to and/or actively involved in helping an environmental organisation or group

Twenty-seven per cent (*n* = 1393) of respondents donated to and/or were actively involved in helping an environmental organisation. The most popular environmental groups included Greenpeace; NSW National Parks Association and/or helping out with their local NPWS; World Wide Fund for Nature (WWF); Wilderness Society; Wildlife Information and Rescue Service (WIRES); Bushcare and the Australian Conservation Foundation (ACF). A table of all environmental organisations that respondents listed is given in Appendix 5.

Frequency with which respondents incorporate environmentally friendly behaviours into their daily lives

Six questions were used to gauge the frequency with which whale-watchers incorporated environmentally friendly behaviours into their daily lives. The majority of Cape Solander whale-watchers either 'always' or 'frequently' carried out the first four of these environmentally friendly behaviours but relatively few 'always' or 'frequently' donated to and/or were actively involved in helping an environmental organisation or used alternatives to plastic bags when shopping for groceries (Table 6.3).

Four of these six questions were based on a survey developed by the NSW Department of Environment and Conservation (2003) to assess participation in environmentally friendly actions. That survey offered five categories (Often, Sometimes, Occasionally, Never, Not applicable) of response instead of the six used in this study ('Always', 'Frequently', 'Sometimes', 'Rarely', 'Not at all', 'Not applicable'). For comparative purposes the categories 'Always' and 'Frequently' were combined and renamed 'Often', 'Sometimes' remained the same, 'Rarely' was renamed 'Occasionally' and 'Not at all' was renamed 'Never'. It could be argued that the DEC categories of 'Sometimes' and 'Occasionally' are not different from one another, however given that 'Occasionally' came after 'Sometimes' on an apparently sliding scale then it is assumed that respondents who ticked 'Occasionally' would probably have ticked 'Rarely' if that

was an option. Comparisons of these results indicate that Cape Solander whale-watchers display more environmentally friendly behaviours than the average person living in NSW (Figure 6.2).

Table 6.3. Frequency with which Cape Solander whale-watchers incorporated environmentally friendly behaviours into their daily lives. Values represent percentage of responses.

	Not at all	Rarely	Sometimes	Frequently	Always	Not applicable	*n*
Recycle bottles, cans, paper or plastic instead of throwing them away	1	1	2	17	79	0	1407
Choose household products that you think are better for the environment	2	4	19	38	36	1	1323
Avoid putting things like oil, fat , turps or paints down the sink or toilet	1	2	4	20	72	0	1391
Avoid putting things like litter or detergents into gutters or storm water drains	1	1	4	17	77	0	1399
Donate to and/or actively involved in helping an environmental group	31	31	22	10	5	1	1231
Use alternatives to plastic bags when shopping for groceries	14	21	25	20	18.5	1	1292

Environmental rating

An 'environmental rating' was given to respondents based on their answers to all of the above six question (i.e. how often you personally do the following activities…) where the score was: 'not at all' = 0 points, 'rarely' = 1 point, 'sometimes' = 2 points, 'frequently' = 3 points and 'always' = 4 points (0 is the minimum environmental rating and 24 is the maximum environmental rating a person can have). Respondents who did not answer all six questions or who answered 'not applicable' to at least one were excluded. The median environmental rating of respondents was 17 and the interquartile range (IQR) was 5 indicating that most respondents frequently

incorporated environmentally friendly behaviours into their daily lives. Sixty-one per cent (*n* = 1066) had a high environmental rating i.e. between 17 and 24, 36% medium environmental rating i.e. between 9 and 16 and only 2% low rating of 8 or less.

Frequency of previous visits to the Botany Bay National Park and previous whale-watching experiences.

Most respondents (72%, *n* = 1491) were on a repeat visit to the Park. Of those who had been to the park before, most had visited between 2 and 10 times and 23% had visited more than ten times. Most respondents (74%, *n* = 1458) had been whale-watching before, but it was the first time watching whales at Cape Solander for 68% of visitors. Of those repeating the experience at Cape Solander, the relative frequency was once before (12%), 2-10 times (15%) and >10 times (5%). Fifty-nine per cent (*n* = 1437) of respondents had watched whales from land, elsewhere, at a relative frequency of once (22%), 2-5 times (29%) and ≥ 6 times (9%). Thirty-two per cent (*n* = 1408) of respondents had watched whales from a boat. Most of these respondents had watched whales from a boat only once before (Table 6.4a).

Frequency of visits to other wildlife areas in the last 12 months

Seventy-two per cent (*n* = 1472) of respondents had taken a trip to a zoo/aquarium/wildlife park during the 12-month period prior to completing the survey. Most had been either once (37%), or between 2 – 5 times (29%). Ninety-four per cent (*n* = 1491) of respondents had visited a national park/nature reserve during the 12-month period prior to completing this survey. Most had been between 2 – 5 times (47%) or more than 6 times (31%). Sixty-nine per cent (*n* = 1434) of respondents had visited a place specifically to view wildlife over the 12-month period prior to completing the survey. Most had visited between 2-5 times (33%) followed by 23% who had visited only once (Table 6.4b).

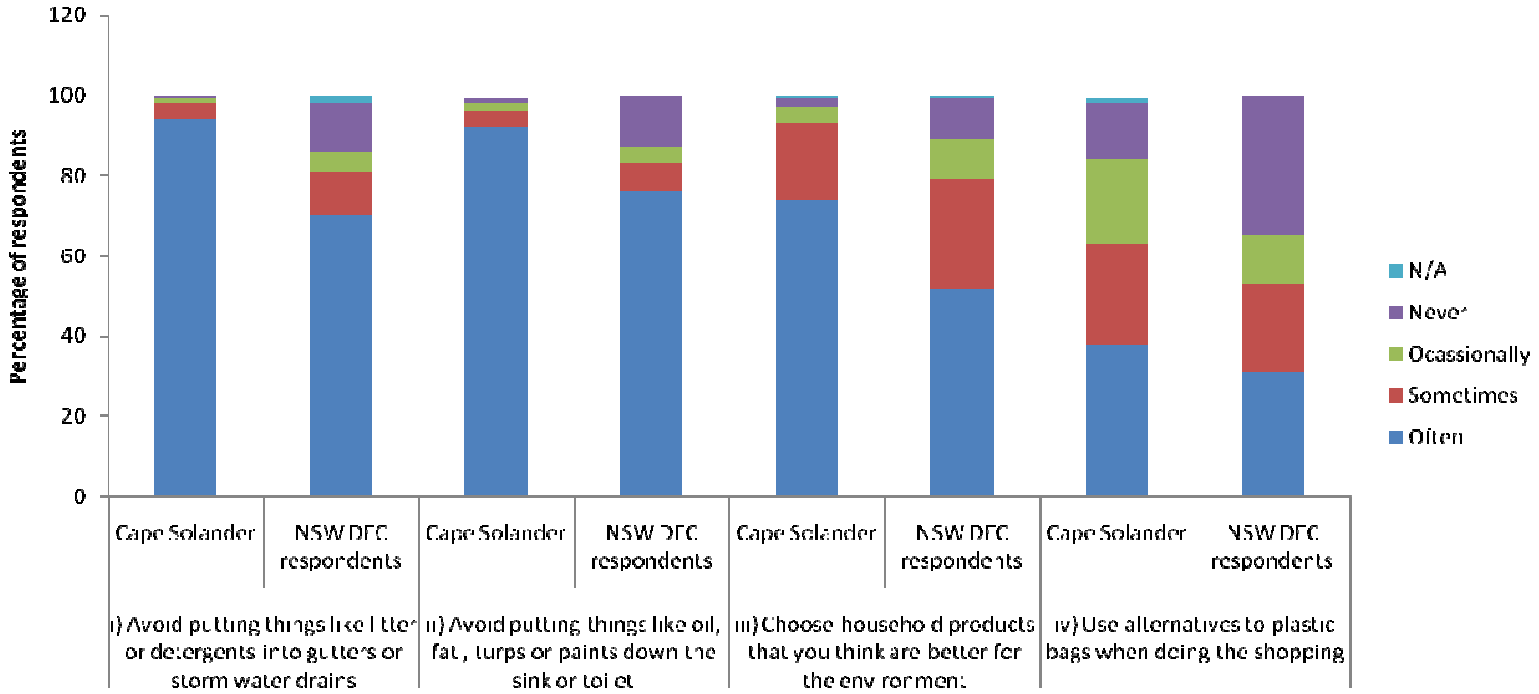


Figure 6.2. Frequency with which Cape Solander whale-watchers and NSW Department of Environment and Conservation (2003) respondents incorporate environmentally friendly behaviours into their daily lives i) $\chi^2 = 270.09$, df = 4, p <0.001, *n* (CS WW's) = 1399 *n* (NSW) = 1421; ii) $\chi^2 = 174.76$, df = 4, p <0.001, *n* (CS WW's) = 1391 *n* (NSW) = 1421; iii) $\chi^2 = 184.85$, df = 4, p <0.001, *n* (CS WW's) = 1323 *n* (NSW) = 1421; iv) $\chi^2 = 177.26$, df = 4, p <0.001, *n* (CS WW's) = 1292 *n* (NSW) = 14

Table 6.4. Frequency of **a)** previous visits to the Botany Bay National Park and previous whale-watching experiences and **b)** visits to other wildlife areas in the 12 months prior to completing the survey. Values represent percentage of responses

a)

	Not at all	Once	2-5 times	6-10 times	More than 10 times	*n*
Visited Botany Bay National Park	28	15	25	9	23	1491
Watched whales at Cape Solander	68	12	12	3	5	1458
Watched whales from land elsewhere	41	22	29	5	4	1437
Watched whales from a boat	68	21	9	1	1	1408

b)

	Not at all	Once	2-5 times	6-10 times	More than 10 times	*n*
Taken a trip to a zoo/aquarium/wildlife park	29	37	29	3	3	1472
Visited a National Park/Wildlife Reserve	6	16	47	13	18	1491
Visited a place specifically to view wildlife	31	23	33	7	6	1434

Nature/wildlife interest rating

A 'nature/wildlife interest rating' was given to respondents who answered both parts (i.e. 'How many times have you done the following before today?' and 'In the last 12 months, how many times have you done the following?') of the three questions relating to participation in a wildlife/nature-based experience. The ratings for each question were: 'Not at all' = 0 point, 'once' = 1 point, '2-5 times' = 2 points, 6-10 times = 3 points and 'more than 10 times' = 4 points (0 is the minimum nature/wildlife interest rating and 28 is the maximum nature/wildlife interest rating a person can have). The median nature/wildlife interest rating of respondents was 8 (IQR = 7) and so most respondents only occasionally visit nature-based tourism areas. Even though most people had a low nature/wildlife interest rating, 98% (*n* = 1346) had been at least once to at least one type of place in the 12 months prior to completing the questionnaire.

There was a significant positive correlation between whale-watchers' nature/wildlife interest rating and their environmental rating (Spearman's rho = 0.225 p =<<0.001

Respondents self assessment of knowledge

Most people surveyed rated their knowledge of whales, other marine life, the marine environment, birds, local terrestrial wildlife, local geology, and local history as either moderate or little (Table 6.5).

Those people with a nature/wildlife interest rating above the median rated their knowledge of all topics significantly higher than those whose nature wildlife/interest rating that was below the median (Table 6.6). Previous whale-watchers also rated their knowledge of all topics significantly higher than those who were whale-watching for the first time (Table 6.7).

Table 6.5. How Cape Solander whale-watchers rated their knowledge of various topics. Values represent percentage of responses.

	None	Little	Moderate	Good	Expert	*n*
Whales	3	42	43	11	1	1515
Other marine life	3	40	44	12	1	1494
Marine environment	4	39	42	15	1	1497
Birds	4	36	41	17	2	1494
Local terrestrial wildlife	10	48	30	11	1	1488
Local history	8	36	35	19	1	1502
Local geology	15	46	27	10	2	1497

How respondents found out about whale-watching at Cape Solander

Sixty-two per cent (*n* = 1514) of respondents had heard about whale-watching at Cape Solander from one or more media sources. Most people (35%) heard about whale-watching from a newspaper, 19% via radio and 16% from television. One quarter of respondents had heard about whale-watching at Cape Solander from friends/relatives and a further 21% from other sources including previous visits, local knowledge/live locally, internet or found out upon arrival to the park.

Table 6.6. Mann-Whitney U analysis of differences in self-assessed knowledge on various topics between respondents with a low nature/wildlife interest rating (i.e. below median) and respondents with a high nature/wildlife interest rating (i.e. above median).

All variables were measured on a 5-point Likert scale with values of 1 = 'none', 2 = 'Little', 3 = 'Moderate', 4 = 'Good' and 5 ='expert'.

	Nature/wildlife interest rating	*n*	Mean Rank	Mean Rating ± SE	Test Statistics
Whales	Low	614	541.1	2.5±0.03	Mann-Whitney U = 143417 z = -7.31 p <<0.001
	High	601	676.4	2.8±0.03	
Other marine life	Low	610	538.3	2.5±0.03	Mann-Whitney U = 141983 z = -7.23 p <<0.001
	High	598	672.1	2.8±0.03	
Marine environment	Low	611	528.4	2.5±0.03	Mann-Whitney U = 135576 z = -8.29 p <<0.001
	High	598	683.3	2.9±0.03	
Birds	Low	611	543.9	2.6±0.03	Mann-Whitney U = 46432 z = -4.84 p <<0.001
	High	595	664.7	2.9±0.03	
Local terrestrial wildlife	Low	611	522.9	2.2±0.03	Mann-Whitney U = 132539 z = -8.85 p <<0.001
	High	597	688.0	2.7±0.04	
Local history	Low	611	498.7	2.4±0.04	Mann-Whitney U = 117707 z = -11.19 p <<0.001
	High	596	712.0	3.0±0.04	
Local geology	Low	611	527.7	2.1±0.03	Mann-Whitney U = 135286 z = -8.44 p <<0.001
	High	598	686.3	2.6±0.04	

Table 6.7. Mann-Whitney U comparison of differences in self-assessed knowledge on various topics between respondents who had and had not been whale-watching previously.
All variables were measured on a 5-point Likert scale with values of 1 = 'none', 2 = 'Little', 3 = 'Moderate', 4 = 'Good' and 5 ='expert' probability level.

	Previous whale-watching experience	*n*	Mean Rank	Mean Rating ± SE	Test Statistics
Whales	Yes	1083	769.9	2.7±0.02	Mann-Whitney U = 156026 z = -7.06 p <<0.001
	No	372	605.9	2.4±0.04	
Other marine life	Yes	1070	748.3	2.7±0.02	Mann-Whitney U = 166114 z = -4.86 p <<0.001
	No	368	636.0	2.5±0.04	
Marine environment	Yes	1073	752.3	2.8±0.02	Mann-Whitney U = 163857 z = -5.24 p <<0.001
	No	368	629.8	2.5±0.04	
Birds	Yes	1066	744.5	2.8±0.03	Mann-Whitney U = 169519 z = -4.30 p <<0.001
	No	370	643.7	2.6±0.04	
Local terrestrial wildlife	Yes	1063	745.2	2.5±0.03	Mann-Whitney U = 1658608 z = -4.80 p <<0.001
	No	369	633.8	2.3±0.04	
Local history	Yes	1073	760.3	2.8±0.03	Mann-Whitney U = 158453 z = -6.17 p <<0.001
	No	371	613.1	2.4±0.05	
Local geology	Yes	1068	754.1	2.5±0.03	Mann-Whitney U = 161722 z = -5.64 p <<0.001
	No	371	621.9	2.2±0.05	

6.5.2 Visitors' expectations

What is important when seeking a good whale-watching experience

Respondents were given 14 features whale-watchers may look for when seeking a good whale-watching experience and were asked to rate each as either 'important', 'neutral' or 'not important'. The five features that rated most important for a good whale-watching experience, each with score of >60% of respondents, were (Table 6.8):

1) *Seeing whales in their natural environment*
2) *Seeing whales behaving naturally*

3) *Opportunity to spend time with family and friends*
4) *A chance to do something new, exciting and different*
5) *Seeing whales up close*.

Respondents' expectations of viewing wildlife during their visit to Cape Solander

Respondents were asked to rate their chances of seeing a humpback whale, a southern right whale, dolphin, seal or sea bird as either 'guaranteed', 'high', 'medium', 'low' or 'no chance'. Most people thought they had a medium to high chance of seeing a humpback whale and a medium to low chance of seeing a southern right whale or a dolphin. Most people thought there was 'no chance' that they would see a seal. Forty-three per cent of respondents thought that they were guaranteed of seeing sea birds whilst at Cape Solander (Table 6.9).

Those who had been whale-watching before had higher expectations of seeing a humpback whale and lower expectations of seeing a seal than those who had not been whale-watching before (Table 6.10a). There was no significant difference in expectations of seeing southern right whales, dolphins or seabirds between those who been whale-watching before and those who had not (Table 6.10a). Those who had been whale-watching at Cape Solander before had higher expectations of seeing humpback whales, southern right whales, dolphins or sea birds (Table 6.10b). Previous Cape Solander whale-watchers had lower expectations of seeing a seal than those who had not watched whales at Cape Solander before (Table 6.10b).

Table 6.8. The importance of 14 features when seeking a good whale-watching experience, as rated by land-based whale-watchers at Cape Solander.

	Important (%)	Neutral (%)	Not important (%)	Mean	SE	*n*
Seeing whales in their natural environment	90	8	2	2.9	0.01	1524
Seeing whales behaving naturally	90	8	2	2.9	0.01	1501
Opportunity to spend time with family and friends	68	24	8	2.6	0.02	1495
A chance to do something new, exciting and different	62	30	8	2.5	0.02	1496
Seeing whales up close	63	26	11	2.5	0.02	1516
An opportunity to learn more about whales	56	36	8	2.5	0.02	1488
To feel safe and comfortable whilst viewing whales	57	29	14	2.4	0.02	1502
Seeing large numbers of whales	48	35	18	2.3	0.02	1505
An opportunity to learn more about the marine environment	48	37	15	2.2	0.02	1487
Being able to tell people you have seen whales	44	34	22	2.2	0.02	1491
An opportunity to learn more about a variety of marine life	34	49	17	2.2	0.02	1482
An opportunity to learn more about the local area	35	45	20	2.2	0.02	1490
Seeing a large variety of marine life	34	49	17	2.1	0.02	1487
Opportunity to take photos	33	36	32	2.0	0.02	1494

Table 6.9. Cape Solander whale-watchers' expectations of seeing a humpback whale, southern right whale, dolphin, seal or seabird. Values represent percentage of responses.

	Guaranteed	High Chance	Medium Chance	Low Chance	No Chance	*n*
Humpback whales	5	28	39	24	3	1521
Southern Right whales	1	14	37	39	9	1462
Dolphins	1	8	27	46	18	1469
Seals	0	1	9	41	48	1450
Seabirds	43	32	15	7	2	1484

Table 6.10. Mann-Whitney U comparison of differences in expectations of seeing a humpback whale, southern right whale, dolphin, seal and seabird between respondents who **a)** had and had not been whale-watching previously and **b)** had and had not been whale-watching at Cape Solander previously. All variables were measured on a 5-point Likert scale with values of 1 = 'Guaranteed', 2 = 'High chance', 3 = 'Medium chance', 4 = 'Low chance' and 5 ='no chance'.

a)

	Previous whale-watching experience	*n*	Mean Rank	Mean Rating ± SE	Test Statistics
Humpback Whales	Yes	1088	713.5	2.9±0.03	Mann-Whitney U = 183848 z = -2.47 p = 0.01
	No	368	772.9	3.0±0.05	
Southern Right Whales	Yes	1049	704.4	3.4±0.03	Mann-Whitney U = 184243 z= -0.31 p = 0.75
	No	355	697.0	3.4±0.05	
Dolphins	Yes	1053	697.2	3.7±0.03	Mann-Whitney U = 179192 z = -1.49 p = 0.14
	No	358	732.0	3.8±0.05	
Seals	Yes	1041	710.6	4.4±0.03	Mann-Whitney U = 172180 z = -2.13 p = 0.03
	No	355	663.0	4.3±0.06	
Seabirds	Yes	1064	710.9	1.9±0.04	Mann-Whitney U = 189850 z = -0.35 p = 0.73
	No	361	719.1	2.0±0.02	

b)

	Cape Solander whale-watching experience	*n*	Mean Rank	Mean Rating ± SE	Test Statistics
Humpback Whales	Yes	465	`627.9	2.7±0.04	Mann-Whitney U = 183625 z = -5.78 p <<0.001
	No	962	755.6	3.0±0.03	
Southern Right Whales	Yes	445	653.2	3.3±0.04	Mann-Whitney U = 191429 z = -2.45 p = 0.01
	No	932	706.1	3.4±0.03	
Dolphins	Yes	447	663.2	3.7±0.04	Mann-Whitney U = 196307 z = -2.08 p =0.04
	No	939	707.9	3.8±0.03	
Seals	Yes	452	747.4	1.8±0.03	Mann-Whitney U = 178695 z = -4.29 p <<0.001
	No	946	658.5	2.0±0.03	
Seabirds	Yes	440	667.0	4.5±0.05	Mann-Whitney U = 200004 z = -2.08 p = 0.04
	No	933	714.1	4.3±0.04	

Respondents' expectations of viewing specific types of whale behaviour during their visit to Cape Solander

Respondents were asked to rate their chances of seeing a whale breach, spy hop, tail slap and blow as either 'guaranteed', 'high', 'medium', 'low' or 'no chance'. The most likely whale behaviour that respondents thought they would see was a 'blow', with most rating their chances of seeing this as medium to high. The next most likely behaviour that Cape Solander whale-watchers thought they would see was a 'tail slap' followed equally by a 'breach and a 'spy hop', with most rating their chances of seeing these two behaviours as low to medium (Figure 6.3).

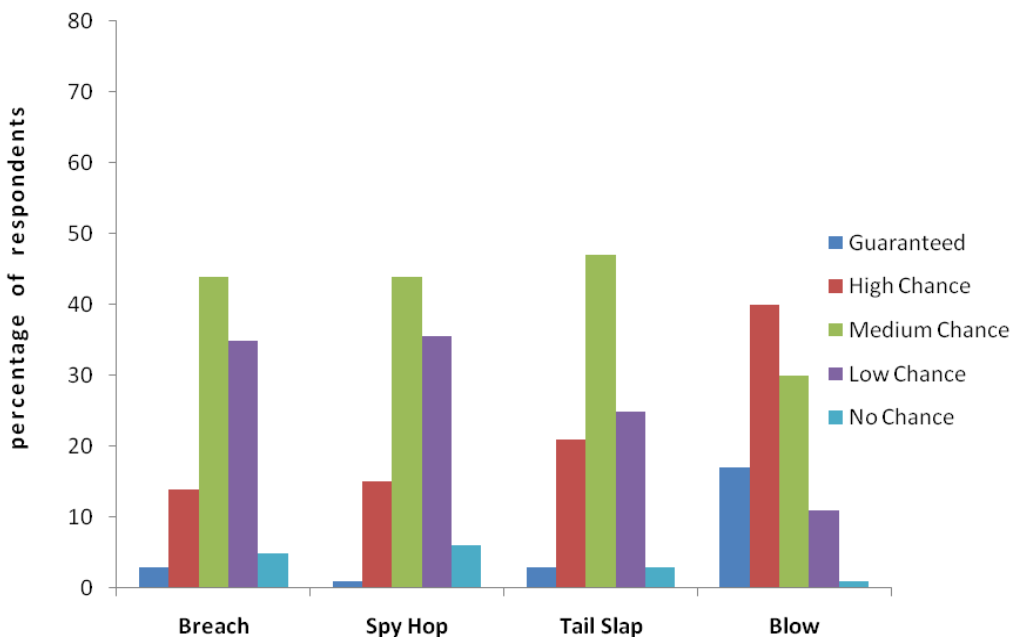


Figure 6.3 Cape Solander whale-watchers' expectations of seeing a whale breach (*n* = 1051), spy hop (*n* = 1042), tail slap (*n* = 1172) or blow (*n* = 1361) whilst at Cape Solander.

Expectations of seeing a whale breach, tail slap or spy hop were not significantly different depending on whether respondents had been whale-watching before or not. However expectations of seeing a whale blow were significantly higher for those with previous whale-watching experience (Table 6.11a). Expectations of seeing a whale breach or spy hop were not significantly different if they had been whale-watching at Cape Solander before or not. However expectations of seeing a whale blow and tail slap were higher for those who had watched whales at Cape Solander before (Table 6.11b).

Table 6.11. Mann-Whitney U comparison of differences in expectations of seeing a whale blow, tail slap, breach and spy hop between respondents who a) had and had not been whale-watching previously and b) had and had not been whale-watching at Cape Solander previously. All variables were measured on a 5-point Likert scale with values of 1 = 'Guaranteed', 2 = 'High chance', 3 = 'Medium chance', 4 = 'Low chance' and 5 ='no chance'.

a)

	Previous whale-watching experience	***n***	**Mean Rank**	**Mean Rating ± SE**	**Test Statistics**
Blow	Yes	989	633.2	2.3±0.03	Mann-Whitney U = 136626 z = -3.79 p <<0.001
	No	319	720.7	2.6±0.06	
Tail Slap	Yes	844	563.9	3.1±0.03	Mann-Whitney U = 115277 z = -0.47 p = 0.64
	No	278	554.2	3.0±0.06	
Breach	Yes	756	506.9	3.3±0.03	Mann-Whitney U = 92684 z = -0.59 p = 0.56
	No	251	495.3	3.2±0.06	
Spy Hop	Yes	844	502.6	3.3±0.03	Mann-Whitney U = 95064 z = -0.28 p = 0.78
	No	278	508.2	3.3±0.06	

b)

	Cape Solander whale-watching experience	***n***	**Mean Rank**	**Mean Rating ± SE**	**Test Statistics**
Blow	Yes	426	547.7	2.1±0.04	Mann-Whitney U = 142387 z = -6.71 p <<0.001
	No	855	687.5	2.5±0.03	
Tail Slap	Yes	357	514.6	2.9±0.04	Mann-Whitney U = 119814 z = -2.75 p = 0.006
	No	742	567.0	3.1±0.03	
Breach	Yes	317	476.3	3.2±0.05	Mann-Whitney U = 100581 z = -1.49 p = 0.16
	No	669	501.6	3.3±0.03	
Spy Hop	Yes	315	469.4	3.2±0.04	Mann-Whitney U = 98078 z = -1.95 p = 0.05
	No	671	504.8	3.3±0.03	

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6.5.3 Visitors' experience and satisfaction

Time spent at Cape Solander

Most (63%, *n* = 870) respondents spent between 30 minutes and two hours at Cape Solander, 30% were there for 2-3 hours or more. Only 7% were there for less than 30 minutes.

Marine mammals that respondents saw

Sixty-four per cent (*n* = 1394) of people saw whales. Sixty-two per cent of those people who saw whales knew they were humpbacks, thirty-eight per cent were either not sure which whales they saw or incorrectly identified them as southern right whales. Three per cent of people saw dolphins, 5% were unsure if they saw dolphins. Only 5 people (i.e. less than 1%) saw seals. Three people saw a blue whale and two people saw minke whales.

There was a higher chance of seeing a whale if whale-watchers spent more than two hours at Cape Solander ($\chi^2 = 44.37$, df = 4, $p < 0.001$, *n* = 815, standardised residuals significant >1.96 at p = 0.05). Eighty-two per cent of people who did not see whales stayed less than two hours.

Approximate distance to whales

Fifty-one per cent (*n* = 786) of respondents who saw whales estimated that they were between 500 and 1000 m from the whales, 23% estimated that they were less than 500 m from the whales, 10% were >1500 - 2000 m, 8% between >1000 - 1500 and 7% said they were more than 2000 m from the whales.

Respondents' satisfaction with their proximity to the whales

Sixty-four per cent (*n* = 985) of people responding to this question thought that their whale viewing was *not close enough*. The main reasons that visitors gave were: "Couldn't see whales clearly, wanted to be able to see more detail" (e.g. size, shape, behaviours, type of whale, more of their body); "would like to see them closer up and needed binoculars to see them".

Thirty-six per cent of people thought that the distance they were from the whales was *close enough.* The main reasons that they gave were: "It's what you would expect when viewing from land", "good views with binoculars", "could see them clearly/could see with naked eye/good views", "don't want to disturb the whales", "as close as the whales wanted to be" and "just lucky/happy to see them".

Return Cape Solander whale-watchers were more likely to say that the distance was 'close enough' than those who were watching whales at Cape Solander for the first time (Figure 6.4).

Whale behaviours that respondents saw

Seventeen per cent (*n* = 1302) saw a whale *breach* and 6% were unsure if they saw a whale breach. Eight per cent (*n* = 1292) saw a whale *spy hop* and 9% were unsure if they saw a spy hop.

Twenty-six per cent (*n* = 1303) saw a whale *tail slap* and 6% were unsure if they saw a whale tail slap. Sixty-three per cent (*n* = 1334) of people saw a whale *blow* and 2% were unsure if they saw a whale blow.

The percentages of people who saw and were unsure if they saw each of the behaviours were added together. The probability of seeing each behaviour was then rated on the following scale: No chance = 0, Low = 1%-33%, Medium = 34%-66%, High = 67%-99%, Guaranteed = 100%. Based on this scale there was a low probability of seeing a whale *breach*, *spy hop* or *tail slap* and a medium probability of seeing a whale *blow* at Cape Solander. The accuracy of peoples' expectations can also be determined based on the above scale. The majority of respondents had expectations that were too high for all of the four whale behaviours (Figure 6.5).

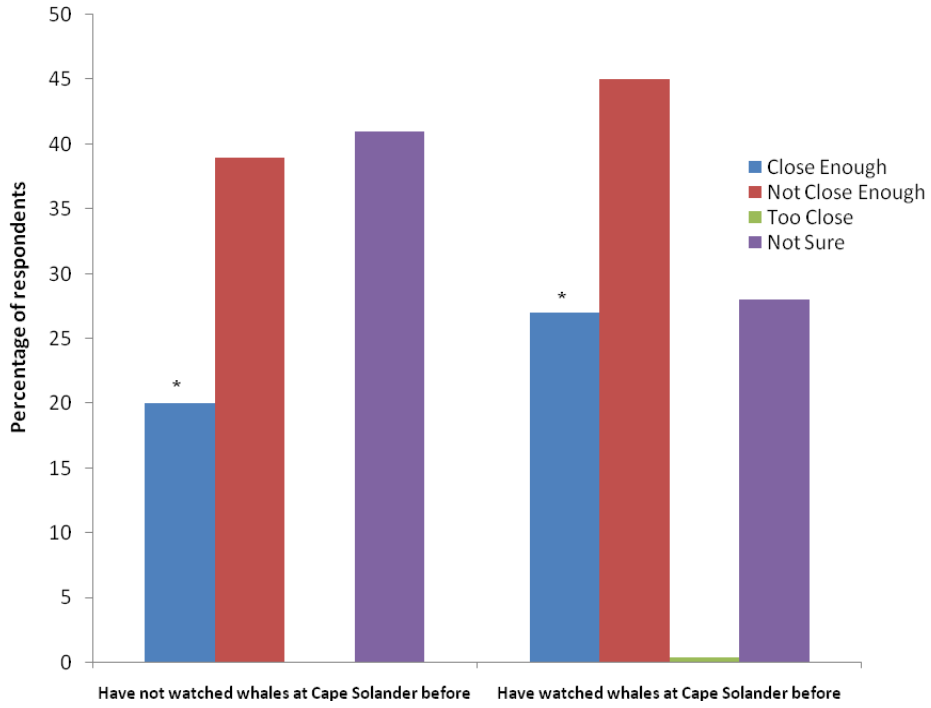


Figure 6.4. Satisfaction with proximity to whales for respondents who had (*n* = *987*) and had not (*n* = 471) been whale-watching at Cape Solander previously. χ^2 = 26.65, df = 3, p <<0.001. * significant at the 0.05 probability level.

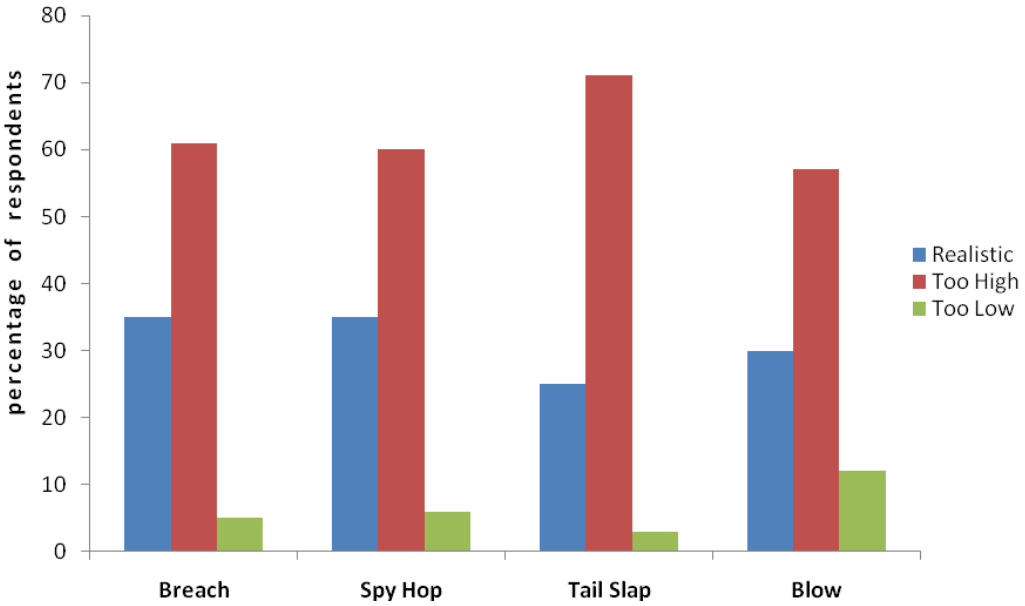


Figure 6.5 Evaluation of Cape Solander whale-watchers' expectations of seeing a whale breach, spy hop, tail slap or blow whilst at Cape Solander.

Other activities (apart from whale-watching) respondents participated in or planned to participate in during their visit to the Botany Bay National Park

As well as whale-watching, 72% of respondents participated in at least one other activity whilst at the Botany Bay National Park. Twenty-seven per cent (*n* = 963) went on one or more of the walking tracks, 38% had a picnic or BBQ in the park (5% had not decided), 38% visited the Discovery Centre (7% had not decided) and 19% went bird watching (6% had not decided). In 2004 an additional question asked whale-watchers if they had listened to a NPWS ranger give a talk on whales and/or spoke to a ranger or whale-watching volunteer about whales. Thirty nine per cent indicated that they had and 12% had not decided (*n* = 349). Some of the other activities that people participated in were diving, fishing, bike riding, drawing and looking at plants and flowers.

What respondents learnt during their visit to the Botany Bay National Park

Thirty per cent (*n* = 1343) of people surveyed said they learnt 'nothing' about *whales* during their visit to the Botany Bay National Park, 60% said they learnt 'a little' and 10% said they learnt 'a lot' about *whales*. Eighty-one per cent (*n* = 1271) of respondents said they learnt 'nothing' about *other marine life*, 75% (*n* = 1265) said they learnt 'nothing' about *marine environment*, 82% (*n* = 1271) said they learnt 'nothing' about *birds*, 89% (*n* = 1270) said they learnt 'nothing' about *local terrestrial wildlife*, 78% (*n* = 1276) said they learnt 'nothing' about *local geology* and 72% (*n* = 1284) said they learnt 'nothing' about *local history.*

There was a significant relationship between whether or not they had listened to and/or spoke to a ranger/volunteer and how much they said they learnt about whales, the marine environment and other marine life (Table 6.12). Those who had listened to a talk or spoken to a ranger or volunteer were more likely to say they had learnt 'a lot' about *whales* and less likely to say they had learnt 'nothing' about *whales* than those who had not listened to a talk or spoke to a ranger or volunteer**.** They were also more likely to say that they had learnt 'a lot' about *other marine life* and less likely

to say they learnt 'nothing' about *other marine life* and were more likely to say they had learnt 'a little' or 'a lot' about the *marine environment*.

Table 6.12. How much Cape Solander whale-watchers said they learnt about whales, the marine environment and other marine life, for those respondents who had and had not listened to a ranger talk and/or spoken to a whale-watching volunteer. Values represent percentage of responses.

	Did not attend talk			**Attended talk**			**Test statistics**
	Nothing	A little	A lot	Nothing	A little	A lot	
Whales	35	58	7	6	68	25	$\chi^2 = 82.79$ df = 2 p <<0.001
n	1026			156			
Marine Environment	78	21	1	58	37	5	$\chi^2 = 34.39$ df = 2 p <<0.001
n	990			142			
Other Marine Life	84	15	1	65	32	3	$\chi^2 = 36.02$ df = 2 p <<0.001
n	996			142			

People visiting Cape Solander in 2003 and 2004 learnt more than those who were surveyed in 2002 (Table 6.13). In 2002 respondents were more likely to say they learnt 'nothing' about whales whereas whale-watchers in 2003 and 2004 were more likely to say they learnt 'a lot' about whales. Whale-watchers in 2002 were more likely to say they learnt 'nothing' about the marine environment whereas whale-watchers in 2003 and 2004 were more likely say they learnt 'a little' about marine environment. Finally, 2002 whale-watchers were also more likely to say they learnt 'nothing' about other marine life, whereas whale-watchers in 2003 and 2004 were more likely to say they learnt 'a little' about other marine life.

Respondents' whale knowledge

Respondents were asked four multiple choice questions relating to whales. The results are presented in Table 6.14. There was a significant relationship between previous whale-watching experience and knowledge. Those people who had no previous whale-watching experience were more likely to answer all four questions

incorrectly or to answer only one or two questions correctly. Those who had been whale-watching before were more likely to answer all four questions correctly than those who had not been before ($\chi^2 = 38.04$, df = 4, p <<0.001, *n* = 1310). People with a low nature/wildlife interest rating (i.e. below the median of 8) got fewer questions correct than those with a high nature/wildlife interest rating (above the median of 8) ($\chi^2 = 35.17$, df = 4, p<<0.001, *n* = 1091).

Table 6.13. How much Cape Solander whale-watchers said they learnt about whales, the marine environment and other marine life, for those who were surveyed in 2002 and those respondents that were surveyed in 2003 or 2004. Values represent percentage of responses.

	2002 respondents			**2003 and 2004 respondents**			**Test statistics**
	Nothing	A little	A lot	Nothing	A little	A lot	
Whales	44	51	5	24	64	12	$\chi^2 = 66.14$ df = 2 p <<0.001
n	423			920			
Marine Environment	87	13	0	69	29	2	$\chi^2 = 45.01$ df = 2 p <<0.001
n	403			862			
Other Marine Life	93	7	0	75	24	1	$\chi^2 = 54.08$ df = 2 p <<0.001
n	407			864			

Table 6.14. Frequency of correct, incorrect and 'don't know' responses to four multiple choice questions relating to knowledge of whales. Values represent the percentage of responses.

	Answered correctly	**Answered Incorrectly**	**Chose 'don't know' response**	***n***
What is a baby whale called?	92	3	5	1468
What is a group of whales called?	91	2	7	1467
Why do humpback whales spend summer in Antarctica?	51	29	20	1486
What is the minimum distance a boat can approach a whale from in NSW?	37	27	35	1461

Factors respondents thought posed a direct threat to humpback whales in Australia today

Ninety per cent (*n* = 1451) of respondents thought that pollution poses a direct threat to humpback whales in Australia today. Commercial fisheries (71%) and whaling (61%) were also indicated by many as threatening humpback whales. Ozone depletion was identified as a threat by 39% of respondents, boat-based whale-watching by 30% and land-based whale-watching by 2%.

Respondents' satisfaction with their whale-watching experience overall

Respondents were asked to rate their satisfaction with their experience on a 7 point scale (1 = boring, 4 = acceptable and 7 = fascinating). The median satisfaction rating was 4 (IQR = 3, *n* = 1348). Twenty-five per cent gave their whale-watching experience a high rating of 6 or 7 and 14% gave it a low rating of 1 or 2. Of those respondents who did not see whales whilst at Cape Solander, 33% (*n* = 435) gave a satisfaction rating of 4 (acceptable), 54% gave a rating below 4 and 14% gave a rating above 4.

There was a significant relationship between the amount that people thought they learnt and their satisfaction with their whale-watching experience. Those that said they learnt 'nothing' about whales were more likely to give their whale-watching experience a low satisfaction rating and those that said they learnt 'a lot' about whales were more likely to give their experience a high satisfaction rating of 6 or 7 ($\chi^2 = 77.15$, df = 2, $p \ll 0.001$, *n* = 1279).

Female whale-watchers gave their experience a higher satisfaction rating than male whale-watchers (U = 199397, z = -2.12, p = 0.034, *n* = 1346). Those respondents with previous whale-watching experience were more satisfied with their experience than those with no previous whale-watching experience (U = 141260, z = -2.94, p = 0.003, *n* = 1290) as were those with a high nature/wildlife interest rating (U = 122596, z = -4.55, $p \ll 0.001$, *n* = 1079). Whale-watchers in 2004 were more satisfied than whale-watchers from the two previous seasons and 2003 whale-watchers were the least satisfied with their experience ($\chi^2 = 13.07$, df = 2, p = 0.001, *n* = 1348).

There was a significant relationship between the distance that visitors estimated the whales were offshore and their satisfaction rating. Respondents gave highest satisfaction scores when they estimated that the whales were within 1000 m of shore and lowest satisfaction scores when the whales were more than 2000 m from shore (Table 6.15).

Table 6.15. Kruskal-Wallis comparison of overall satisfaction levels of Cape Solander whale-watchers relating to distance respondents stated the whales were off shore.
All variables were measured on a 7-point Likert scale with values of 1 indicating 'very boring' , a value of 4 indicating 'acceptable' and a value of 7 indicating 'fascinating'.

	n	Mean Rank	Mean Rating	Test Statistics
Distance from whales				χ^2 = 18.90 df = 4 p = 0.01
<500m	179	388.9	4.9±0.12	
500-1000m	390	403.6	5.0±0.07	
>1000-1500	59	378.7	4.8±0.18	
>1500-2000	79	336.0	4.6±0.14	
>2000	57	286.5	4.2±0.20	

How respondents' whale-watching experience lived up to their expectations

Fifty-one per cent (*n* = 1346) of respondents said that their experience met their expectations, 34% said that it fell short of their expectations, 10% said the experience exceeded their expectations and 5% were unsure.

There was a significant relationship between expectations and whether or not it was respondents' first time whale-watching or not. First time whale-watchers were more likely to say their experience 'fell short' of their expectations (41%, *n* = 326) than those who had been whale-watching before (32%, *n* = 959, χ^2 = 16.78, df = 3, p = 0.001, standardised residuals significant >1.96 at p = 0.05). Those who had watched whales at Cape Solander previously were more likely to say their expectations were met (59 %, *n* = 419) than those who were watching whales at Cape Solander for the first time (47%, *n* = 838). Those who had watched whales at Cape Solander previously were less likely to say that their experience fell short of expectations (27%) than those that were watching whales at Cape Solander for the first time (37%) (χ^2 = 20.103, df = 3, p = 0.000, standardised residuals significant <-1.96 at p = 0.05).

If expectations were met or exceeded then respondents were more likely to give a higher satisfaction rating than if experience fell short of expectations (χ^2 = 653.460, df = 18 p<<0.001, *n* = 1348).

How respondents rated the quality of specific aspects of their whale-watching experience

Cape Solander whale-watchers were asked to rate various qualities of their experience on a 5-point Likert scale with a value of 1 indicating 'very poor', 2 indicating 'poor', 3 indicating 'neutral', 4 indicating 'good' and 5 indicating 'excellent'. The mean rating for the surrounding environment was 4 i.e. good. The mean rating was 3 (i.e. neutral) for each of the following categories: the number of whales seen, whale behaviours and distance to whales. The mean rating for photo opportunities was 2 (i.e. poor) (Table 6.16).

First time Cape Solander whale-watchers gave 'number of whales seen', 'whale behavioural displays', 'distance from whales' and 'photo opportunities' a significantly lower ranking than those who had been whale-watching at Cape Solander previously (Table 6.17).

Female whale-watchers gave 'distance from whales' and 'whale behavioural displays' and 'surrounding environment' a significantly higher ranking than males (Table 6.18).

Table 6.16. Mean ratings of satisfaction with 5 aspects of the Cape Solander whale-watching experience. All variables were measured on a 5-point Likert scale with values of 1 indicating 'very poor' and a value of 5 indicating 'excellent'.

	Mean Rating ± SE	***n***
Surrounding environment	3.9 ± 0.03	1247
Number of whales seen	2.7 ± 0.04	1306
Whale behavioural displays	2.7 ± 0.04	1196
Distance from whales	2.6 ± 0.03	1211
Photo opportunities	2.1 ± 0.03	1204

Information respondents would have liked to have received

Forty-five per cent (*n* = 1399) of people surveyed wanted more information on *whales*, 33% (*n* = 1400) wanted more information on *other marine life*, 29% (*n* = 1401) wanted more information on the *marine environment*, 27% (*n* = 1401) wanted more information on *local history,* 24% (*n* = 1403) wanted more information on *local geology*, 23% (*n* = 1400) wanted more information on *local terrestrial wildlife* and 24% (*n* = 1400) wanted more information on *birds.*

Whale-watchers surveyed in 2002 were more likely to want more information on whales (χ^2 = 37.88, df = 2, p<<0.001, *n* = 1399), marine life (χ^2 = 54.97, df = 2, p<<0.001, *n* = 1400), marine environment (χ^2 = 56.81, df = 2, p<<0.001, *n* = 1401), local geology (χ^2 = 48.715, df = 2, p<<0.001, *n* = 1403), local terrestrial wildlife (χ^2 = 43.44, df = 2, p<<0.001, *n* = 1400), birds (χ^2 = 27.75, df = 2, p<<0.001, *n* = 1400) and local history (χ^2 = 31.40, df = 2, p<<0.001, *n* = 1401) than whale-watchers surveyed in 2003 and 2004.

Seventy-nine people added some other information they would have liked to have received, including: aboriginal history, local flora, conservation/protection of marine environment, map of the area. Some of the additional information people wanted to receive on whales included: best places and times to see whales, the effects of boats on whales, migration patterns, why whales are at Cape Solander, whale behaviours and changes in whale numbers.

Table 6.17. Mann-Whitney U comparison of differences in satisfaction level of Cape Solander whale-watchers with five aspects of their experiences relating to whether they had previously watched whales at Cape Solander or not.

All variables were measured on a 5-point Likert scale with values of 1 indicating 'very poor' and a value of 5 indicating 'excellent'.

	Previous Cape Solander whale-watching experience	*n*	Mean Rank	Mean Rating ±SE	Test Statistics
Surrounding environment	Yes	392	605.6	4.0±0.05	Mann-Whitney U = 143825 z = -1.63 p = 0.10
	No	776	573.8	3.9±0.04	
Number of whales seen	Yes	407	687.9	3.1±0.06	Mann-Whitney U = 134336 z = -5.59 p <<0.001
	No	814	572.5	2.6±0.05	
Whale behavioural displays	Yes	380	613.8	2.9±0.06	Mann-Whitney U = 119946 z = -4.13 p <<0.001
	No	739	532.3	2.6±0.05	
Distance from whales	Yes	386	636.1	2.8±0.06	Mann-Whitney U = 117122 z = -5.32 p <<0.001
	No	746	530.5	2.5±0.04	
Photo Opportunities	Yes	375	610.7	2.3±0.05	Mann-Whitney U = 123498 z = -3.56 p <<0.001
	No	752	540.7	2.1±0.04	

Table 6.18. Mann-Whitney U comparison of differences in satisfaction level of Cape Solander whale-watchers with three aspects of their whale-watching experience according to gender.
All variables were measured on a 5-point Likert scale with values of 1 indicating 'very poor' and a value of 5 indicating 'excellent'.

	Gender	*n*	Mean Rank	Mean Rating ±SE	Test Statistics
Surrounding environment	Female	769	650.7	3.9±0.04	Mann-Whitney U = 161741 z = -3.69 p <<0.001
	Male	476	578.3	3.8±0.05	
Distance from whales	Female	748	625.3	2.7±0.04	Mann-Whitney U = 157197 z = -2.60 p = 0.008
	Male	461	572.0	2.5±0.05	
Whale behavioural displays	Female	737	613.2	2.7±0.05	Mann-Whitney U = 156846 z = -2.06 p = 0.004
	Male	457	572.2	2.6±0.06	

Suggested improvements to enhance enjoyment of the Cape Solander whale-watching experience

A total of 635 people (i.e. 40% of all people surveyed) listed one or more improvements that they thought would enhance the enjoyment of their whale-watching experience. One hundred and forty-nine people (i.e. 23% of respondents to this question) wanted more information including information on whale behaviours; types of whales; whale numbers; present and previous sightings; best ways to watch whales; how to prepare/what to expect; environment and local area. Some people specified that they wanted this information provided by expert guides (5%), on boards/signs (3%), handed out on information sheets (2%) or on interactive displays (1%). Thirty eight people wanted better information on recent and current sightings, predictions on when whales will be in the area and chances of seeing whales. They wanted this information provided via radio, internet sites, signs, loudspeakers, guides pointing whales out to them or a whale-watchers' hotline.

Ninety-eight people (i.e. 15% of respondents to this question) thought that seeing whales would improve their experience**,** 10% wanted coin operated telescopes or hired binoculars, 9% wanted food/drinks available, 8% wanted more whales, 7% listed improvements related to toilets**,** 6% thought closer viewing would improve their whale-watching experience, 5% wanted seats and/or tables, 4% wanted less boats, no boats or water patrols to stop boats harassing whales, 4% specified that they wanted the area left natural/as is, 3% wanted more parking. Three per cent of people thought that better weather and/or sea conditions would have enhanced their whale-watching experience and 2% wanted whale-watching tours offered (85% of them specified boat tours and 15% specified helicopter tours)**.**

Most memorable aspect of respondents' visit to Botany Bay National Park

A total of 916 people mentioned one or more of the most memorable aspects of their visit to the Botany Bay National Park. Four hundred and forty-one people (48%) nominated seeing whales as the most memorable aspect of their visit including seeing a whale breach (6%), seeing whales in good numbers (3%), seeing whales for the first time (3%), seeing a whale's tail (2%), seeing whales in their natural environment (2%) and the close viewing of whales (2%).

Two hundred and sixty-five people (29%) said their most memorable aspect related to the surrounding area including views/scenery (17%, *n* = 916) beauty of the area/natural environment (8%) and a relaxing/peaceful environment (3%). The weather was mentioned by 113 people, 5% thought that spending time with family/friends was the most memorable aspect, 5% mentioned going on a walk and a ranger talk/information and/or friendliness and availability of the NPWS staff was mentioned by 3%. Seeing so many people enjoying or being interested in whales was mentioned by 2% of respondents.

Respondents' predicted future behaviour

Eighty-six per cent (*n* = 1374) of respondents would go whale-watching from land again, 13% possibly and 1% would not like to go whale-watching from land again. The main reasons people would like to go whale-watching from land again included: it was an enjoyable, exciting, fun or pleasant experience (13%, *n* = 1374); did not see any whales today and would still like to (6%); to see more whales, more behaviours or to see them closer (6%), like whales/interested in whales (5%); relaxing/peaceful (4%); fascinating/interesting (4%); it is a good day out (4%) ; like to see whales in their natural environment (3%); convenient/easy (3%); beautiful place/scenery (2%); non restrictive can do other activities such as picnic and walk (2%); and inexpensive (2%).

Twelve people gave reasons for not wanting to go land-based whale-watching again. They were: too far away, would be better from a boat, too boring, no whales, too uncertain and prefer chance sightings.

Sixty-two per cent (*n* = 1384) of people surveyed would like to go whale-watching from a boat, 22% would possibly go whale-watching from a boat and 15% would not like to go whale-watching from a boat. Fifty-three per cent of people who gave a reason for wanting to go whale-watching from a boat said they would do so to get a closer view. Other reasons included: have done it before and enjoyed it, better chance of seeing whales and to get a different perspective.

The reasons people did not want to go whale-watching from a boat included: don't think boats should get close to whales/don't want to distress whales and get seasick/too scary.

Some people were unsure if they would like to go whale-watching from a boat. Some would go on a tour if it were conducted responsibly or if it did not threaten the whales. Others wouldn't go because they might cause whales distress or get seasick.

Eighty-two per cent (*n* = 1376) of people surveyed would recommend someone else going whale-watching from land, 16% would possibly recommend land-based whale-watching and 2% would not.

6.6 DISCUSSION

6.6.1 Profile of land – based whale-watchers

There was a gender bias towards females in this study. This result was consistent with many other studies (Muloin 1998, Warburton et al. 2000, Parsons et al. 2003, Reid 1999, Neil et al. 2003, Corbelli 2006, Smith et al. 2006) that have found a higher proportion of female than male whale-watchers. This does not necessarily mean that there are more women than men participating in whale-watching at Cape Solander, but may reflect a tendency for females to be more willing to complete a questionnaire. There is evidence to suggest that the proportion of females responding to whale-watching questionnaires is higher than the overall proportion of female whale-watching participants (Smith et al. 2006, chapter 6, Reid 1995).

Cape Solander whale-watchers were not travelling far from home. The majority of respondents were living within 50 km of the Sydney CBD and the average distance that they lived from Kurnell was 16 km. Fifty per cent were from the south-west Sydney area. Most of the respondents were visiting the Botany Bay National Park specifically to watch whales.

Most Cape Solander whale-watchers were travelling in immediate family groups (i.e. parents and children) or were relatives/friends travelling together. Parsons *et al*. (2003) in their study of boat-based whale-watchers in Scotland also found that whale-watching appealed to family groups, with a higher proportion of whale-watching tourists accompanied by children than expected among general tourists. The importance of family and friends in the land-based whale-watching experience was clearly evident in this study. The opportunity to spend time with family and friends was rated as the third most important feature when seeking a good whale-watching experience and scored higher than seeing whales up close, an opportunity to learn more about whales and seeing large numbers of whales. In addition forty-eight people mentioned spending time with family and friends as their most memorable aspect of their whale-watching experience.

Cape Solander whale-watchers were typically middle aged (i.e. 35-54 years old). There is some variation in age profiles for whale-watchers from different areas and so it is important that managers consider whale-watcher profiles on a site-specific basis. Whilst the Cape Solander whale-watchers' age profile is consistent with that for boat-based whale-watchers in other parts of Australia, e.g. Hervey Bay (Muloin 1998) and Moreton Island (Neil *et al.* 2003), as well as boat-based whale-watchers from other parts of the world e.g. Scotland (Parsons et al. 2003, Warburton et al. 2000) and Canada (Corbelli 2006). Reid (1995) found that most land-based whale-watchers at the Head of the Great Australian Bight were aged 50 or older. Other studies have found that boat-based whale-watchers are typically younger; for example, (Pearce & Wilson 1995) found that most New Zealand whale-watchers were aged between 20 and 34 years. Similarly, Reid (1993) found that most whale-watchers at Encounter Bay in South Australia were in their twenties to thirties. Land-based whale-watchers in San Juan Islands, USA were typically aged between 20-49 which was younger than boat-based whale-watchers in the same region who were predominantly aged between 30-59 (Finkler & Higham 2004).

Cape Solander whale-watchers were well educated with almost half professionally employed as managers/executives, teachers or other professionals. This is consistent with profiles of land-based whale-watchers elsewhere (Finkler & Higham 2004, Reid 1995, Reid 1993) and of boat-based whale-watchers (Neil et al. 2003, Pearce & Wilson 1995, Parsons et al. 2003, Warburton et al. 2000, Finkler & Higham 2004, Muloin 1998, Corbelli 2006, Smith et al. 2006). The proportion of respondents employed as professionals is not different from the NSW population census data (Australian Bureau of Statistics 2002). However the percentage of Cape Solander whale-watchers with a university degree, diploma or higher degree (50%) is higher than the NSW population census data of 36%

Cape Solander whale-watchers exhibited more environmentally friendly behaviours than the average person living in NSW (NSW Department of Environment and Conservation 2003). This result contrasts with Forestell and Kaufman's (1990) belief that whale-watchers in Australia, Hawaii and elsewhere in America represent a cross section of the travelling public and not a significantly more environmentally aware group. Until now, no study has assessed the environmental awareness of whale-

watchers other than to quantify their level of involvement in environmental organisations. Sixty-one per cent of whale-watchers in this study were given a high environmental rating based on the frequency with which they performed specific environmentally friendly behaviours. Beaumont (2001) used a similar 5-point scale to assess levels of environmental behaviours of ecotourists visiting Lamington National Park in Queensland. She found only 36% performed high levels of environmentally friendly behaviours. As well as looking at the frequency of recycling, donating to and/or participation in environmental groups and the use of environmentally friendly products, Beaumont also used the frequency with which visitors used public transport, wrote to politicians and signed petitions to assess environmental behaviour, and so these results may not be directly comparable to this study.

Twenty-seven per cent of Cape Solander whale-watchers donated to and/or were actively involved in helping an environmental organisation. This is only slightly higher than the national statistic of one in five Australians donating some time or money to help protect the environment (Australian Bureau of Statistics 2004). Reid (1995) reported that 30% of land-based whale-watchers in her study were members of a conservation group and, like Cape Solander whale-watchers, Greenpeace, Australian Conservation Foundation (ACF) and the Wilderness Society were amongst the most popular organisations that they belonged to. A much larger proportion (58%) of marine wildlife tourists in Scotland were members of an environmental organisations (Warburton *et al.* 2000). However other researchers have found it to be a lot lower. Only 13% of Hervey Bay whale-watchers belonged to an environmental organisation (Muloin 1998) and it was even lower (4%) for swim-with-dolphin participants in New Zealand (Lück 2003b).

A large proportion of respondents (70%) had been whale-watching at least once before either from land or by boat. This is much higher than for boat-based whale-watchers in Moreton Bay where Neil *et al*. (2003) found only 18% had previous whale-watching experience either from land or boat. Most Cape Solander whale-watchers were given a low wildlife/nature interest rating. This rating was based on the frequency with which respondents visited wildlife and/or nature areas. Despite this low rating, over 98% had visited one type of wildlife/nature area at least once in the 12 months prior to completing the survey. Moscardo and Saltzer (2005) also found a high level of

interest in nature/wildlife areas with 68% of wildlife tourists surveyed having at least once visited one type of wildlife based tourism place in the 12 months prior to their study. Further support of the high level of interest in nature and wildlife that exists amongst whale-watchers comes from the study of Warburton *et al*. (2000) who found that 91% per cent of marine wildlife tourists were regularly involved in one or more wildlife-related activities.

The correlation between whale-watchers' nature/wildlife interest rating and their environmental rating could suggest that more exposure to nature and wildlife tourist sites increases environmentally friendly behaviour. However, many studies on this topic have produced conflicting results (Beaumont 2001). Some have found that nature based tourism can contribute to an increase in positive environmental attitudes and behaviours, others have found only small changes in behaviours and attitudes, and some have found no effect at all. The results presented here could also indicate that people who are more environmentally aware visit wildlife/nature areas more often. Continued involvement in nature-based experiences could then be acting to strengthen already existing attitudes and behaviours (Beaumont 2001).

Despite their interest in wildlife/nature areas most respondents rated themselves as having little to moderate knowledge of whales, other marine life, the marine environment, birds and local terrestrial wildlife. Those who visit wildlife and/or nature areas more often rate their knowledge of whales, other marine life, the marine environment, birds and local terrestrial wildlife higher and, based on their answers to the four multiple choice questions, demonstrated a higher knowledge of whales**.** This is consistent with results of Neil *et al.* (2003) and Corbelli (2006) who found those who had previously been whale-watching were consistently more knowledgeable about whales than those who had not watched whales before. The results of this study therefore provide validation of the largely untested belief that nature-based wildlife experiences can provide educational benefits for participants.

6.6.2 Satisfaction, experience and expectations

Cape Solander whale-watchers rated 'seeing whales behaving naturally' and 'seeing whales in their natural environment' as the two most important features of a good whale-watching experience. Other studies into the human dimension of wildlife tourism have found the 'naturalness' of the experience to be a highly important factor contributing to visitor enjoyment and overall satisfaction (Davis *et al.* 1997, Muloin 1998, Muloin 2000, Moscardo & Slatzer 2002, Woods 2001, Pearce & Wilson 1995, Moscardo & Saltzer 2005, Smith et al. 2006, Higham *et al.* 2001). It does seem that people are moving away from wanting to see whales in captivity in favour of a more natural experience and they are more satisfied when viewing whales in their natural environment than they are when seeing them in a captive setting (Muloin, 2000). Less people, particularly in western countries, support keeping animals in captivity for entertainment purposes (Freeman & Kellert, 1994 as cited in Muloin 2000). This is probably due to an increase in public awareness, generated largely by the media and the environmental movement, about the stress a captive environment can place on cetaceans.

This does not mean however, that whale-watchers do not like viewing other animals in captive settings. Seventy-two per cent of Cape Solander whale-watchers had visited a zoo, aquarium and or wildlife park at least once in the 12 months prior to completing the questionnaire. As reviewed by Moscardo *et al.* (2001), other studies have found that an interest in seeing wildlife in natural settings does not preclude an interest in visiting captive settings.

This study shows only a moderate level of satisfaction with the Cape Solander whale-watching experience, with most people rating their experience as acceptable. Typically, high levels of satisfaction have been found with boat-based whale-watching experiences (Muloin 1998, Muloin 2000, Orams 2000, Neil et al. 2003, Smith et al. 2006, Corkeron 2006) and swim with cetacean experiences (Valentine et al. 2004, O'Neill et al. 2004). Muloin (2000) compared the satisfaction of boat-based whale-watchers and land-based whale-watchers, and found that tourists were more satisfied observing cetaceans from a boat than from land, although a high level of satisfaction was gained from both experiences.

Interestingly despite only moderate levels of satisfaction, 86% of Cape Solander whale-watchers would like to go whale-watching from land again and 82% would recommend land-based whale-watching to someone else. As expected, higher levels of satisfaction were observed when there were whales present than when no whales were sighted. However, 46% of Cape Solander whale-watchers still gave their experience a satisfaction rating of 4 (acceptable) or higher even when they did not see any whales. Others have also found that whale-watchers can still be satisfied even when whale viewing is poor (Orams 2000, Muloin 2000). It is apparent then that factors other than the presence of whales can contribute to an enjoyable land-based whale-watching experience. Most Cape Solander whale-watchers (72%) participated in another activity apart from whale-watching. The most common activities (apart from whale-watching) were going on a walk, having a picnic and visiting the Discovery Centre. Apart from wanting more whale sightings or closer whale sightings, some of the other more common reasons for wanting to watch whales from land again were that it was relaxing and peaceful, it was a beautiful area, it was a good day out and you could do other activities such as walk and picnic. Over half of the respondents indicated that their most memorable aspect related to something other than the whales, including surrounding area, the weather and spending time with family/friends. Reid's studies concur that whale-watching is about more than just seeing whales. The scenic beauty of the area and the peacefulness of the atmosphere were an important part of the whale-watching experience at Encounter Bay and the Great Australian Bight (Reid 1993, Reid 1995).

Females were more satisfied than males with the quality of their whale-watching experience. As well as giving a higher satisfaction rating for their experience overall, females ranked their satisfaction with 'distance from whales', 'whale behavioural displays' and 'surrounding environment' higher than males. This difference is not related to expectations as there was no variation in expectations between the sexes. These findings concur with Moscardo and Saltzer (2005) who found that female respondents were more satisfied with their wildlife experience than male respondents. Muloin (2000) also found that female whale-watchers were more satisfied than males. She reviewed the psychology literature and concluded that this variation is likely due to differences in attitudes and socialization processes between males and females.

Females hold more moralistic and humanistic attitudes toward animals than males, have stronger emotional attachments for individual animals and tend to be more emotionally expressive and environmentally receptive (Muloin 2000).

Seeing whales up close was considered important, with 63.5% of Cape Solander whale-watchers saying it was an important feature of a good whale-watching experience. Despite more than half of them seeing whales within 1 km of shore, most whale-watchers (64%) thought that the distance from the whales was not close enough. Distance from whales was ranked quite low in satisfaction, with most scoring it somewhere between poor and neutral. Fifty-three per cent of people who gave a reason for wanting to go whale-watching from a boat said they would do so to get a closer view. There was a significant relationship between the distance the whales were off shore and whale-watchers' overall satisfaction with their experience; i.e. the greater the whales were from shore the lower the satisfaction rating.

Highest satisfaction existed in 2004 and lowest in 2003. The number of whales recorded passing Cape Solander in 2004 was almost double that seen in 2003 (NPWS 2005, unpublished report). Almost half of respondents (48%) said that the number of whales was important for a good whale-watching experience. When asked to rate their satisfaction with the number of whales seen, it was given a mean ranking between poor and neutral. Whale behavioural displays were also given a mean ranking between poor and neutral.

It appears then that the lower level of satisfaction reported in this study compared to others could be largely due to low numbers of whales, low levels of surface activity and the distances whales were from shore. Other researchers have also noted the importance of proximity to wildlife to visitor satisfaction (Reid 1995, Muloin 2000, Woods 2001, Muloin 1998, Pearce & Wilson 1995, Moscardo & Slatzer 2002, Valentine et al. 2004, O'Neill et al. 2004, Duffus & Dearden 1993, Higham et al. 2001, Corbelli 2006). Muloin (2000) looked at the relationship between intensity of the experience and satisfaction. She found that the more whales observed by tourists at close range for a considerable length of time, the higher levels of tourist satisfaction. Moscardo and Saltzer (2005) found that visitors who got closer to the wildlife gave higher satisfaction scores. Not surprisingly, swim-with-whale participants are highly satisfied with their experience. Valentine *et al*. (2004) found a mean satisfaction score

of 9 on a 10 point scale for swim-with-dwarf minke whale participants and this satisfaction was correlated with distance from whale, number of whales and time spent with whales. There are others, however, who have found that proximity to the wildlife does not affect overall satisfaction (Orams 2000, Davis *et al*. 1997). Although when comparing these results to those of Orams' it should be realised that the land-based whale-watching experience is much different to the boat-based whale-watching experience. If the boat-based whale-watchers in Orams' and swim-with-whale shark participants in Davis *et al.*'s studies were observing wildlife at distances ≥1000 m, as is typical for land-based whale-watching, then proximity to wildlife could have been a contributing factor to overall satisfaction.

There is a contradiction between peoples' desire to get close to whales and their concern over the welfare of the animals. Of the 437 people who thought boat-based whale-watching poses a direct threat to humpback whales in Australia, 79% said they either would like or would possibly like to go whale-watching from a boat. This suggests that many whale-watchers are putting their own desires ahead of the welfare of the whales. Only 38 people who would like to or would possibly like to go boat-based whale-watching mentioned that they were concerned with the impact on whales. A further 54 people said they did not want to go whale-watching from a boat because they were concerned about the disturbance this would cause the whales.

This paradox amongst whale-watchers has been recognised by others studying cetacean – human interactions (Finkler & Higham 2004, Muloin 2000, O'Neill et al. 2004, Reid 1995). Swim-with-dolphin participants in Western Australia thought it was very important that they did not have a negative impact on the dolphins but on the other hand many thought that touching dolphins was important to their enjoyment. Of further concern is that 55% of these swim-with-dolphin participants said they would have tried to touch, follow or chase the dolphins if they had been on an unmanaged tour (O'Neill *et al.* 2004). Reid (1995) noted that the behaviour of whale-watchers on site at the Great Australian Bight was inconsistent with their expressed interest in and sensitivity to the environment. Although these whale-watchers considered themselves environmentally aware and somewhat knowledgeable about preventing problems like coastal erosion at the Bight, they were frequently observed trampling on fragile vegetation.

Boats in the area were seen as detracting from the viewing experience for some Cape Solander whale-watchers. Some people were under the impression that if there were few whales and/or whales out a considerable distance, then it was probably because the boats were chasing or scaring them away. When asked for any suggested improvements to enhance their viewing experience, 28 people mentioned less boats, no boats or the need for National Parks and Wildlife Service to conduct water patrols to stop boats 'harassing' the whales. Finkler and Higham (2004) found that land-based whale-watchers in the USA were also concerned over the disturbance boats in the area were causing to the whales and to their own viewing experience. Similarly, (Muloin 2000) found that the number of other boats in the viewing region inversely influenced whale-watchers' satisfaction and Valentine *et al*. (2004) reported the second most frequently mentioned detracting element of swim with dwarf minke whale participants' experiences was that of other divers chasing or following whales. Botany Bay is a busy area for both commercial and recreational vessels. Management of vessel activities around whales should be considered a priority to ensure the welfare of the whales is maintained. This could also enhance the land-based whale-watching experience at the same time.

Learning about whales was important to Cape Solander whale-watchers with the majority of respondents (56%) saying the opportunity to learn more about whales was an important component of a good whale-watching experience. When asked to list any improvements that would enhance their whale-watching experience, 149 people wanted more information on whales, whale-watching, the local area and the environment. Whale-watchers elsewhere also valued education during their whale-watching experiences. The opportunity to learn and the delivery of information were important for whale-watchers in Hervey Bay (Smith *et al.* 2006) and Canada (Corbelli 2006). O'Neill *et al*. (2004) and Lück (2003a) also noted that education during dolphin watching cruises and the opportunity to learn new information was important for visitor enjoyment. It is not surprising then that the satisfaction of Cape Solander whale-watchers related to the amount they had learnt. Moscardo and Saltzer (2005) also found a strong relationship between the amount visitors said they had learnt about the wildlife and their overall satisfaction.

Even though learning about whales was considered to be a valuable part of the whale-watching experience, most people said they learnt little or nothing about whales and 45% wanted more information on whales. Inadequate educational material and/or lack of effective interpretation available at the Cape Solander viewing area is likely another factor contributing to lower levels of satisfaction reported for whale-watchers in this study.

In 2003 the NSW NPWS introduced Discovery Ranger talks on the viewing platform roughly every half an hour. These talks seem to have had a positive effect, as those who listened said they learnt more. However their answers to the four multiple choice questions on whales did not vary depending on whether or not they had listened to a talk. There were still a lot of people (49%) who visited who did not listen to ranger talk and/or talk to a volunteer about whales and a further 12% who had not decided. Discovery Rangers conduct their talks on the viewing platform, which is only a small section of the entire viewing area at the Cape and it is likely that many whale-watchers may have not seen them. Overall, those who visited in 2003 and 2004 said they learnt more than those who visited in 2002. As well as the introduction of ranger talks this perceived increase in knowledge could have been due to the erection of information signs at the viewing platform. Although the increased education at the viewing site may have gone some way to improve visitor knowledge, there is clearly a need for interpretation at this site to be developed further.

It is important that managers consider the benefits that effective interpretation can bring to land-based whale-watching. Not only is it likely to increase visitors' enjoyment and satisfaction but it may also lead to a greater awareness about whales and their conservation (Lück 2003a, Meinhold 2003, Weiler & Davis 1993, Duffus & Dearden 1993, Moscardo et al. 2001, Orams 1996, Orams 1995a, Higginbottom et al. 2001a, Higginbottom 2002, Reid 1999). The widely recognised belief that education during a wildlife encounter can be used as a tool for management has led to the development of models for effective interpretation programs that can be used at whale-watching sites (Orams 1996, Orams 1994, Forestell 1993, Reid 1999).

A planned and structured interpretation program based on the above models should be considered. It is not desirable that thirty-eight per cent of Cape Solander whale-watchers should not know which type of whales they were watching. (Findlay

1997) reported that only 44% of land-based whale-watchers in South Africa could correctly identify the name of the whale they were watching. The number of boat-based whale-watchers able to correctly identify the species of whales they were watching is much higher. A survey of boat-based whale-watchers on the NSW south coast revealed that 93% knew that they were watching humpback whales (Chapter 7). Boat-based whale-watching is a lot more structured and therefore more conducive to a direct guided experience. The vessel itself provides for a captive audience where participants are concentrated in a small area. Public address systems and the use of props are therefore often effective on board boat-based tours. Furthermore whale-watchers on boat tours are on board for the same amount of time rather than coming and going at different times as is typical at land-based viewing areas. Providing effective interpretation at a land-based viewing area poses extra challenges. Nevertheless, it is important that land-based whale-watchers are given the same opportunity to learn about whales and the marine environment as those who go on commercial whale-watching boat tours. Recommendations for the application of effective interpretation during land-based and boat-based whale-watching experiences are discussed further in Chapter 8.

There were higher satisfaction levels for those with previous whale-watching experience than those who were watching whales for the first time. Neil *et al*. (1996) reported that there was little difference in the level of satisfaction between the two groups. The results in this study and that of Neil *et al.* (1996) contrast with other research which suggests that tourists with more experience are less satisfied and obtain fewer benefits from their wildlife encounters (Applegate & Clark 1987, Muloin 2000, Moscardo & Slatzer 2002). Applegate and Clark (1987) use the goal specificity theory proposed by (Vaske *et al.* 1982) to suggest that more experienced bird watchers are less satisfied because they have more specific goals and possibly more advanced expectations and preferences than novices. The more detailed and specific the expectations, then the less likely they are to be met and therefore the higher chance that they will be disappointed (Applegate & Clark 1987, van Raaij 1987). Muloin (1998) also uses this theory to suggest that the high level of satisfaction found amongst boat-based whale-watchers in her study may be because most had not been whale-watching before and therefore they may have been easier to satisfy due to lower expectations or

lack of specific goals. Further contradicting the above findings is that in this study those who visited wildlife viewing areas and/or nature areas more often (i.e. those with a high nature/wildlife interest rating) were more satisfied with their whale-watching experience than those who had not visited such places.

Results of this study support the hypothesis that whale-watchers have high and often unrealistic expectations of their whale-watching experiences. Expectations of seeing whale behavioural displays were high regardless of whether or not they had been whale-watching before or not. The only exception was that people who had previous whale-watching experience had higher expectations of seeing a whale blow than those who had not watched whales before. In contrast (Neil *et al.* 2003) found that expectations of seeing specific whale behaviours were consistently lower for people with previous whale-watching experience than those who were watching whales for the first time.

While most people stated that their expectations were either met or exceeded, a large proportion (34%) said their expectations fell short. Not surprisingly there was a significant relationship between how well visitors thought their expectations had been met and their satisfaction rating i.e. those who said their experience fell short of expectations were more likely to give a lower satisfaction score. First time whale-watchers were more likely to say their expectations fell short than those that had been whale-watching before, suggesting that first time whale-watchers have higher expectations. As noted earlier, first time whale-watchers were less satisfied with their whale-watching experience than those who had watched whales previously. This is likely to be the result of them having unrealistic expectations. Even though their expectations of seeing whale behaviours were not different to those of previous whale-watchers, it does appear that first time whale-watchers had expected to see whales closer. This expectation not being met may have led to their higher dissatisfaction. Although participants in this survey were not asked directly how close they had expected to see whales, first time whale-watchers ranked 'distance from whales', 'number of whales' and 'whale behavioural displays' lower than those who had previous whale-watching experience. Furthermore, repeat Cape Solander whale-watchers were more likely to describe the distance the whales were off shore as 'close enough' than those who had not watched whales from Cape Solander before.

Most Cape Solander whale-watchers (62%) had heard about whale-watching there from one or more media sources. It is likely that the media is generating unrealistic expectations amongst Cape Solander whale-watchers. There are many examples of the media and tour companies using close up pictures of whales breaching to sell their product or to make their story look more appealing. During the study period there were at least six articles in Sydney newspapers on whale-watching at Cape Solander, four of them included close up pictures of whales (Vanessa Wilson, personal communication). Meinhold (2003) and Moscardo *et al*. (2001) also highlight the problem of media creating false expectations for wildlife tourists and portraying distorted messages about acceptable behaviour around wildlife. First-time tourists establish their expectations on information from external sources whereas repeat tourists set their expectations on the basis of previous experience (Reid & Reid 1993). Hence the lower expectations amongst previous Cape Solander whale-watchers could be because they are relying more on their personal experiences to generate their expectations and not what they have seen on T.V. or in the newspaper.

It is important that wildlife tourism managers consider visitors' expectations, as they can be directly related to visitor satisfaction and hence the value that people place on their viewing experience (Hammit *et al.* 1993; Ryan 1995; Van Raaij 1986). In this study it is clear that expectations play a significant role in determining the quality of the whale-watching experience. (Hammit *et al.* 1993) also found that expectations were a good predictor of a quality wildlife viewing experience. Managing these expectations will help people form realistic expectations and beliefs about their experience and ultimately lead to a more satisfied wildlife tourist (Hammit *et al*. 1993; O'Neill *et al*. 2004). It is important that wildlife tourists are informed early in their experience of the behaviours of the animals they have come to view and the likely conditions that they will encounter (Moscardo *et al*. 2001).

In the case of Cape Solander, it is important that whale-watchers are educated on the migration pattern of the humpback whales. Watching humpbacks near Sydney is very different to whale-watching further north (e.g. Hervey Bay). Whale-watchers at Cape Solander cannot expect to see whales staying in the one area for any length of time, nor can they expect to see a humpback mother and calf. The humpback whales passing Cape Solander are on a 'mission' to get to their calving grounds further north

and Cape Solander whale-watchers should be aware that breaching and other surface behaviours are not as common during this phase of the migration. Whale-watchers should never be under the impression that they are guaranteed to see whales. The results of this study suggest that there is a 36% chance that they will not see any whales on their visit to Cape Solander.

Many whale-watchers indicated on the survey that they wished they had been better prepared and/or had more information on what to expect. There were many people at Cape Solander who expected to turn up and see whales immediately (personal observations) and this is rarely the case. If people are prepared to stay for a considerable amount of time and bring provisions with them, they are more likely to see some whales pass by. Cape Solander whale-watchers should be prepared for cold weather and if possible have a pair of binoculars with them. Most whale-watchers were spending between 30 minutes and two hours at Cape Solander. If people were better prepared then they may stay longer and increase their chances of seeing whales.

6.7 CONCLUSION

Cape Solander whale-watchers were moderately satisfied with their land-based whale-watching experience, but they had high and often unrealistic expectations, which probably influenced their enjoyment and satisfaction with their experience. Other factors that contributed to their (dis)satisfaction were proximity to whales, numbers of whales, the extent of whale behavioural displays and the amount of detailed information and interpretation available to them.

Land-based whale-watching is a low-impact form of whale-watching. With land-based whale-watching the emphasis can be taken off the whales to some extent and the experience can, and should, be seen as having a lot more to offer than just viewing whales. It provides a chance to relax and enjoy time in a naturally beautiful setting, it offers the chance to spend time with family and friends, and visitors are able to enjoy other activities whilst waiting for whales such as nature walks, bird watching, and picnics. There is also the added benefit of it being more accessible, more affordable and for many more comfortable than boat-based whale-watching.

Such a large participation in this activity means that land-based whale-watching has the potential to be a significant platform from which wildlife managers can increase visitors' knowledge of whales and their ideas of conservation. However, interpretation at land-based viewing areas is usually minimal or non-existent. Managers of land-based whale-watching sites should be provided with effective techniques, which are based on scientific research, to enable them to enhance the whale-watching experience, by maximizing visitors' enjoyment and satisfaction, whilst at the same time increasing its conservation value. A list of recommendations specific to management of whale-watching activities at Cape Solander is given in Appendix 6.

CHAPTER 7: Expectations, experience and satisfaction of boat-based whale-watchers on the south coast of New South Wales, Australia

7.1 ABSTRACT

A sample of 1018 boat-based whale-watchers were surveyed on board commercial whale-watching vessels on the south coast of NSW during the 2002, 2003 and 2005 whale-watching seasons. Whale-watching in this area occurs during the humpback whales' (*Megaptera novaeangliae*) southern migration to their Antarctic feeding grounds. Information was gathered on the whale-watchers' demographics, expectations, experience and satisfaction. Boat-based whale-watchers on the south coast of NSW were typically well-educated, middle aged, and resided in NSW, VIC or ACT**.** Most had not watched whales from a boat before, had a low to moderate knowledge of whales and wanted to learn more as part of their whale-watching experience. Boat-based whale-watchers on the south coast of NSW were highly satisfied with their experience. They had high, but often realistic expectations of their boat-based whale-watching experience. As with land-based whale-watchers at Cape Solander (Chapter 6), factors influencing their satisfaction included the degree to which expectations were met, proximity of whales, numbers of whales, the extent of whale behavioural displays and the level of information on whales available to them. Improving the quality of education provided during boat-based whale-watching experiences on the south coast of NSW could further increase whale-watchers' satisfaction, whilst at the same time increasing whale-watchers' appreciation of whales and their conservation.

7.2 INTRODUCTION

Whale-watchers' satisfaction varies with the quality of the experience. Factors which determine the latter include the degree to which expectations are met, the proximity of whales, the numbers of whales, the whale behavioural displays and the level of information on whales available (Chapter 6). Cape Solander whale-watchers reported only moderate satisfaction levels (Chapter 6). Land-based whale-watching at Cape Solander occurs during the whales' northern migration to their tropical breeding grounds. Humpback whales passing Cape Solander are travelling steadily, rarely staying in the one area for any length of time, or engaging in aerobatic behaviour. Whale-watching on the south coast of NSW, however, occurs during the humpback whales' southern migration. Whales in this area are travelling slower, mothers can be seen with young calves and whales are often seen engaging in surface-active social and feeding behaviour at close range (see Chapter 3 and 4). Thus it is hypothesised that the satisfaction levels of boat-based whale-watchers in southern NSW will exceed those of land-based whale-watchers further north.

The aims of this chapter are: (1) to provide a profile of the people who go boat-based whale-watching on the south coast of NSW, (2) to ascertain the expectations of boat-based whale-watchers, (3) to determine the level of satisfaction with the boat-based whale-watching experience on the south coast of NSW and what factors may contribute to visitor (dis)satisfaction, and (4) to make comparisons between the boat-based whale-watcher and their experience on the south coast of NSW with the land-based whale-watcher and their experience at Cape Solander, NSW**.** Comparisons of the responses of boat-based whale-watching participants with those of land-based whale-watching participants will improve our understanding of the generality of the factors identified in Chapter 6 in determining a satisfying whale-watching experience. It will also help to identify those factors which are platform-specific. A better understanding the values of both experiences will help in the management of the whale-watching industry as a whole.

7.3 METHODS

Boat-based whale-watchers were surveyed on six commercial whale-watching vessels operating out of Eden, Merimbula and Narooma on the far south coast of New South Wales during the humpback whales' (*Megaptera novaeangliae*) southern migration. Surveys were conducted over a total of 90 days from late September to early November in 2002, 2003 and 2005.

The survey was undertaken in two parts. Part 1 'before seeing the whales' was completed by whale-watchers before boarding the boat and Part 2 'after seeing the whales' was completed on the return journey to port.

The researcher (KS) handed out Part 1 and Part 2 of the questionnaire to passengers waiting to board the whale-watching vessel. Participants were given a clipboard containing both parts of the questionnaire and were given both written and verbal instructions to complete Part 1 before boarding the vessel and to complete Part 2 on their return trip. The researcher stayed onboard the vessel during the whale-watching trip and collected the questionnaires upon return to port. Apart from distributing and collecting questionnaires the researcher's role on board the vessel was passive. Generally the researcher did not provide additional information to passengers, although she did answer questions if asked.

All questionnaires contained both open and closed questions including some Likert-scale and multiple choice type questions. A copy of the boat-based whale-watcher questionnaire is provided in Appendix 7. As with the land-based whale-watchers questionnaire the questions were designed to obtain information on whale-watchers' demographic profile, the background of their visit, the frequency with which they visit wildlife areas, their self-assessed knowledge of whales and other wildlife, their expectations, their levels of satisfaction with their whale-watching experience and their predicted future behaviour. Where possible, questions were phrased as per the land-based questionnaire to enable direct comparisons.

A total of 1037 Part 1 and Part 2 questionnaires were distributed and 1018 were returned, yielding a return rate of 98%. Some people left out answers to some of the questions and so the sample size varies from question to question. The

questionnaire was quite long (35 questions, 11 pages) and this could be why some questionnaires were incomplete.

Observations of humpback whale behaviour were made by the researcher during 91% of whale-watching trips in which questionnaires were handed out and could be cross-matched with 843 questionnaires (i.e. 83% of all respondents). Methods for the collection of whale behavioural data are outlined in Chapter 5.

Non-parametric analyses were performed on the data using Statistical Package for Social Sciences (SPSS for Windows V14.0; SPSS Inc., Chicago) to determine the factors that contribute to visitor (dis)satisfaction, and to make comparisons between the boat-based whale-watcher and their experience on the south coast of NSW with the land-based whale-watcher and their experience at Cape Solander. Analyses of similarity (ANOSIM) and similarity per cent (SIMPER) routines were performed using Plymouth Routines in Multivariate Ecological Research [Primer V5.2.9] software to test for differences in profiles, expectations and satisfaction levels between land-based and boat-based whale-watchers. Variables were normalised. Similarity was based on Euclidean distance.

7.4 RESULTS

7.4.1 Visitor profile

Most respondents (64%, *n* = 904) were female. Most were aged between 35 and 54 years of age (Table 7.1). Most were well educated with 47.5% (*n* = 945) of people surveyed holding a university degree, diploma or higher degree. Forty-five per cent (*n* = 936) were employed as executives/managers, teachers/lecturers or 'other professionals' (Table 7.1). Whale-watchers were in groups of mainly adult couples (38%, *n* = 1021), friends or relatives (29%) or immediate family members (i.e. parents and children) (28%).

The number of all male and female adult passengers onboard the vessel (i.e. not just respondents) was counted for 30 trips during the 2005 whale-watching season. Forty-four per cent of passengers counted were male and 56% were female (*n* = 965).

ANOSIM revealed no significant differences between the demographic profiles (i.e. age, education, occupation, gender and travel party) of land-based and boat-based whale- watchers (R = -0.005, p = 0.719).

Thirty-four per cent (*n* = 596) of respondents were from NSW, 33% were from Victoria, 19% from ACT and a further 3% from other Australian states. Eleven per cent of respondents were international visitors. Most international visitors were from Europe (87%) with 24 people coming from the UK. The other countries included USA, New Zealand, Canada, Israel, and Uruguay.

The four most important factors people gave for choosing the whale-watching trip that they did were: 'the date and time best suited my schedule', 'the advertisement caught my eye', 'it was recommended by others' and 'the price best matched my budget' (Table 7.2). Many people saw the trip advertised in a tourist brochure (54%, *n* = 986) or at a visitor information centre (32%) (Table 7.3). Eighty-one per cent of all people surveyed indicated that they had received information on whales that were in the local area. The three most common sources of this information were via word of mouth, the Eden Whale Museum and television (Table 7.4).

Frequency of people donating to and/or actively involved in helping an environmental organisation or group

Twenty-six per cent (*n* = 826) of respondents donated to and/or were actively involved in helping an environmental organisation. The most popular environmental groups included: World Wide Fund for Nature (WWF); Greenpeace; Wilderness Society; Landcare; Royal Society for the Prevention of Cruelty to Animals (RSPCA) and the Australian Conservation Foundation (ACF). A table of all environmental organisations that respondents listed is given in Appendix 8.

Table 7.1. Demographic profile of boat-based whale-watchers on the south coast of NSW.

	%	*n*
Gender		904
Female	64	
Male	36	
Age		888
35-44	24	
45-54	24	
55-64	17	
30-34	11	
25-29	10	
65 or over	7	
20-24	4	
15-19	3	
Schooling		945
University degree, diploma or higher degree	47	
Completed secondary school	23	
Trade or technical qualifications	19	
Some secondary school	10	
Primary school	1	
No formal schooling	0	
Occupation		936
Other Professional	21	
Executive/Manager	13	
Retired/Pensioner	12	
Teacher/Lecturer	11	
Clerical	8	
Home Duties	8	
Skilled Tradesperson	6	
Sales/Service	6	
Technical	5	
Student	5	
Driver/Machinery operator	1	
Labourer	1	
Self employed	1	
Unemployed	1	
Other	1	
Travel Party		1021
Adult couple	38	
Friends/relatives	29	
Family (parents and children)	28	
Unaccompanied	4	
Other	1	

Table 7.2. Whale-watchers' reasons for choosing the whale-watching trip they were on. Respondents could choose more than one response and so the total percentages of respondents is >100.

	Number of responses	**% of respondents (*n* = 992)**
The date and time best suited my schedule	454	46
The advertisement caught my eye	266	27
It was recommended by others	220	22
The price best matched my budget	197	20
Someone organised the trip for me	161	16
The size of the boat	156	16
It was the only one I saw advertised	86	9
It offered expert commentary and/or naturalist on board	70	7
Have had previous dealings with the operator*	43	4
It offered a money back guarantee*	24	2
Other	57	6

*This was not given as a specific option on the questionnaire, but occurred frequently under the 'other' category of this question.

Table 7.3. The instrument by which whale-watchers had seen the trip they were on advertised. Respondents could choose more than one response and so the total percentages of respondents is >100.

	Number of responses	**% of respondents (*n* = 986)**
Tourist Brochure	532	54
Visitor Information Centre	321	32
Newspaper	135	14
Internet	117	12
Magazine	93	9
Haven't seen any advertisements	92	9
Radio	49	5
Television	44	4
At wharf*	25	2
Various advertisements around town*	20	2
Accommodation*	15	1
Travel guide book*	14	1
Other	31	3

*This was not given as a specific option on the questionnaire, but occurred frequently under the 'other' category of this question.

Table 7.4. The instrument by which whale-watchers found out information on whales that were in the local area. Respondents could choose more than one response and so the total percentages of respondents is >100.

	Number of responses	% of respondents (*n = 821*)
Word of mouth	301	37
Eden Whale Museum	229	28
Television	169	21
Magazines	146	18
Newspaper	134	16
Internet	124	15
NPWS information signs	80	10
Books	79	10
Radio	73	9
NPWS Discovery Centre	36	4
Videos	33	4
Other	52	6

Frequency with which respondents incorporate environmentally friendly behaviours into their daily lives

Six questions were used to gauge the frequency with which whale-watchers incorporated environmentally friendly behaviours into their daily lives. The majority of whale-watchers either 'always' or 'frequently' carried out the first four of these environmentally friendly behaviours but relatively few 'always' or 'frequently' donated to and/or were actively involved in helping an environmental organisation or used alternatives to plastic bags when shopping for groceries (Table 7.5).

Four of these six questions were based on a survey developed by the NSW Department of Environment and Conservation (DEC) (2003) to assess participation in environmentally friendly actions. That survey offered Five categories (Often, Sometimes, Occasionally, Never, Not applicable) of response instead of the six used in this study ('Always', 'Frequently', 'Sometimes', 'Rarely', 'Not at all', 'Not applicable'). For comparative purposes the categories 'Always' and 'Frequently' were combined and renamed 'Often', 'Sometimes' remained the same, 'Rarely' was renamed 'Occasionally' and 'Not at all' was renamed 'Never'. It could be argued that the NSW DEC categories of 'Sometimes' and 'Occasionally' are not different from one another, however given that 'Occasionally' came after 'Sometimes' on an apparently sliding scale then it is assumed that respondents who ticked 'Occasionally' would probably

have ticked 'Rarely' if that was an option**.** Comparisons of these results indicate that boat-based whale-watchers display more environmentally friendly behaviours than the average person living in NSW (Figure 7.1).

Table 7.5. Percentage with which boat-based whale-watchers on the south coast of NSW incorporated environmentally friendly behaviours into their daily lives. Values represent percentage of responses.

	Not at all	Rarely	Sometimes	Frequently	Always	Not applicable	*n*
Recycle bottles, cans, paper or plastic instead of throwing them away	1	2	1	18	78	0.5	820
Choose household products that you think are better for the environment	3	6	6	43	41	1	710
Avoid putting things like oil, fat , turps or paints down the sink or toilet	2	2	2	21	72	1	802
Avoid putting things like litter or detergents into gutters or storm water drains	2	2	1	19	75	1	811
Donate to and/or actively involved in helping an environmental group	45	23	12	12	5	3	677
Use alternatives to plastic bags when shopping for groceries	17	25	15	25	17	1	673

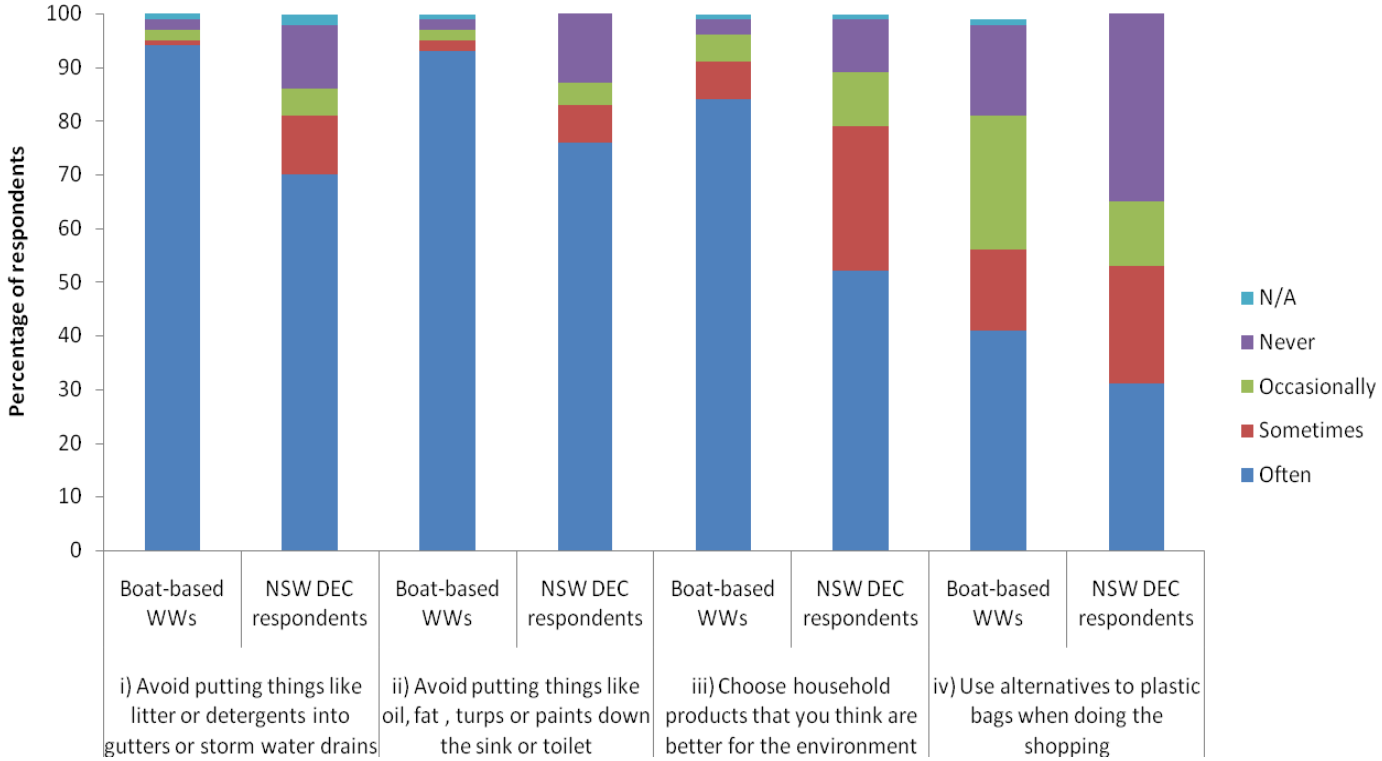


Figure 7.1. Frequency with which boat-based whale-watchers and Department of Environment and Conservation, NSW (2003) respondents incorporate environmentally friendly behaviours into their daily lives.
i) $\chi^2 = 174.76$, df = 4, p <0.001, *n* (BB WW's) = 812 *n* (NSW) = 1421; ii) $\chi^2 = 15.34$, df = 4, p = 0.004, *n* (BB WW's) = 803 *n* (NSW) = 1391;; iii) $\chi^2 = 218.84$, df = 4, p <0.001, *n* (BB WW's) = 711 *n* (NSW) = 1421; iv) $\chi^2 = 144.56$, df = 4, p <0.001, *n* (BB WW's) = 673 *n* (NSW) = 1421

Environmental rating

An 'environmental rating' was given to respondents based on their answers to all of the above six question (i.e. how often you personally do the following activities…) where the score was: 'not at all' = 0 points, 'rarely' = 1 point, 'sometimes' = 2 points, 'frequently' = 3 points and 'always' = 4 points (0 is the minimum environmental rating and 24 is the maximum environmental rating a person can have). Respondents who did not answer all six questions or who answered 'not applicable' to at least one were excluded. The median environmental rating of respondents was 17, interquartile range (IQR) = 5 indicating that most respondents often incorporated environmentally friendly behaviours into their daily lives. Fifty-nine per cent (*n* = 777) had a high environmental rating i.e. between 17 and 24, 37% had a medium environmental rating i.e. between 9 and 16 and only 4% had a low environmental rating of 8 or less.

Frequency of previous boat-based whale-watching experiences.

It was the first time whale-watching from a boat for most respondents (76%), although 51% had been whale-watching from land before (Table 7.6a). Of those who had been whale-watching from land before, the relative frequency was once before (24%), 2-10 times (24%) and >10 times (4%).

Frequency of visits to other wildlife areas in the last 12 months

Seventy-eight per cent of respondents had taken a trip to a zoo/aquarium/wildlife park during the 12-month period prior to completing the survey. Most had been either once, or between two to five times (Table 7.6b). Eighty-seven per cent of respondents had visited a national park/nature reserve during the twelve-month period prior to completing this survey. Most of these respondents had been between one and five times (Table 7.6b). Seventy-six per cent of respondents had visited a place specifically to view wildlife over the 12-month period prior to

completing the survey. Thirty-four per cent had visited between two and five times, followed by 20% who had visited only once (Table 7.6b).

Table 7.6. Frequency of **a)** previous whale-watching experiences and **b)** visits to other wildlife areas in the 12 months prior to completing the questionnaire. Values represent percentage of responses.

a)

	Not at all	Once	2-5 times	6-10 times	More than 10 times	*n*
Watched whales from a boat	76	15	7	1	1	967
Watched whales from land elsewhere	49	24	20	3	4	922

b)

	Not at all	Once	2-5 times	6-10 times	More than 10 times	*n*
Taken a trip to a zoo/aquarium/wildlife park	22	30	32	6	9	935
Visited a National Park/Wildlife Reserve	13	18	41	11	17	945
Visited a place specifically to view wildlife	24	20	34	9	13	919

Nature/wildlife interest rating

A 'nature/wildlife interest rating' was given to respondents who answered all parts of both questions relating to participation in a wildlife/nature-based experience (i.e. 'How many times have you done the following before today?' (two part question) and 'In the last 12 months, how many times have you done the following?' (three part question). The ratings for each question were: 'Not at all' = 0 point, 'once' = 1 point, '2-5 times' = 2 points, 6-10 times = 3 points and 'more than 10 times' = 4 points (0 is the minimum nature/wildlife interest rating and 20 the maximum nature/wildlife interest rating a person can have). The median nature/wildlife interest rating of respondents was 6 (IQR = 6, *n* = 813), and so most respondents only occasionally visit nature-based tourism areas**.** Even though most people had a low nature/wildlife interest rating, 94% (*n* = 813) had been at least once to at least one type of place in the 12 months prior to completing the questionnaire.

There was a significant positive correlation between whale-watchers' nature/wildlife interest rating and their environmental rating (Spearman's rho = 0.11 p = 0.004)

Respondents' self assessment of knowledge

Most people surveyed rated their knowledge of whales, other marine life, the marine environment, birds, local terrestrial wildlife, local history and local geology as either little or moderate (Table 7.7).

Those people with a nature/wildlife interest rating above the median rated their knowledge of all topics significantly higher than those whose nature wildlife/interest rating that was below the median (Table 7.8). Previous whale-watchers also rated their knowledge of all topics significantly higher than those who were whale-watching from a vessel for the first time (Table 7.9).

Table 7.7. How boat-based whale-watchers on the south coast of NSW rated their knowledge of various topics. Values represent percentage of responses.

	None	Little	Moderate	Good	Expert	*n*
Whales	4	54	35	6	0	969
Other marine life	4	48.5	38	9	0	962
Marine environment	6	50	35	9	0	957
Birds	7	46	34	12	1	963
Local terrestrial wildlife	17	50	23.5	9	0	952
Local history	20	56	19	4	1	960
Local geology	27	55	13.5	4	0	960

ANOSIM revealed no significant differences between the wildlife interest profiles (i.e. how often they have visited wildlife areas, if they had watched whales from a boat and their self-assessed knowledge of wildlife) of land-based and boat-based whale- watchers ($R = 0.04$, $p = 0.001$).

Table 7.8. Mann-Whitney U comparison of differences in boat-based whale-watchers' self-assessed knowledge on various topics between respondents with a low nature/wildlife interest rating and respondents with a high nature/wildlife interest rating. All variables were measured on a 5-point Likert scale with values of 1 = 'none', 2 = 'Little', 3 = 'Moderate', 4 = 'Good' and 5 ='expert'

	Nature/wildlife interest rating	***n***	**Mean Rank**	**Mean Rating ± SE**	**Test Statistics**
Whales	Low (i.e. below median)	339	303.6	2.3 ± 0.03	Mann-Whitney U = 45279 z = -5.66 p <<0.001
	High (i.e. above median	344	379.9	2.6 ± 0.04	
Other marine life	Low (i.e. below median)	336	303.5	2.4 ± 0.04	Mann-Whitney U = 45373 z = -5.33 p <<0.001
	High (i.e. above median	344	376.6	2.7 ± 0.04	
Marine environment	Low (i.e. below median)	336	307.3	2.3 ± 0.04	Mann-Whitney U = 46633 z = -4.74 p <<0.001
	High (i.e. above median	343	372.0	2.6 ± 0.04	
Birds	Low (i.e. below median)	338	306.9	2.4 ± 0.04	Mann-Whitney U = 46432 z = -4.84 p <<0.001
	High (i.e. above median	343	374.6	2.7 ± 0.05	
Local terrestrial wildlife	Low (i.e. below median)	334	299.9	2.1 ± 0.04	Mann-Whitney U = 44230 z = -5.47 p <<0.001
	High (i.e. above median	342	376.2	2.5 ± 0.05	
Local history	Low (i.e. below median)	336	311.6	2.0 ± 0.04	Mann-Whitney U = 48084 z = -4.10 p <<0.001
	High (i.e. above median	342	366.9	2.2 ± 0.04	
Local geology	Low (i.e. below median)	336	320.4	1.9 ± 0.04	Mann-Whitney U = 51020 z = -2.81 p = 0.005
	High (i.e. above median	342	358.3	2.0 ± 0.04	

Table 7.9. Mann-Whitney U test comparison of differences in boat-based whale-watchers self-assessed knowledge on various topics between respondents who had been boat-based whale-watching previously and respondents who had not been boat-based whale-watching previously. All variables were measured on a 5-point Likert scale with values of 1 = 'none', 2 = 'Little', 3 = 'Moderate', 4 = 'Good' and 5 ='expert'.

	Previous boat-based whale-watching experience	***n***	**Mean Rank**	**Mean Rating ± SE**	**Test Statistics**
Whales	Yes	219	536.2	2.7 ± 0.05	Mann-Whitney U = 61270 z = -5.19 p <<0.001
	No	706	440.3	2.4 ± 0.02	
Other marine life	Yes	217	505.1	2.7 ± 0.05	Mann-Whitney U = 66388 z = -3.14 p = 0.002
	No	702	446.1	2.5 ± 0.03	
Marine environment	Yes	217	507.0	2.6 ± 0.05	Mann-Whitney U = 65094 z = -3.44 p = 0.001
	No	698	442.8	2.4 ± 0.03	
Birds	Yes	218	499.4	2.7 ± 0.06	Mann-Whitney U = 68047 z = -2.67 p = 0.008
	No	702	448.4	2.5 ± 0.03	
Local terrestrial wildlife	Yes	215	512.8	2.5 ± 0.06	Mann-Whitney U = 62404.5 z = -3.95 p <<0.001
	No	695	437.8	2.2 ± 0.03	
Local history	Yes	218	499.7	2.3 ± 0.06	Mann-Whitney U = 60762 z = -5.02 p<< 0.001
	No	699	446.3	2.0 ± 0.03	
Local geology	Yes	218	499.7	2.1 ± 0.06	Mann-Whitney U = 67309.5 z = -2.89 p = 0.004
	No	699	446.3	1.9 ± 0.03	

7.4.2 Visitors' expectations

What is important when seeking a good whale-watching experience

Respondents were given 14 features whale-watchers may look for when seeking a good whale-watching experience and were asked to rate each as either 'important', 'neutral' or 'not important'. The five most important features for a good whale-watching experience were (Table 7.10):

1) Seeing whales in their natural environment
2) Seeing whales behaving naturally
3) Seeing whales up close
4) A chance to do something new, exciting and different
5) An opportunity to learn more about whales

Respondents' expectations of viewing wildlife during their whale-watching trip

Respondents were asked to rate their chances of seeing a humpback whale, a southern right whale, a dolphin, a killer whale or a seal as either 'guaranteed', 'high', 'medium', 'low' or 'no chance'. Most people thought they had a high to medium chance of seeing a humpback whale, a seal and a dolphin and a medium to low chance of seeing a southern right whale. Most people thought there was little to no chance that they would see a killer whale (Table 7.11).

Those who had been whale-watching from a boat before had lower expectations of seeing a humpback whale, a seal and a dolphin and higher expectations of seeing a southern right whale and a killer whale than those who had not been boat-based whale-watching before (Table 7.12).

Table 7.10. The importance of 14 features when seeking a good whale-watching experience, as rated by boat-based whale-watchers on the south coast of NSW. All variables were measured on a 3-point Likert scale with values of 1 = 'important', 2 = 'neutral' and 3 = 'not important'.

	Important (%)	Neutral (%)	Not important (%)	Mean	SE	*n*
Seeing whales in their natural environment	95	5	0	1.0	0.01	986
Seeing whales behaving naturally	95	5	0	1.0	0.01	987
Seeing whales up close	92	7	1	1.1	0.01	989
A chance to do something new, exciting and different	77	21	2	1.3	0.03	972
An opportunity to learn more about whales	76	23	1	1.2	0.01	975
To feel safe and comfortable whilst viewing whales	75	20	5	1.3	0.02	962
Opportunity to take photos	69	24	7	1.4	0.02	950
Seeing a large variety of marine life	61	37	2	1.4	0.02	944
Opportunity to spend time with family and friends	59	31	10	1.5	0.02	933
An opportunity to learn more about the marine environment	57	41	2	1.5	0.02	959
An opportunity to learn more about a variety of marine life	57	41	2	1.5	0.02	961
Being able to tell people you have seen whales	50	35	15	1.6	0.03	929
Seeing large numbers of whales	50	42	8	1.6	0.02	911
An opportunity to learn more about the local area	43	49	7	1.6	0.02	932

Table 7.11. The expectations of boat-based whale-watchers on the south coast of NSW of seeing a humpback whale, southern right whale, killer whale, dolphin or seal. Values represent percentage of responses.

	Guaranteed	High Chance	Medium Chance	Low Chance	No Chance	*n*
Humpback whales	11	39	36	13	1	956
Southern Right whales	3	23	40	30	5	913
Killer whales	1	8	21	43	28	902
Dolphins	12	43	34	10	1	945
Seals	12	32	34	17	5	940

Table 7.12. Mann-Whitney U comparison of differences in expectations of seeing a humpback whale, southern right whale, dolphin, seal and killer whale between respondents who had and had not been boat-based whale-watching previously. All variables were measured on a 5-point Likert scale with values of 1 = 'Guaranteed', 2 = 'High chance', 3 = 'Medium chance', 4 = 'Low chance' and 5 ='no chance'.

	Previous boat-based whale-watching experience	*n*	Mean Rank	Mean Rating ± SE	Test Statistics
Humpback Whales	Yes	220	422.4	2.4 ± 0.06	Mann-Whitney U = 68622 z = -2.34 p = 0.019
	No	692	467.3	2.6 ± 0.03	
Southern Right Whales	Yes	205	469.1	3.3 ± 0.07	Mann-Whitney U = 61687 z = -2.23 p = 0.025
	No	667	426.5	3.1 ± 0.03	
Dolphins	Yes	207	416.3	2.3 ± 0.06	Mann-Whitney U = 67079 z = -2.74 p = 0.006
	No	660	468.6	2.5 ±0.03	
Seals	Yes	214	409.8	2.5 ± 0.07	Mann-Whitney U =64702 z = -2.70 p = 0.007
	No	685	462.54	2.8 ± 0.04	
Killer whales	Yes	219	478.8	4.1 ± 0.06	Mann-Whitney U = 59840 z = -3.13 p = 0.002
	No	692	419.9	3.8 ± 0.04	

Respondents' expectations of viewing specific types of whale behaviour during their whale-watching trip

Respondents were asked to rate their chances of seeing a whale breach, spy hop, tail slap or blow as either 'guaranteed', 'high', 'medium', 'low' or 'no chance'. Most respondents rated their chances of seeing a whale blow, spy hop and tail slap as medium to high. Forty-five per cent of respondents thought that they had a medium chance of seeing a whale breach whilst 26% and 24% thought they had a low or high chance of seeing a whale breach, respectively (Figure 7.2).

Expectations of seeing a whale breach, tail slap or spy hop were not significantly different if respondents had been whale-watching before or not. However expectations of seeing a whale blow were significantly lower for those with previous boat-based whale-watching experience (Table 7.13).

ANOSIM and SIMPER revealed no significant differences in expectations between boat-based whale-watchers and land-based whale-watchers (R = 0.00, p = 0.522).

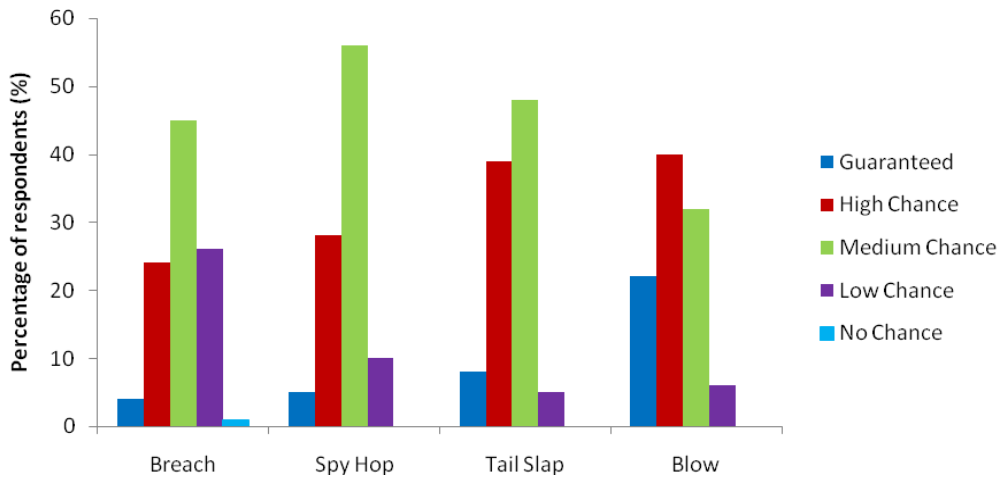


Figure 7.2. Boat-based whale-watchers' expectations of seeing a whale breach (*n* = 762), spy hop (*n* = 678), tail slap (*n* = 734) or blow (*n* = 818) whilst on their whale-watching trip on the south coast of NSW.

Table 7.13. Mann-Whitney U comparison of differences in expectations of seeing a whale blow, tail slap, breach and spy hop between respondents who had and had not been boat-based whale-watching previously. All variables were measured on a 5-point Likert scale with values of 1 = 'Guaranteed', 2 = 'High chance', 3 = 'Medium chance', 4 = 'Low chance' and 5 ='no chance'.

	Previous boat-based whale-watching experience	*n*	Mean Rank	Mean Rating ± SE	Test Statistics
Blow	Yes	222	418.4	2.2 ± 0.07	Mann-Whitney U = 67936 z = -3.11 p = 0.002
	No	707	479.5	2.4 ± 0.04	
Tail Slap	Yes	221	437.3	2.8 ± 0.08	Mann-Whitney U = 72335 z = -1.93 p = 0.05
	No	696	475.0	3.0 ± 0.05	
Breach	Yes	222	479.4	3.4 ± 0.08	Mann-Whitney U = 75268 z = -0.96 p = 0.34
	No	709	460.5	3.3 ± 0.05	
Spy Hop	Yes	221	453.6	3.4 ± 0.10	Mann-Whitney U = 73151 z = -1.165 p = 0.24
	No	708	476.0	3.3 ± 0.05	

7.4.3 Visitors' experience and satisfaction

Marine mammals seen

Ninety-eight per cent (*n* = 915) of respondents saw whales. Ninety-four per cent of respondents correctly identified the whales they saw as humpback whales and a further 1% were unsure if they were humpback whales they saw. One per cent of respondents saw killer whales and a further 1% saw southern right whales. Fifty-nine per cent of people saw dolphins and 83% saw seals. Thirty-seven per cent of respondents (*n* = 873) saw 1-3 whales, 34% between two and six whales, and 27% saw seven or more whales.

Approximate distance to whales

Sixty-nine per cent of respondents (*n* = 840) who saw whales estimated that the whales were less than 100 m from the vessel. Twenty–six per cent of respondents estimated that the whales were between 100 m and 200 m from the vessel and only 4% estimated that the whales were more than 200 m from the vessel.

Respondents' satisfaction with their proximity to the whales

Eighty per cent (*n* = 873) of people responding to this question thought that their whale viewing was *close enough*. In an open-ended question, respondents were asked to give their reasons for their response. The main reasons whale-watchers gave were: "Don't want to disturb them/respect their space" (23%, *n* = 563), "Whales came to us" (21%), "Could see clearly/could see good detail" (20%) and "Close enough/good views without disturbing them" (14%). Nineteen per cent of people thought that the distance they were from the whales was *not close enough.* The main reasons that visitors gave were: "Wanted to see more detail" (19%, *n* = 133), "Would like to see them closer" (15%), "Couldn't see whales clearly" and "Couldn't get a good photo" (12%). Nine people (i.e. 1%) thought that the distance was too close**.** The reasons they gave related to feelings that the safety of whales was being compromised, that whales

were being harassed and one person raised concerns over the effect of diesel fumes on the whales.

Respondents who had been whale-watching on a boat before were more satisfied with the distance they were from the whales (U = 58783, z = -2.46, p = 0.014, *n* = 832). Fifty-two per cent (*n* = 33) of respondents who estimated the whales to be at 200 m or greater indicated that the distance was 'not close enough', 35% (*n* = 221) of respondents who saw whales between 100 m and 200 m indicated that the distance was 'not close enough' and 11% (*n* = 566) of respondents who saw whales less than 100 m from the vessel thought that the distance was 'not close enough'. Return whale-watchers were less likely to say that the distance was 'not close enough' than those who were watching whales for the first time (χ^2 = 8.14, df = 2, p = 0.017 *n* = 832, standardised residuals significant < -1.96 at p = 0.05).

Whale behaviours that respondents saw

Forty-five per cent (*n* = 904) saw a whale *breach* and 3% were unsure if they saw a whale breach. Forty-two per cent (*n* = 896) saw a whale *spy hop* and 6% were unsure if they saw a *spy hop*. Ninety-six per cent (*n* = 914) of people saw a whale *blow*. Whale-watchers were also asked if they saw a whale *tail slap*. Eighty-nine per cent of respondents indicated that they had seen a whale *tail slap*. The researcher's observations, however, revealed that tail slaps only occurred during 34% of observations. It is likely that some respondents misunderstood the question to mean *tail up*. *Tail up* (or Fluke up as it is also known*)* is a much more common behaviour which occurred during 91% of the researcher's observations.

If the percentages of people who saw and were unsure if they saw each of the behaviours are added together the actual chances of seeing each behaviour can be rated on the following scale: No chance = 0, Low = 1%-33%, Medium = 34%-66%, High = 67%-99%, Guaranteed = 100%. Based on this scale there is medium chance of seeing a whale *breach* or *spy hop* and a high chance of seeing a *blow* from a whale-watching vessel on the south coast of NSW (given the unreliability of the data, tail slap is not considered here). The accuracy of peoples' expectations can also be determined based on the above scale. Forty per cent of respondents had accurate expectations of seeing

a whale blow, and 45% had realistic expectations of seeing a whale breach (Figure 7.3a). Inconsistencies were also found between the likelihood of seeing a whale spy hop based on whale-watchers' observations and the researcher's observations. A spy hop was observed by the researcher on 31% of whale-watching trips, giving it a low chance of occurring whereas 48% of whale-watchers surveyed indicated that they saw a whale spy hop. This would give it a medium chance rating. Based on the researcher's observations, 10% of people had accurate expectations of seeing a whale spy hop and 89% of respondents had expectations that were too high (Figure 7.3b).

Four humpback whale behaviours were chosen by the researcher as spectacular surface behaviours based on their acrobatic, energetic and easily visible nature. These were breach, pectoral slap, fluke slap and lateral feeding lunge. The presence or absence of these four behaviours was recorded by the researcher during the majority of whale-watching trips. At least one of these behaviours occurred when 76% (*n* = 843) of respondents were onboard. Of these respondents (*n* = 637), 34% were onboard when only one of these behaviours was recorded, 21% when two of these behaviours were noted, 16% when three behaviours were recorded and 5% when all four behaviours occurred at least once.

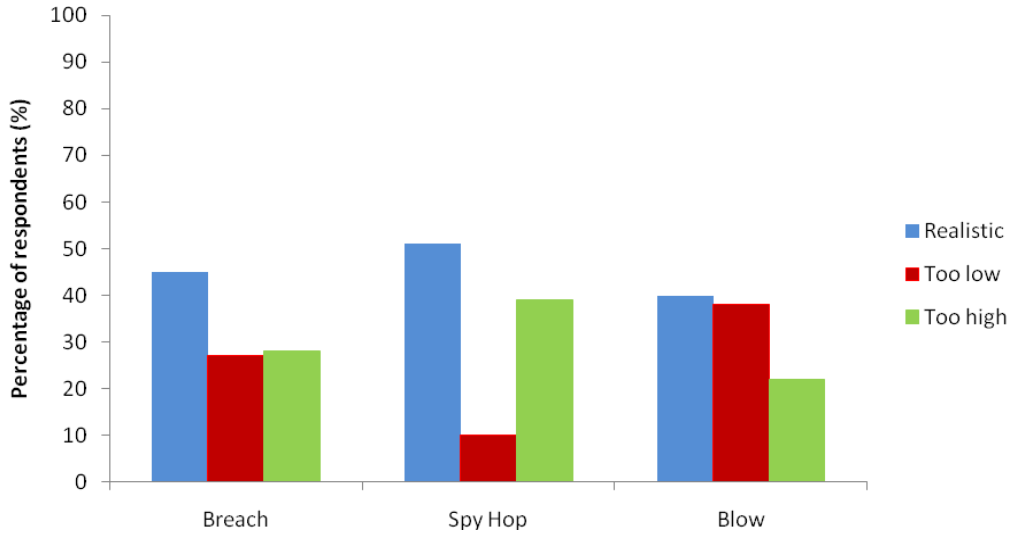
What respondents learnt during their whale-watching trip

Fifty-two per cent of people surveyed said they learnt 'a little' about *whales* during their whale-watching trip, 44% said they learnt 'a lot' and 4% said they learnt 'nothing' about *whales*. Sixty-four per cent of respondents said they learnt 'a little' about *other marine life*, 55% said they learnt 'a little' about the *marine environment* and 56% said they learnt 'a little' about the *local area (Table 7.14).*

Table 7.14. How much boat-based whale-watchers said they learnt about whales, the marine environment, other marine life and the local area. Values represent percentage of responses.

	Nothing	A little	A lot
Whales (*n* = 905)	4	52	44
Other Marine Life (*n* = 844)	27	64	9
Marine Environment (*n* = 829)	35	55	10
Local Area (n = 848)	26	56	18

a)



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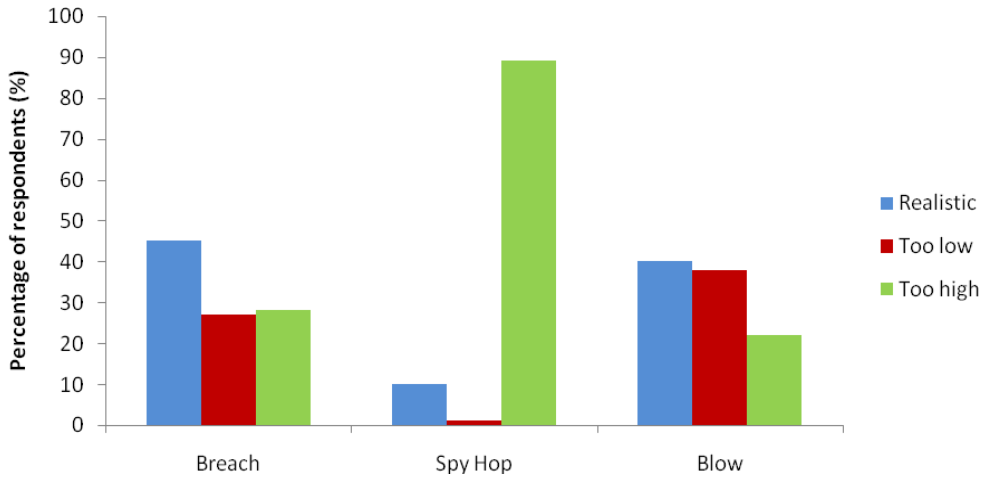

Figure 7.3. Evaluation of boat-based whale-watchers' expectations of seeing a whale breach, spy hop and blow whilst on their whale-watching trip on the south coast of NSW based on **a)** respondents' reports of seeing these behaviours and **b)** the researcher's observations.

Respondents' whale knowledge

Respondents were asked 4 multiple choice questions relating to whales before boarding the vessel. The results are presented in Table 7.15. Respondents were asked the same multiple choice questions when returning to port (Part 2 of the questionnaire). Comparisons between whale-watchers' knowledge before and after their whale-watching trip are provided in Chapter 8.

There was a significant relationship between previous whale-watching experience and knowledge. Categories used for analysis were: 1 question correct, 2 questions correct, 3 questions correct and all 4 questions correct. Those who answered no questions correctly were excluded from the analysis due to the small sample size. Those who had been whale-watching before were more likely to answer three or all four questions correctly before their whale-watching trip than those who had not been before (χ^2 = 28.91, df = 3, p <<0.001, *n* = 845 standardised residuals significant > 1.96 at p = 0.05). Those who had previous whale-watching experience also scored slightly better on the same multiple choice questions after the whale-watching trip. People who had no previous experience were more likely to get only one question correct after their whale-watching trip (χ^2 = 9.83, df = 3, p = 0.020, standardised residuals significant > 1.96 at p = 0.05, *n* = 864). People with a low nature/wildlife interest rating (i.e. below the median of 6) got fewer questions correct before their whale-watching trip than those with a high nature/wildlife interest rating (above the median of 6) (χ^2 = 16.01, df = 3, p = 0.001, *n* = 631) however there was no difference in the number of questions answered correctly after the whale-watching experience between high and low nature/wildlife interest raters (χ^2 = 2.88, df = 3, p = 0.411, *n* = 636).

Table 7.15. The frequency of correct, incorrect and 'don't know' responses of boat-based whale-watchers on the south coast of NSW to four multiple choice questions relating to whales. Values represent the percentage of responses.

	Answered correctly	**Answered Incorrectly**	**Chose 'don't know' response**	***n***
What is a baby whale called?	92	2	5	961
What is a group of whales called?	87	3	10	957
Why do humpback whales spend summer in Antarctica?	49	29	22	980
What is the minimum distance a boat can approach a whale from in NSW?	34	25	41	949

Factors respondents thought posed a direct threat to humpback whales in Australia today

Eighty-three per cent (*n* = 1018) of respondents thought that pollution poses a direct threat to humpback whales in Australia today. Commercial fisheries (43%) and whaling (42%) were also indicated by many as threatening humpback whales. Ozone depletion was identified as a threat by 34% of respondents, boat-based whale-watching by 10% and land-based whale-watching by 1%.

Respondents' satisfaction with their whale-watching experience overall

Respondents were asked to rate their satisfaction with their experience on a 7 point scale (1 = boring, 4 = acceptable and 7 = fascinating). The median satisfaction rating was 6 (IQR = 2, *n* = 896). Sixty-eight per cent gave their whale-watching experience a high rating of 6 or 7 and 2% a low rating of 1 or 2. Boat-based whale-watchers were more satisfied with their whale-watching experience than land-based whale-watchers at Cape Solander (Figure 7.4).

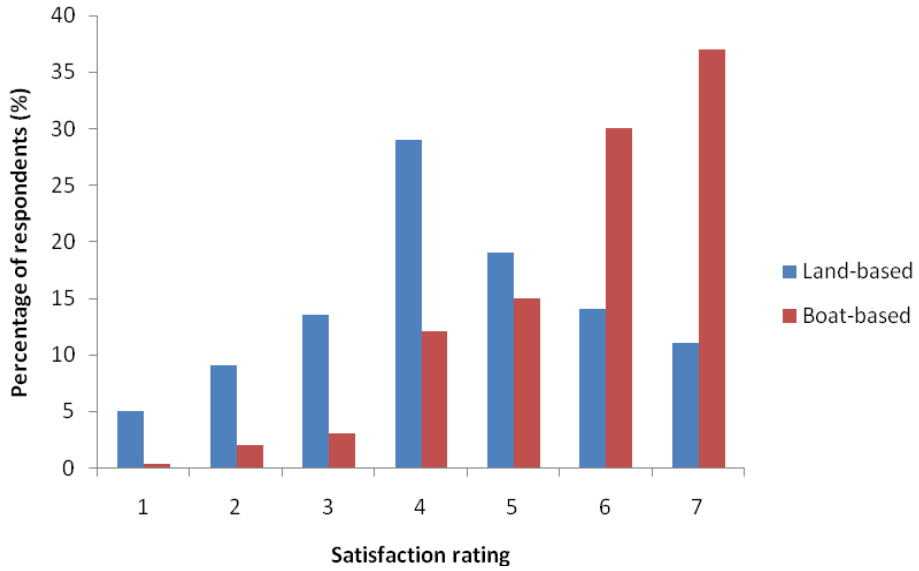

Figure 7.4. The mean satisfaction rating of the overall whale-watching experience given by land-based whale-watchers (*n* = 1348) and boat-based whale-watchers (*n* = 896) (U = 293871, z = -20.10, p <<0.001). Satisfaction was measured on a 7-point Likert scale with values of 1 = boring, 4 = acceptable and 7 = fascinating. Land-based whale-watcher data discussed in Chapter 6.

There was a significant relationship between whale-watchers' overall satisfaction and the number of whales and whale behaviours observed. Respondents on board trips where none of the four spectacular behaviours was observed were more likely to give a low satisfaction score of 2 or 3 and less likely to give the highest satisfaction score of 7 than those respondents who saw at least one of the four spectacular behaviours (χ^2 = 33.73, df = 5, p <<0.001, *n* = 753, standardised residuals significant > 1.96 at p = 0.05). Only satisfaction scores >1 were included in the chi-square analysis. Overall satisfaction scores increased with the number of the four spectacular behaviours observed (Figure 7.5). For analysis purposes, the quality of the whale-watching experience was given a rating of 'ordinary' or 'excellent'. If one to three whales were seen at distances greater than 100 m, not displaying any of the four spectacular behaviours then the whale-watching experience was labelled 'ordinary', if more than four whales were observed at distances less than 100 m displaying at least three of the four spectacular behaviours, then the whale-watching experience was labelled as 'excellent'. The mean satisfaction score with an 'ordinary' experience was 4.8 ± 0.2, (median = 5, *n* = 34). The mean satisfaction score with an 'excellent' whale-watching experience was 6.3 ± 0.1 (median = 7, *n* = 100).

There was a significant relationship between the amount that people thought they learnt and their satisfaction with their whale-watching experience. Those who said they learnt 'nothing' about whales gave their whale-watching experience a lower satisfaction rating and those who said they learnt 'a lot' about whales (χ^2 = 176.258, df = 2, p<<0.001, *n* = 883).

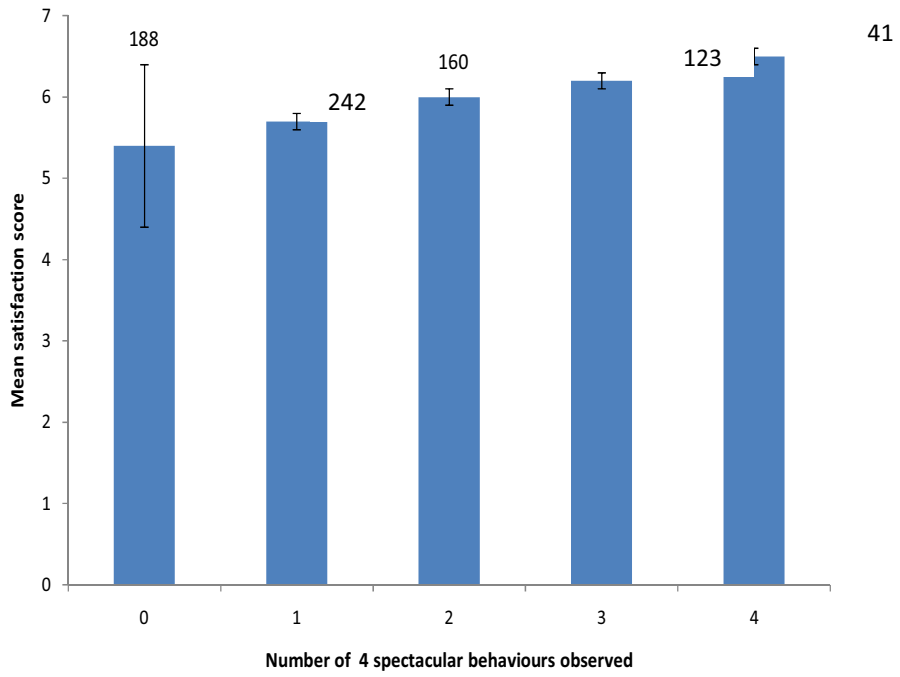

Figure 7.5. The mean satisfaction rating of the overall whale-watching experience given by boat-based whale-watchers who saw none of the four spectacular humpback whale behaviours, one of the behaviours, 2 of the behaviours, 3 of the behaviours or all 4 spectacular behaviours at least once during their whale-watching trip (χ^2 = 30.787, df = 3, p <<0.001). Satisfaction was measured on a 7-point Likert scale with values of 1 = boring, 4 = acceptable and 7 = fascinating. Sample sizes are shown above each bar.

Female whale-watchers gave their experience a higher satisfaction rating than male whale-watchers (U = 69645, z = -2.38, p = 0.017, *n* = 824). There was no difference in the satisfaction levels of those with previous boat-based whale-watching experience and those with no previous boat-based whale-watching experience (U = 63336, z = -1.27, p = 0.21, *n* = 853) or between those with a high nature/wildlife interest rating and those with a low nature/wildlife interest rating (U = 49502, z = -1.12, p = 0.980, *n* = 631).

There was a significant relationship between the distance that visitors estimated the whales were from the vessel and their satisfaction rating. Respondents gave highest satisfaction scores when they estimated the whales were less than 100 m from the vessel and lowest satisfaction scores when the whales were more than 200 m from the vessel (χ^2 = 51.73, df = 2, p <<0.001, *n* = 819).

How respondents' whale-watching experience lived up to their expectations

Fifty-three per cent (*n* = 895) of respondents said that their experience met expectations, 31% said the experience exceeded expectations, 16% said that it fell short of expectations and 1% were unsure. There was no significant relationship between the degree to which expectations were met and whether or not it was respondents' first time whale-watching or not. If the whale-watching experience exceeded expectations, respondents were more likely to give their overall experience the highest satisfaction rating of 7. If expectations were met then respondents were more likely to give their experience a satisfaction rating of 5 or 6. If the experience fell short of expectations, respondents were more likely to give as low satisfaction rating of 1 to 4 (χ^2 = 419.10, df = 2, p <<0.001, *n* = 896).

How respondents rated the quality of specific aspects of their whale-watching experience

Whale-watchers were asked to rate 10 aspects of their experience on a 5-point Likert scale with a value of 1 indicating 'very poor', 2 indicating 'poor', 3 indicating 'neutral', 4 indicating 'good' and 5 indicating 'excellent'. The mean rating for all 10 aspects was between 4 and 5 (i.e. good and excellent) (Table 7.16). Seal viewing had the lowest mean rating of 3.9. Those respondents with previous boat-based whale-watching experience rated 'value for money' higher than those whale-watching from a boat for the first time. There were no other differences in the satisfaction with any of the other nine aspects between those with previous boat-based whale-watching experience and those without (Table 7.17) or for any of the 10 aspects between gender (Table 7.18).

ANOSIM and SIMPER revealed significant differences between the boat-based and land-based experience (R = 0.3904, p = 0.001, average squared distance = 44.95). Variables used in the analysis included those associated with: amount learnt; whales and behaviours seen; overall satisfaction; and satisfaction with specific aspects of the experience such as distance from whales, number of whales seen and whale

behavioural displays. The boat-based whale-watching experience rated higher in all aspects (Table 7.19).

Table 7.16. Mean ratings of whale-watchers' satisfaction with 10 aspects of the boat-based whale-watching experience on the south coast of NSW. All variables were measured on a 5-point Likert scale with values of 1 indicating 'very poor' and a value of 5 indicating 'excellent'.

	n	Mean Rating	SE
Staff friendliness	890	4.6	0.02
Safety and comfort	866	4.5	0.02
Value for money	888	4.3	0.03
Distance from whales	891	4.3	0.03
Number of whales see	894	4.1	0.03
Dolphin viewing	848	4.1	0.05
Whale behavioural displays	884	4.1	0.03
Interpretive style used to convey information	852	4.1	0.03
Photo opportunities	879	4.0	0.04
Seal viewing	866	3.9	0.04

Table 7.17. Mann-Whitney U comparison of differences in satisfaction levels of boat-based whale-watchers on the south coast of NSW with 10 aspects of their experiences relating to whether they had been boat-based whale-watching previously or not. All variables were measured on a 5-point Likert scale with values of 1 indicating 'very poor' and a value of 5 indicating 'excellent'.

	Previous boat-based whale-watching experience	*n*	Mean Rank	Mean Rating ± SE	Test Statistics
Staff friendliness	No	642	422.5	4.6±0.02	Mann-Whitney U = 64825 z = -0.51 p = 0.61
	Yes	206	430.8	4.6±0.04	
Safety and comfort	No	640	419.7	4.5±0.03	Mann-Whitney U = 63463 z = -0.63 p = 0.50
	Yes	204	431.4	4.5±0.05	
Value for money	No	642	415.0	4.2±0.03	Mann-Whitney U = 60016 z = -2.07 p = 0.04
	Yes	205	452.2	4.4±0.06	
Distance from whales	No	642	419.9	4.2±0.04	Mann-Whitney U = 63177 z = -1.16 p = 0.25
	Yes	207	440.8	4.4±0.06	
Number of whales seen	No	647	423.3	4.1±0.04	Mann-Whitney U = 64239 z = -0.84 p = 0.40
	Yes	206	438.7	4.2±0.07	
Dolphin viewing	No	612	399.7	4.1±0.07	Mann-Whitney U = 57042 z = -1.27 p = 0.21
	Yes	198	423.4	4.2±0.12	
Whale behavioural displays	No	638	415.4	4.0±0.04	Mann-Whitney U = 61193 z = -1.36 p = 0.17
	Yes	204	440.5	4.2±0.07	
Interpretive style used to convey information	No	616	401.4	4.0±0.04	Mann-Whitney U = 57247 z = -1.61 p = 0.11
	Yes	200	430.3	4.1±0.06	
Photo opportunities	No	634	412.3	4.0±0.05	Mann-Whitney U = 60113 z = -1.59 p =0.11
	Yes	204	414.8	4.0±0.09	
Seal viewing	No	627	408.3	3.9±0.06	Mann-Whitney U = 59114 z = -1.47 p = 0.14
	Yes	202	435.9	4.0±0.09	

Table 7.18. Mann-Whitney U comparison of differences in satisfaction level of boat-based whale-watchers on the south coast of NSW with 10 aspects of their whale-watching experience between gender. All variables were measured on a 5-point Likert scale with values of 1 indicating 'very poor' and a value of 5 indicating 'excellent'.

	Gender	*n*	Mean Rank	Mean Rating ± SE	Test Statistics
Staff friendliness	Male	289	392.9	4.5±0.04	Mann-Whitney U = 71572 z = -2.00 p = 0.05
	Female	533	421.7	4.6±0.03	
Safety and comfort	Male	289	392.7	4.4±0.04	Mann-Whitney U = 71580 z = -1.71 p = 0.09
	Female	529	418.7	4.5±0.03	
Value for money	Male	289	391.9	4.2±0.05	Mann-Whitney U = 71358 z = -1.81 p = 0.07
	Female	531	420.6	4.3±0.04	
Distance from whales	Male	291	395.8	4.2±0.06	Mann-Whitney U = 115186 z = -1.48 p = 0.14
	Female	530	419.3	4.3±0.04	
Number of whales seen	Male	293	408.8	4.1±0.06	Mann-Whitney U = 76696 z = -0.41 p = 0.68
	Female	532	415.3	4.1±0.04	
Dolphin viewing	Male	280	397.8	4.2±0.10	Mann-Whitney U = 72700 z = -1.48 p = 0.14
	Female	506	391.1	4.1±0.07	
Whale behavioural displays	Male	286	392.8	4.0±0.06	Mann-Whitney U = 71308 z = -1.43 p = 0.15
	Female	529	416.2	4.1±0.05	
Interpretive style used to convey information	Male	279	382.8	4.0±0.05	Mann-Whitney U = 67733 z = -1.19 p = 0.23
	Female	510	401.7	4.1±0.04	
Photo opportunities	Male	287	416.3	4.1±0.07	Mann-Whitney U = 72798 z = -0.88 p = 0.38
	Female	526	401.9	4.0±0.05	
Seal viewing	Male	285	393.8	3.9±0.07	Mann-Whitney U = 71475 z = -0.68 p = 0.50
	Female	516	405.0	3.9±0.06	

Table 7.19. SIMPER analysis of respondents' ratings of various aspects of the land-based and boat-based whale-watching experience.

Variable	Difference	Average squared distance	% contribution
Photo opportunities	Boat>Land	2.85	6.34
Distance from whales	Boat>Land	2.76	6.13
Learnt about other marine life	Boat>Land	2.63	5.86
Saw tail slap	Boat>Land	2.63	5.85
Whale behavioural displays	Boat>Land	2.52	5.61
Close enough	Boat>Land	2.51	5.59
Learnt about whales	Boat>Land	2.44	5.43
Number of whales seen	Boat>Land	2.38	5.29
Learnt about the marine environment	Boat>Land	2.37	5.28
Overall satisfaction	Boat>Land	2.35	5.23
Saw humpback whales	Boat>Land	2.33	5.19
Saw spy hop	Boat>Land	2.32	5.17
Exceeded expectations	Boat>Land	2.22	4.94
Saw breach	Boat>Land	2.20	4.90
Not close enough	Boat>Land	2.16	4.80
Too close	Boat>Land	2.12	4.72
Saw a blow	Boat>Land	2.12	4.72

Information respondents would have liked to have received

Forty- four per cent (*n* = 854) of people surveyed wanted more information on *whales*, 45% (*n* = 845) wanted more information on *other marine life*, 48% (*n* = 844) wanted more information on the *marine environment* and 37% (*n* = 839) wanted more information on the *local area.* Respondents were asked in an open-ended question to list any other topics they would have liked to have received information on. One hundred and twenty-two people added some other information they would have liked to have received, including: information on seabirds, more information on other marine life seen including seals, dolphins, jellyfish, sharks and other fish. Some people would have liked to have received more information on the marine ecosystem in general and the ecology of the area. Some of the additional information people wanted to receive on whales included: history of whaling in the area, migration patterns, population numbers and trends, other whales that may be seen in the area, ways to identify whale species, whale conservation or threats facing whales, whale behaviour and general whale biology.

Suggested improvements to enhance enjoyment of the whale-watching experience

A total of 260 people (i.e. 25% of all people surveyed) listed one or more improvements that they thought would enhance the enjoyment of their whale-watching experience. Sixty-four people (i.e. 25% of respondents to this question) wanted better quality information and interpretation. Some people specified that they wanted this information in the form of videos, expert guides, visual displays and handout sheets or brochures. Forty five people (i.e. 17%) thought that a closer view of the whale, more whales and/or more whale activity would improve their whale-watching experience. Twenty-nine people (i.e. 11%) indicated that they would have liked a better quality PA system as it was hard to hear commentary. Twenty-two people (i.e. 9%) thought that better weather and/or sea conditions would have enhanced their whale-watching experience. Twenty-two people (i.e. 9%) would have liked a better viewing opportunity including less people, people sitting down in front, bigger viewing areas, vessel rotating its position and people rotating their position. A further 22 people (i.e. 9%) indicated that they would have liked food and drinks or better quality food/drinks provided**.**

Most memorable aspect of respondents' whale-watching trip

In an open-ended question respondents were asked to list the most memorable aspects of their whale-watching trip. A total of 727 people mentioned one or more memorable aspects. Six hundred and forty-three people (i.e. 88%) nominated seeing whales as the most memorable aspect of their visit including; the close viewing of whales (29%), seeing whale behavioural displays (22%), seeing a whale's tail (6%), seeing whales in their natural environment (5% people), seeing a mother and calf (4%), seeing whales feeding (4%), seeing whales in good numbers (3%), seeing whales for the first time (3%) and hearing the whales (1%).

A further 109 people (14%) said their most memorable aspect related to something other than the whales including: dolphins (7%, n = 727), being seasick or with seasick people (2%), friendliness of the staff (2%), seals (2%), spending time or sharing an experience with family (1%).

Respondents' predicted future behaviour

Seventy-one per cent (*n* = 885) of respondents would go whale-watching from a boat again, 24% possibly and 5% would not like to. Respondents were asked in an open-ended question to give reasons for their response. The main reasons people would like to go whale-watching from a boat again included: it was an enjoyable, exciting, fun or pleasant experience (23%, *n* = 885); to see more whales, more behaviours or to see them closer (12%); to gain more experience, to see other species and at different locations (5%); fascinating/interesting (3%); like whales/interested in whales (3%)**;** best way to see whales/close proximity (3%); like to see whales in their natural environment (2%); interested in nature/wildlife (2%); did not get to see much today and would still like to (2%); and to learn more (1%).

Some people gave reasons for not wanting to go boat-based whale-watching again. They were: got seasick (4%, *n* = 885), once is enough (2%), expensive (1%), did not see much (1%), trip was too long (1%) and concerned that it was detrimental to whales (1%).

Forty-nine per cent (*n* = 891) of people surveyed would like to go whale-watching from land, 32% would possibly go whale-watching from land and 18% would not like to go whale-watching from land. The main reasons people gave for wanting to go whale-watching from land included: like to see whales any way/like to see whales in their natural environment (8%), no seasickness/more comfortable (5%) have done this before and enjoyed it (4%), to get a different perspective (3%), easier/more accessible (3%), cheaper (3%), and interested in whales/wildlife (2%)

Some of the reasons people gave for not wanting to go whale-watching from land included: better from a boat/not close enough (17%, *n* = 891), not as much fun/not as exciting as boat-based whale-watching (1%), prefer to be in whales' own environment (1%) and not as interesting as boat-based whale-watching (1%).

Ninety per cent (*n* = 789) of people surveyed would recommend someone else to go whale-watching from a boat, 8% would possibly recommend boat-based whale-watching and 2% would not.

7.5 DISCUSSION

7.5.1 Profile of boat – based whale-watchers

The boat-based whale-watchers' profile was consistent with the land-based whale-watchers' profile described in Chapter 6. They were generally middle aged (i.e. 35-54 years old). This is typical with the age profile of boat-based whale-watchers' in other parts of Australia, e.g. Hervey Bay (Muloin 1998, Smith et al. 2006) and Moreton Island (Neil *et al.* 2003), as well as boat-based whale-watchers from other parts of the world such as Scotland (Parsons et al. 2003, Warburton et al. 2000) and Canada (Corbelli 2006), but is older than described for New Zealand boat-based whale-watchers (Pearce & Wilson 1995). As with Cape Solander whale-watchers, boat-based whale-watchers were well educated with almost half professionally employed as managers/executives, teachers or other professionals and this is also consistent with the profiles of boat-based whale-watchers elsewhere (Neil et al. 2003, Pearce & Wilson 1995, Parsons et al. 2003, Warburton et al. 2000, Finkler & Higham 2004, Muloin 1998, Corbelli 2006, Smith et al. 2006). The proportion of respondents employed as professionals is not different from the NSW population census data (Australian Bureau of Statistics 2002). However the percentage of boat-based whale-watchers with a university degree, diploma or higher degree (47%) is higher than the NSW population census data of 36%.

There was a gender bias towards females in this study as was found with Cape Solander whale-watchers (Chapter 6) and in many other studies on whale-watchers (Muloin 1998, Warburton et al. 2000, Parsons et al. 2003, Reid 1999, Neil et al. 2003, Corbelli 2006, Smith et al. 2006). This does not necessarily mean that there are more women than men participating in boat-based whale-watching, but may just reflect a tendency for females to be more willing to complete a questionnaire. A sample of boat-based whale-watchers on board 30 whale-watching trips in 2005 revealed the proportion of female whale-watchers to be 56% which is less than the 64% of female respondents to the questionnaire. Smith *et al.* (2006) also found that, whilst more females participated in whale-watching than males, there was a tendency for females to more often participate in a survey.

Boat-based whale-watching in southern NSW appeals to adult couples as well as families and groups of friends travelling together. The close proximity of the region to the Victorian and ACT borders meant that many whale-watchers were interstate travellers with an almost equal proportion of NSW and Victorian residents. Most whale-watchers had seen the tour they chose advertised. Visitor information centres and tourist brochures appeared to be the most effective form of advertising. As well as advertising, other factors influencing peoples' choice of whale-watching trip were the schedule and cost of the cruise and the recommendations from others. Many whale-watchers were finding out information about whales in the local area before their trip via word of mouth, the Eden whale museum and television.

Boat-based whale-watchers exhibited more environmentally friendly behaviours than the average person living in NSW (NSW Department of Environment and Conservation 2003). This result contrasts with Forestell and Kaufman's (1990) belief that whale-watchers in Australia, Hawaii and elsewhere in America represent a cross section of the travelling public and not a significantly more environmentally aware group**.** Fifty-nine per cent of whale-watchers in this study were given a high environmental rating based on the frequency with which they performed specific environmentally friendly behaviours. Beaumont (2001) used a similar five point scale to assess levels of environmental behaviours of ecotourists visiting Lamington National Park in Queensland. She found only 36% performed high levels of environmentally friendly behaviours. As well as looking at the frequency of recycling, donating to and/or participation in environmental groups and the use of environmentally friendly products, Beaumont also used the frequency with which visitors used public transport, wrote to politicians and signed petitions to assess environmental behaviour, and so these results may not be directly comparable to this study.

Twenty-six per cent of boat-based whale-watchers in this study donated to and/or were actively involved in helping an environmental organisation. This is slightly higher than the national statistic of one in five Australians donating some time or money to help protect the environment (Australian Bureau of Statistics 2004). As with Cape Solander whale-watchers (Chapter 6), Greenpeace, Australian Conservation Foundation (ACF) and World Wide Fund for Nature (WWF) were amongst the most

popular organisations that they belonged to. Other popular organisations included Landcare and the Royal Society for the Prevention of Cruelty to Animals (RSPCA). A much larger proportion (58%) of marine wildlife tourists in Scotland were members of an environmental organisations (Warburton *et al.* 2000). However other researchers have found it to be a lot lower. Only 13% of Hervey Bay whale-watchers belonged to an environmental organisation (Muloin 1998) and it was even lower for swim-with-dolphin participants in New Zealand (4%) (Lück 2003b).

Whilst this was the first boat-based whale-watching experience for most respondents, a large proportion (51%) had been whale-watching from land before and a total of 57% had been whale-watching at least once before either from land or boat. This is much higher for boat-based whale-watchers in Moreton Bay where Neil *et al*. (2003) found only 18% had previous whale-watching experience either from land or boat. Most boat-based whale-watchers were given a low wildlife/nature interest rating. This rating was based on the frequency with which respondents visited wildlife and/or nature areas. Despite this low rating, 94% had visited one type of wildlife/nature area at least once in the 12 months prior to completing the survey. Moscardo and Saltzer (2005) also found a high level of interest in nature/wildlife areas with 68% of wildlife tourists surveyed having at least once visited one type of wildlife based tourism place in the 12 months prior to their study. Further support for the high level of interest in nature and wildlife that exists amongst whale-watchers comes from the study of Warburton *et al*. (2000) who found that 91% per cent of marine wildlife tourists were regularly involved in one or more wildlife-related activities.

The correlation between whale-watchers' nature/wildlife interest rating and their environmental rating could suggest that more exposure to nature and wildlife tourist sites increases environmentally friendly behaviour. However, many studies on this topic have produced conflicting results (Beaumont 2001). Some have found that nature-based tourism can contribute to an increase in positive environmental attitudes and behaviours, others have found only small changes in behaviours and attitudes and some have found no effect at all (see Chapter 8). The results presented here could also indicate that people who are more environmentally aware visit wildlife/nature areas more often. Continued involvement in nature-based experiences

could then be acting to strengthen already existing attitudes and behaviours (Beaumont 2001).

Despite their interest in wildlife/nature areas most respondents rated themselves as having little to moderate knowledge of whales, other marine life, the marine environment, birds and local terrestrial wildlife. Those who visit wildlife and/or nature areas more often rate their knowledge of whales other marine life, the marine environment, birds and local terrestrial wildlife higher and, based on their answers to the four multiple choice questions, demonstrated a higher knowledge of whales prior to their whale-watching experience. This is consistent with results of Neil *et al.* (2003) and Corbelli (2006) who found those who had previously been whale-watching were consistently more knowledgeable about whales than those who had not watched whales before.

7.5.2 Satisfaction, experience and expectations

Many studies into the human dimension of wildlife tourism have found the 'naturalness' of the experience to be a highly important factor contributing to visitor enjoyment and overall satisfaction (Davis et al. 1997, Muloin 1998, Muloin 2000, Woods 2001, Pearce & Wilson 1995, Moscardo & Saltzer 2005, Smith et al. 2006, Higham et al. 2001). This was also true for boat-based whale-watchers in this study who rated 'seeing whales behaving naturally' and 'seeing whales in their natural environment' as the two most important features of a good whale-watching experience. As reviewed by Moscardo *et al*. (2001), research has shown that an interest in seeing wildlife in natural settings does not preclude an interest in visiting wildlife in captive settings. Seventy-seven per cent of boat-based whale-watchers had visited a zoo, aquarium and or wildlife park at least once in the 12 months prior to completing the questionnaire. This paradox also existed amongst Cape Solander whale-watchers (Chapter 6).

Boat-based whale-watchers on the south coast of NSW are highly satisfied with their experience. Typically high level of satisfaction have been found with boat-based whale-watching experiences elsewhere (Muloin 1998, Muloin 2000, Orams 2000, Neil et al. 2003, Corbelli 2006, Smith et al. 2006) and with swim with cetacean experiences

(Valentine et al. 2004, O'Neill et al. 2004). It appears that the high levels of satisfaction reported in this study is largely due to high numbers of whales seen**,** high levels of surface activity and the close proximity at which passengers are able to view whales. In this area, humpback whales are often seen engaging in spectacular aerial behaviour such as breaching and other high energy behaviour such as feeding (see Chapter 5, 3 & 4). This was reflected in the results of the questionnaires, with almost half of the respondents indicating that they saw a whale breach. Furthermore, 76% were on board whale-watching trips when at least one of the four most spectacular humpback whale behaviours was observed (i.e. breach, lateral feeding lunge, pectoral slap and fluke slap).

Most boat-based whale-watchers on the south coast are able to view whales at close range. Under the NSW whale-watching regulations vessels are not permitted to approach whales closer than 100 m. Most whale-watching encounters on the south coast of NSW occur with vessels sitting idle at the 100 m approach limit, however whales sometimes approach vessels at distances closer than this (see Chapter 5). Almost all respondents estimated that they saw whales less than 200 m from the vessel. Highest satisfaction existed amongst whale-watchers who saw high numbers of whales (i.e. ≥7 whales), all four of the spectacular humpback behaviours described above and whales at distances less than 100 m. Relatively lower satisfaction levels were reported by Cape Solander whale-watchers (Chapter 6) where the number of whales was lower, surface behaviours not as frequent and distance from whales greater than for boat-based whale-watching experiences on the south coast of NSW. Others have also looked at the relationship between intensity of the experience and satisfaction. Muloin (2000) and Valentine *et al.* (2004) found that the satisfaction of whale-watchers correlated with distance from whales, number of whales and time spent with whales.

It is clear that seeing whales up close is important for boat-based whale-watchers on the south coast of NSW, with 92% saying it was an important feature of a good whale-watching experience and greater whale-vessel distances relating to lower overall satisfaction levels. Other researchers have also noted the importance of proximity to wildlife to visitor satisfaction (Reid 1995, Muloin 2000, Woods 2001,

Muloin 1998, Pearce & Wilson 1995, Valentine et al. 2004, O'Neill et al. 2004, Duffus & Dearden 1993, Corbelli 2006, Moscardo & Saltzer 2005, Higham et al. 2001).

Although close proximity, high numbers of whales and spectacular whale behaviour are all factors which can enhance whale-watchers' satisfaction, results of this study indicate that boat-based whale-watchers can still be satisfied even when these conditions are not met. In this study, those who saw one to three whales at distances > 100 m not engaging in any of the spectacular surface behaviours still rated their experience as acceptable or higher. Furthermore, seeing whales from a vessel at distances greater than 200 m does not necessarily relate to a poor whale-watching experience. Those who saw whales at distances greater than 200 m still gave their experience a mean rating of 5 (i.e. above acceptable). Orams (2000) also found that people who had 'poor' whale-watching experiences were still reasonably satisfied with their experience. Surprisingly, even those who did not see whales were still satisfied indicating that it was still fun and entertaining even without whales (Orams, 2000). Orams concluded that proximity to whales was not a major influence on satisfaction levels. Results of the present study indicate that boat-based whale-watchers are satisfied within the typical distances expected during boat-based whale-watching experiences on the south coast of NSW and that close proximity (i.e. < 100 m) seems only to influence satisfaction levels at the high end of the scale (i.e. making the difference between having a satisfying experience or an extremely satisfying experience).

Whilst most boat-based whale-watchers on the south coast of NSW were satisfied with the distance they were from whales, 19% would have liked to be closer in order to get a clearer view, see more detail or to take close-up photos. Although a high proportion (52%) of people who had seen whales at distances greater than 200 m indicated that they would have liked to have been closer, some of the people wanting to get closer included those who had seen whales closer than 200 m (11% and 35% of those people who had seen whales < 100 m or between 100-200 m, respectively).

Repeat boat-based whale-watchers were more likely to describe the distance they were from whales as 'close enough' than those who had not watched whales by boat before. This was also true for experienced whale-watchers at Cape Solander (Chapter 6). Despite this, there was no difference in overall satisfaction levels or

satisfaction scores for specific aspects of the trip for boat-based whale-watchers with previous whale-watching experience and those who were watching whales from a boat for the first time. This was also true for boat-based whale-watchers in south east Queensland (Neil *et al.* 2003). In contrast, higher satisfaction did exist amongst Cape Solander whale-watchers with previous whale-watching experience (Chapter 6). The results of this study and that of Neil *et al*. (2003) contrasts with other research which suggests that tourists with more experience are less satisfied and obtain fewer benefits from their wildlife encounters (Applegate & Clark 1987, Muloin 2000, Moscardo & Saltzer 2005). Applegate and Clark (1987) use the goal specificity theory proposed by (Vaske *et al.* 1982) to suggest that more experienced bird watchers are less satisfied because they have more specific goals and possibly more advanced expectations and preferences. The more detailed and specific the expectations then the less likely they are to be met and therefore the higher chance that they will be disappointed (Applegate & Clark 1987, van Raaij 1987). Muloin (1998) also uses this theory to suggest that the high level of satisfaction found amongst boat-based whale-watchers in her study may be because most had not been whale-watching before and therefore may have been easier to satisfy due to lower expectations or lack of specific goals. Further contradicting the above findings is that in this study, those who rarely visited wildlife viewing areas and/or nature areas (i.e. those with a low nature/wildlife interest rating) were no more satisfied with their whale-watching experience than those who often visited such places.

The relationship between expectations and satisfaction has been well documented (Raaij 1996, Ryan 1995). Expectations have proven to be a good predictor of a quality wildlife experience (Hammit, *et al*., 1993, Chapter 6) and boat-based whale-watchers are no exception to this rule. The degree to which expectations were met directly impacted on overall satisfaction scores; i.e. those who said their experience fell short of expectations were more likely to give a lower satisfaction score. Given that most whale-watchers in this study stated that their expectations were either met or exceeded, it is not surprising that overall satisfaction levels were high.

Considering that previous experience did not influence satisfaction levels in this study, it is not surprising that expectations also did not vary with whale-watching

experience. Boat-based whale-watchers had medium to high expectations of their whale-watching experience regardless of whether or not they had been whale-watching before or not. But there were some exceptions; people with previous whale-watching experience had slightly lower expectations of seeing a humpback whale blow than those who had not watched whales before. In addition, people with previous boat-based whale-watching experience had higher expectations of seeing killer whales and southern right whales. Their previous boat-based whale-watching experiences may have increased their awareness that these species do occur in south-eastern NSW waters. The degree to which expectations were met also showed no variation for first time whale-watchers and those with previous experience. In contrast, first-time whale-watchers at Cape Solander were more likely to say their expectations fell short than those who had been whale-watching before. This was likely the result of inexperienced whale-watchers having unrealistic expectations of their land-based whale-watching experience. These expectations were probably fuelled by media images, whereas repeat whale-watchers were basing their expectations on their personal experiences (Chapter 6).

The expectations of boat-based whale-watchers on the south coast of NSW, although often high, were usually justified. Whilst unrealistic expectations amongst whale-watchers does not seem to be a major issue for whale-watching experiences on the south coast of NSW, it is important that whale-watching operators and managers are aware of the influence expectations can have on the value people place on their experience, especially in areas where behavioural displays and close-up encounters are not as prevalent. As shown in Chapter 6, the expectations of Cape Solander whale-watchers often proved unrealistic and led to lower satisfaction with their land-based whale-watching experience. People who hold realistic expectations and beliefs about their experience will ultimately be more satisfied wildlife tourists (Hammit et al. 1993, O'Neill et al. 2004). It is important that wildlife tourists are informed early in their experience of the behaviours of the animals they have come to view and the likely conditions that they will encounter (Moscardo *et al.*, 2001). Whale-watchers should never be under the impression that they are guaranteed to see whales. Although the majority of boat-based whale-watchers in this study had realistic expectations, there

were still 22% who thought they were guaranteed of seeing a whale blow and 28% had unrealistically high expectations of seeing a whale breach.

Not surprisingly, for the majority of people, the most memorable aspect of their whale-watching trip related to whales. There were however quite a lot of people (14%) who mentioned something other than whales, including dolphins, seals, seasickness, the staff and spending time with family and friends. Factors which detracted from the whale-watching experience, apart from whale related issues (discussed above) and deficiencies in information and interpretation (discussed below), included bad weather and/or sea conditions, crowding, the positioning of the vessel and the refreshments available. These are all common elements that are known to detract from whale-watching experiences (Smith et al. 2006, Birtles *et al.* 2002b, Orams 2000, Birtles *et al.* 2002a). Whale-watching operators should inform passengers, prior to them booking the trip, of what to expect including weather conditions and the food and drinks that will or will not be provided. Recommendations for seasickness prevention and gear to bring would also help reduce peoples' disappointment with the trip. During the whale-watching cruise, skippers and crew should be aware of passengers' visibility and ensure that the vessel and passengers rotate their position. If this is not possible (e.g. due to the direction of the swell, the position and behaviour of the whales or passenger safety) then passengers should be informed.

Females were more satisfied than males with their overall whale-watching experience. But unlike Cape Solander whale-watchers (Chapter 6), did not give a higher satisfaction rating for specific aspects of their experience. This trend for females to be more satisfied with wildlife experiences has been noted before (Moscardo & Saltzer 2005, Muloin 2000). Muloin (2000) reviewed the psychology literature and concluded that this variation is likely due to differences in attitudes and socialization processes between males and females. Females hold more moralistic and humanistic attitudes toward animals than males, have stronger emotional attachments for individual animals and tend to be more emotionally expressive and environmentally receptive (Muloin 2000).

Given the high level of satisfaction amongst respondents it is not surprising that 90% would recommend boat-based whale-watching to someone else. Not as

many (71%), however, would definitely like to return to boat-based whale-watching themselves. The main reasons people gave for not wanting to go boat-based whale-watching again was that they were seasick, that they felt one experience was enough and that it was expensive.

Learning about whales was also an important part of the boat-based whale-watching experience, with the majority of respondents (76%) saying the opportunity to learn more about whales was an important component of a good whale-watching experience. Whale-watchers elsewhere also valued education during their whale-watching experiences. The opportunity to learn and the delivery of information were important for whale-watchers in Hervey Bay (Smith *et al.* 2006) and Canada (Corbelli 2006). O'Neill *et al*. (2004) and Lück (2003a) also noted that education during dolphin-watching cruises and the opportunity to learn new information was important for visitors' enjoyment. It is not surprising then that the satisfaction of boat-based whale-watchers was related to the amount they had learnt. As with Cape Solander whale-watchers, those who said they learnt 'a lot' about whales were more likely to give their overall experience a high satisfaction rating. Moscardo and Saltzer (2005) also found a strong relationship between the amount visitors said they had learnt about the wildlife and their overall satisfaction.

The results of this study highlight the need for improvements to the quality of education provided to boat-based whale-watchers on the south coast of NSW, especially given that learning about whales is considered by whale-watchers to be a valuable part of the whale-watching experience. Just over half of respondents said they learnt only 'a little' about whales, 44% wanted more information on whales and when asked to list any improvements, 9% of all people surveyed indicated that they wanted better quality information and/or better delivery of information. In addition, there is evidence to suggest that knowledge gained during boat-based experiences on the south coast of NSW is not being retained in the long term (see Chapter 8).

Boat-based whale-watchers on the south coast of NSW indicated that they are learning more than the land-based whale-watchers at Cape Solander. Only 10% of Cape Solander whale-watchers said they learnt 'a lot' about whales (Chapter 6) compared to 44% of boat-based whale-watchers. Furthermore, 93% of boat-based whale-watchers in this study knew that they were watching humpback whales

compared to only 38% of Cape Solander whale-watchers who could correctly identify the species of whale they were watching (Chapter 6). This is likely to be another factor contributing to differences in satisfaction levels reported by these two groups.

It is important that whale-watching operators and mangers in charge of protecting whales recognise the benefits of effective interpretation. Not only is it likely to increase visitors' enjoyment and satisfaction, but it can be used as an effective management tool by raising awareness about whales and their conservation, promoting realistic expectations and improving visitor behaviour (Lück 2003a, Meinhold 2003, Weiler & Davis 1993, Duffus & Dearden 1993, Moscardo et al. 2001, Orams 1996, Orams 1995a, Higginbottom et al. 2001a, Higginbottom 2002, Reid 1999). Education should be used to help solve inconsistencies between tourists' desires and animal welfare needs. For example, the satisfaction of whale-watchers in this study correlated with proximity to whales. Close approaches by whale-watching vessels, however, can change the behaviour of humpback whales (see Chapter 5). Thus giving whale-watchers deliberate close-up experiences (i.e. <100 m) is not compatible with the animal welfare objectives of the sustainable management of whale-watching and is prohibited by the NSW whale-watching regulations. In this instance an increased understanding of the reasoning behind approach limits and attainment of realistic expectations through improved education for whale-watchers can be an indirect way of increasing satisfaction without compromising the welfare of the whales.

The widely recognised belief that education during a wildlife encounter can be used as a tool for management has led to the development of models for effective interpretation programs that can be used at whale-watching sites (Orams 1996, Orams 1994, Forestell 1993, Reid 1999). A planned and structured interpretation program based on the above models should be considered. Recommendations for the application of effective interpretation during land-based and boat-based whale-watching experiences are discussed further in Chapter 8.

7.6 CONCLUSION

The typical profile for boat-based whale-watchers on the south coast is that they were well educated, middle aged, and resided in NSW, VIC or ACT. They were interested in viewing other types of wildlife in both captive and natural settings and displayed a high level of environmentally friendly behaviours. Most had not been whale-watching from a boat before, although almost half had watched whales from land. They had a low to moderate knowledge about whales, the marine environment and the local area. They were however motivated to learn about these things.

The results of this study support the hypothesis that the satisfaction levels of boat-based whale-watchers in southern NSW exceed those of land-based whale-watchers further north. Boat-based whale-watchers were highly satisfied with their whale-watching experience. They had medium to high expectations of their whale-watching experience, and the quality of the whale-watching experience on the south coast of NSW meant that these expectations were often met. Factors contributing to their satisfaction were proximity to whales, numbers of whales, whale behavioural displays and the amount of information available to them. Even when these conditions were not met, whale-watchers were still moderately to highly satisfied.

Whale-watching on the south coast of NSW is delivering a highly satisfactory experience. Further benefits for management of the industry could be obtained through increased education for whale-watchers that promotes awareness and appreciation of whales and their environment. Education can also help solve inconsistencies that can exist between visitor needs and wildlife needs.

CHAPTER 8: Educational and conservation value of whale-watching experiences in NSW

8.1 ABSTRACT

Whale-watching is a major form of wildlife-based tourism in New South Wales (NSW), with over 936,000 whale-watching participants recorded in NSW during 2003 (IFAW 2004). Despite evidence that whale-watching can have direct impacts on whales' behaviour, many support commercial whale-watching on the basis that it enhances people's appreciation and awareness of the whales they are viewing and can lead to the protection and conservation of the species and of the environment in general. This chapter examines the educational and conservational value of the whale-watching experiences currently offered on commercial vessels on the south coast of NSW and at a land-based whale-watching site at Cape Solander (near Sydney). Whilst the current education provided at these sites contains some elements of a good interpretation program, its structure needs improving and conservation objectives need to be defined. In its current form there is limited addition to knowledge and conservation behaviours of whale-watchers in the long term. Recommendations for creating and implementing effective interpretation during boat-based and land-based whale-watching experiences in NSW are provided. Through improvement of the education provided during whale-watching experiences, the whale-watching industry in NSW is more likely to be a sustainable form of wildlife tourism.

8.2 INTRODUCTION

As the popularity of whale-watching grows so too does the concern over the impact it is having on the whales being watched and whether or not whale-watching can be considered a non-consumptive use of whales or just another form of harmful exploitation (Tilt 1987, Orams 1999, Forestell & Kaufman 1990, Beach & Weinrich 1989, Bejder et al. 2006b). Despite research indicating that close approach by tourist vessels can change the behaviour of cetaceans (Williams et al. 2002, Baker et al. 1983,

Baker et al. 1982, Baker & Herman 1989, Bauer 1986, Bauer & Herman 1986, Blane & Jackson 1994, Corkeron 1995, Bejder et al. 1999, Constantine 2001a, Constantine et al. 2004, Lusseau 2003) many non government organisations (NGOs) involved in the conservation of whales actively support and encourage commercial whale-watching (Corkeron 2004). One of the four main arguments used by these organisations is that whale-watching promotes and induces conservation (Corkeron 2004). The other three common arguments are that commercial vessels provide an opportunity for research; viewing free ranging animals is better than viewing captive animals; and whale-watching is an economically viable alternative to whaling (Corkeron 2004).

The belief that nature-based tourism can lead to a greater awareness about the animals and areas being viewed, and promote conservation and environmental protection in general is widespread (Lück 2003a, Meinhold 2003, Weiler & Davis 1993, Duffus & Dearden 1993, Moscardo et al. 2001, Orams 1996, Orams 1995a, Higginbottom et al. 2001a, Higginbottom 2002, Reid 1999, Reynolds & Braithwaite 2001, Kimmel 1999, Moscardo & Saltzer 2005). Interpretation which incorporates affective and cognitive learning processes is thought to be the key in facilitating this.

According to Higginbottom (2002), for tourism based on viewing of free-ranging animals to be sustainable, it must meet the following criteria: 1) customers must be satisfied with their experiences, 2) operators must make sufficient profits, and 3) the activities must not cause the wildlife population(s) to decline, or to become less viewable over time. If the population were declining due to other causes, the activities should contribute positively to its conservation. Effective interpretation is central to sustainable wildlife tourism because it can help meet these criteria. Not only has it the potential to enhance support for conservation of the wildlife that is being viewed, it can also increase visitors' satisfaction and help reduce the activity's negative impacts (Higginbottom 2002, Ham & Weiler 2001, Kimmel 1999, Higham et al. 2001).

As seen in chapters 5 & 6, learning about whales was important to whale-watchers and their satisfaction correlated with the amount they had learnt. Others have also found a strong relationship between the amount visitors state they had learnt about the wildlife and their overall satisfaction (Lück 2003a, O'Neill et al. 2004,

Moscardo & Slatzer 2002, Moscardo & Saltzer 2005). Obviously the profitability of the industry relies heavily on the satisfaction of its customers. If visitors are satisfied, then they are more likely to return and recommend the experience to others. Education has also proven to be a valuable tool for management of inappropriate behaviours on site. Orams and Hill (1998) found that a carefully structured education program minimised inappropriate behaviours around dolphins at Tangalooma, Australia. Meinhold (2003) also describes how an educational program is useful in managing tourist behaviours around killer whales in Johnstone Strait, Canada.

Tilden (1957) was the first to clearly define interpretation as "An educational activity which aims to reveal meaning and relationships through the use of original objects, by first-hand experience, and by illustrative media, rather than simply to communicate factual information." An essential part of effective interpretation is creating strong emotional feelings towards wildlife and the environment (Ham 1992; Higginbottom 2002; Oliver 1992; Orams 1996). This is best achieved by avoiding classroom type approaches and incorporating sensory and participatory techniques in an informal atmosphere through the use of humour, stories, metaphors, analogies, and role playing (Ham 1992, Oliver 1992). According to Ham and Weiler (2001), the attributes that nature-based tourists associate with quality guided interpretation included the guide's passion, entertainment skills, inferred knowledge and their ability to provide relevant information in the form of 'new insights' about wildlife. Higginbottom (2002) suggests that good interpreters should use the acronym EROTIC Enjoyable, Relevant, Organised, Thematic, Informative and Challenging when planning their program.

Orams (1996) designed a structured interpretation program for the Tangalooma Dolphin Resort which proved successful in influencing visitors' behaviours. Participants in the education program were more likely to find out more information on dolphins, remove beach litter, become more involved in environmental issues and make a donation to an environmental organization upon their return home (Orams 1996). Orams' design was based on four main techniques and included the use of two learning processes: 1) affective domain and 2) cognitive

dissonance. Affective domain refers to the part of human thinking that includes attitudes, feelings, emotions and value systems (Orams 1995a).

Cognitive dissonance is the idea of creating why, how and when questions in people's minds. The theory of cognitive dissonances states that two elements are dissonant if they are in disagreement or inconsistent. An example of this given by Orams (1995a) is 'I do litter' and 'I know litter has a negative impact'. This is psychologically uncomfortable and will motivate the person to reduce the dissonance (Festinger 1957 in Orams 1995a). (Forestell & Kaufman 1990) developed a model for effective interpretation in marine tourism based on cognitive dissonance theory (Figure 8.2). (Forestell 1993) applied this model to whale-watching in Hawaii, dividing the program into three phases: 1) The Pre Contact Phase where cognitive dissonance is created through questions that are created in peoples' minds before coming in contact with the whales. 2) The Contact Phase where cognitive dissonance is managed through information that is provided with relevance to what the whale-watchers are observing, and 3) Post Contact Phase which involves the resolution of cognitive dissonance and uses follow up activities to incorporate new information into changed behaviour.

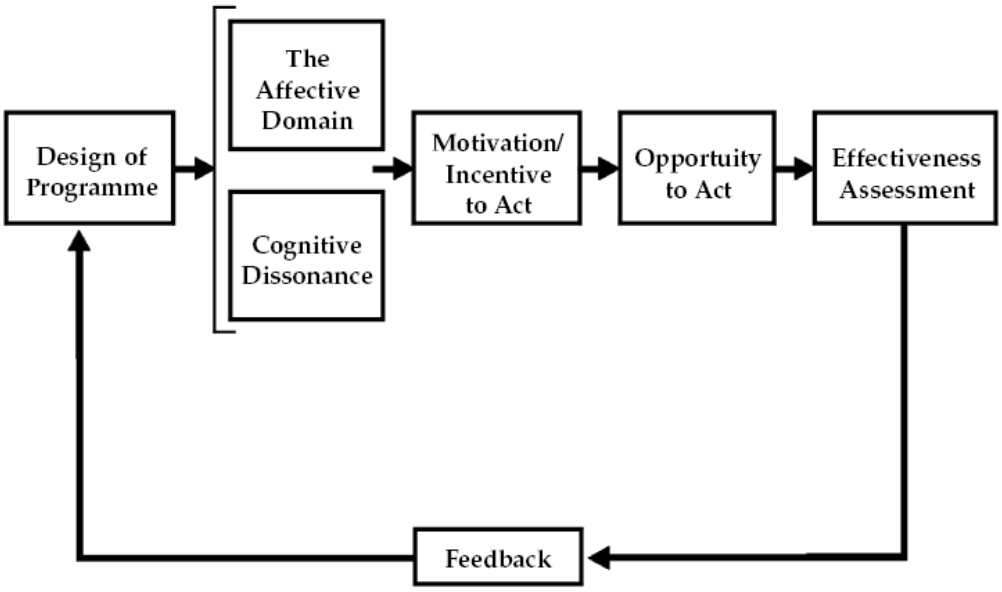

Figure 8.1: Interpretation techniques (features of an effective programme) - taken from Orams (1995a).

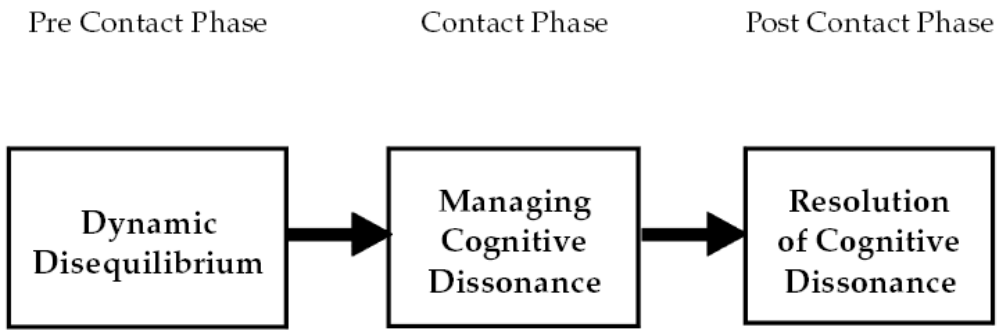

Figure 8.2: Forestell and Kaufman's interpretation model - taken from Orams (1995a).

The third component of Orams' (1995a) program design is providing participants with motivations to act. Messages such as 'we can make a difference' and 'we can do something' need to be incorporated. The final component of the program is giving participants the opportunity to act. Examples of things that can be included in this phase of the interpretation program include getting the tourists involved in research, providing them with petitions to sign and outlining things they can do at home to make a difference.

Successful wildlife tourism management requires an understanding of the needs of wildlife, tourists and industry. The findings presented in Chapter 5 indicate that humpback whales on their southern migration show some short-term behavioural responses in the presence of vessels. For whale-watching to be a sustainable form of wildlife tourism, ways of minimizing its negative impacts must be examined. The development of effective interpretation that promotes a conservation ethic and empathy for whales may be one step in ensuring the sustainability of the whale-watching industry in NSW. Chapter 6 and 7 revealed that whale-watchers have high expectations of their viewing experience and that they value learning as part of this experience. Whilst it appears whale watchers are receptive to learning, the effectiveness of the current interpretation during whale-watching experiences has not been tested.

The aims of this chapter are to: 1) determine the nature, use and effectiveness of interpretation currently offered in whale-watching experiences in NSW. Effectiveness will be measured in terms of knowledge gained and positive behavioural

changes of whale-watching participants; 2) compare land-based and boat-based whale-watching experiences to determine whether the quality of interpretation offered and its effectiveness differed between the two experiences. It is hypothesised that boat-based whale-watching will be more effective than land-based whale-watching in increasing whale-watchers knowledge and inciting positive behavioural changes. The boat-based whale-watching experience lends itself to a more a more structured and personal interpretive program than the land-based whale-watching experience in which visitors are typically widespread with little or no contact with a guide; and 3) to make recommendations to government agencies and to industry on the development of effective interpretation programs to meet visitor expectations, increase satisfaction levels and enhance conservation values.

8.3 METHODS

8.3.1 Boat-based whale-watchers

Boat-based whale-watchers were surveyed on six commercial whale-watching vessels operating out of Eden, Merimbula and Narooma on the far south coast of New South Wales during the humpback whales' southern migration. Surveys were conducted over a total of 90 days from late September to early November in 2002 , 2003 and 2005.

The survey was undertaken in three parts (Appendix 7). Part 1 'before seeing the whales' was completed by whale-watchers before boarding the boat, Part 2 'after seeing the whales' was completed on the return journey to port and Part 3 'follow-up' was completed six to eight months after completing Part 1 and Part 2 of the survey.

The researcher handed out Part 1 and Part 2 of the survey to passengers waiting to board the whale-watching vessel. Participants were given a clipboard containing both parts of the questionnaire and were given both written and verbal instructions to complete Part 1 before boarding the vessel and to complete Part 2 on their return trip. The researcher stayed onboard the vessel during the whale-watching trip and collected the questionnaires upon return to port.

Respondents surveyed in 2002 and 2003 were invited to participate in a follow-up survey (Part 3). If they agreed to participate then they were contacted either by post or via email six to eight months later. A return paid envelope was provided for those contacted by post. Those participating by email could complete the survey online and email it back to the researcher. One reminder was sent out four weeks after the follow-up survey was distributed.

All questionnaires contained both open and closed questions and some adjectival scale type questions. A major component of Part 1 and Part 2 of the questionnaires was designed to obtain information on whale-watchers' experience, satisfaction and expectations. These results have been presented in Chapter 6.

A total of 1037 Part 1 and Part 2 questionnaires were distributed and 1018 were returned, yielding a return rate of 98%. Of the respondents, 276 people agreed to participate in the follow-up survey, 257 questionnaires were successfully distributed and 130 were returned yielding a return rate for Part 3 of 51%. The follow-up return was 13% of the total response to Part 1 and Part 2.

8.3.2 Current education on whale-watching boats

Table 8.1 provides a description of the commercial whale-watching vessels involved in this study and the education they currently provide during their whale-watching cruises. Boats varied in passenger capacity from 12-75 and included three catamarans and three mono-hulled vessels. Most provided live commentary containing information on whale biology, migration patterns and population trends. There was very limited information given on whale conservation and very little on board education material provided such as brochures, books, videos, posters, photos and visual props. Two operators handed out information sheets to passengers. The information sheet handed out on board boat 1 was produced by the International Fund for Animal Welfare (IFAW) and included basic facts about humpback and southern right whales, information on whale migration patterns and the NSW whale-watching guidelines (Appendix 9). The information sheet handed out on board boat 5

was produced by the operators and contained information on whale behaviours to look out for (Appendix 10).

8.3.3 Educational brochure

An educational brochure on humpback whales (Appendix 11) was designed by the researcher and given to boat-based whale-watchers along with the questionnaires in the second season of the study. The brochure contained seven sections as follows:

1) Did You Know? - 22 interesting facts about humpback whales
2) Humpback Whale Migration – a description of migration patterns, including a diagram of migration routes of southern hemisphere humpback whale populations
3) Population Numbers – pre-whaling, post-whaling and current population estimates
4) Humpback Feeding and the Food Chain – a description of humpback whale feeding methods and a diagram of the Antarctic food chain
5) Current Threats – a list of threats facing humpback whales
6) Conservation Initiatives – current research and management initiatives as well as actions needed for the future management of humpback whales in Australia. NSW whale-watching guidelines including a diagram illustrating these guidelines
7) How You Can Help - 9 ways in which people can help with the conservation of humpback whales.

Table 8.1. Description of the commercial whale-watching vessels involved in this study and the education they provided during their whale-watching cruises.

	Boat 1	**Boat 2**	**Boat 3**	**Boat 4**	**Boat 5**	**Boat 6**
Boat Length (metres)	16	13	12	12	16	10
Boat type	Catamaran	Mono hull	Catamaran	Mono hull	Catamaran	Mono hull
Passenger Numbers	72	23	37	27	47	12
Crew (not including skipper)	2	1	2	2	2	1
Educational Material	**Boat 1**	**Boat 2**	**Boat 3**	**Boat 4**	**Boat 5**	**Boat 6**
Trained Guide	Sometimes [a]	No	Sometimes [a]	No	No	No
Live Commentary	Yes	No	Sometimes	Sometimes	Yes	No
Fact Sheets	Yes [b]	No	No	No	Yes [c]	No
Educational brochures	No	No	No	No	No	No
Videos	Sometimes	No	No	No	Sometimes	No
Books	No	No	No	No	Yes	No
Posters	Yes	No	No	No	Yes	No
Visual Props	Sometimes [d]	No	No	No	Sometimes [e]	No
Photos	No	No	No	No	Yes	No

Education Content	**Boat 1**	**Boat 2**	**Boat 3**	**Boat 4**	**Boat 5**	**Boat 6**
Whale Biology	Yes	Sometimes	Yes	Yes	Yes	Sometimes
Whale Migration Patterns	Yes	Sometimes	Yes	Yes	Yes	Sometimes
Whale Population Trends	Yes	No	Sometimes	Sometimes	Yes	Sometimes
Whale Conservation	Sometimes	No	No	No	No	Sometimes
Whaling History	No	No	No	No	Yes	Sometimes
Local History	No	No	No	No	Yes	No
Other Marine Life	No	No	Yes [f]	Yes [f]	Sometimes	No
Marine Environment	No	No	No	No	No	No
Marine Conservation	No	No	Sometimes [g]	Sometimes [g]	No	No

a= guides trained through NPWS discovery program
b = fact sheets produced by the operators on typical behaviours to look for whilst whale-watching
c= fact sheet produced by IFAW including basic facts about humpback and southern right whales (*Eubalaena australis*), information on whale migration and the NSW whale-watching guidelines.
d = crew show pictures of baleen and stomach contents of stranded whale
e = baleen
f = seals
g = crew talk about dangers of plastics bags in relation to seals

8.3.4 Land-based whale-watchers

Land-based whale-watchers were surveyed at Cape Solander over 33 days in June and July of 2002, 2003 and 2004 during the peak of the Humpback whales' northern migration past Sydney. Cape Solander is located approximately 15 km south of Sydney and is part of the South Headland at the entrance of Botany Bay.

While the before/after watching whales survey worked quite well on board whale-watching boats, where there is a structured setting and a captive audience, an initial 3-day trial in June 2002 found that two separate surveys did not work well at Cape Solander. Most people were inclined to fill in the before and after questionnaires together. To overcome this problem Part 1 and Part 2 questionnaires were combined and hence the survey was undertaken in two parts (not three as with the boat-based participants). Part 1 'whilst watching the whales' was completed at Cape Solander and Part 2 'follow-up' was completed 6 to 8 months after completing Part 1 of the survey (see Appendix 4 for copies of questionnaires).

Most of the Part 1 questionnaires were handed out at the ticket booth, at the entrance of the Botany Bay National Park where cars must stop to pay an entry fee to the park. In addition in 2003 and 2004 the researcher handed out questionnaires onboard a shuttle bus ferrying whale-watchers from the car park at Botany Bay National Park Discovery Centre to the viewing area at Cape Solander. There were 3 survey collection boxes for the questionnaires; they were located at Cape Solander, the Discovery Centre and near the exit of the park. Participants were also given the option of mailing the completed questionnaires to the researcher, although most people (99%) opted to return them to the boxes provided on the day of completion.

The distribution and collection of the follow-up surveys were conducted as described above for boat-based whale-watchers. Due to the time constraints of the project only those surveyed in 2002 and 2003 were invited to participate in the follow-up survey.

The questionnaires contained both open and closed questions and some adjective scale type questions. A major component of Part 1 of the questionnaires was

designed to obtain information on whale-watchers experience, satisfaction and expectations. These results have been presented in Chapter 6.

A total of 3500 questionnaires were distributed and 1569 returned, yielding a return rate of 45%. Of the respondents, 336 people agreed to participate in the follow-up survey, 322 follow-up surveys were successfully distributed, 178 returned their completed questionnaires yielding a return rate of 55% or 11% of Part 1 respondents.

Non-parametric analyses were performed on the data using Statistical Package for Social Sciences (SPSS for Windows V12.01, SPSS Inc., Chicago).

8.3.5 Whale-watching education at Cape Solander during the study

There was no formal education or interpretive panels relating to whales or whale-watching available at Cape Solander in 2002 (the first year of the study). A humpback whale fact sheet was occasionally handed out to visitors at the park entry. In 2002 the only information available on site was a white board providing updated information on the time of last whale sighting, number of sightings for the year to date and the number of sightings for the day.

In 2003 (prior to the second year of the study), the National Parks and Wildlife Service (NPWS) made a number of changes to the area in order to meet the demand of the increasing numbers of whale-watchers. A small wooden viewing platform was constructed above the rock platform. A large information sign was erected near the viewing platform. This information sign was designed by NPWS and IFAW and contained information on: common humpback whale behaviours and their distinguishing features; a map of their migration patterns; data from recent humpback whale counts at Cape Solander; whaling and the proposed South Pacific Whale Sanctuary; as well as some information on how people can help with the protection of whales in Australia.

NPWS introduced talks by Discovery Rangers on the viewing platform in 2003. Discovery Rangers are employed by the New South Wales Department of Environment and Climate Change and (DECC) to implement the NPWS Discovery Program; their goal

is to provide educational and recreational experiences to park visitors. The usual duration of these talks was 10-15 minutes and they were conducted roughly every half hour during the busy times of the day, typically between 10:00 and 16:00. These talks provided general information on the biology of the humpback whales, their migration patterns, distinguishing features and general behaviours and what to look for whilst whale-watching at Cape Solander.

In all years of the study a team of whale-watching volunteers was located at the viewing platform at Cape Solander conducting counts of the annual migration for the NPWS whale-monitoring program. These volunteers were accessible to the public and some whale-watchers asked them questions about whales and their migration. While most volunteers were quite knowledgeable about humpback whales and did their best to answer questions, they had not received any formal training on this matter. Also, in both years of this study some information on the local environment and local history as well as some photos of Cape Solander whale sightings were on display in the Botany Bay National Park Discovery Centre located approximately 2 km from Cape Solander.

8.4 RESULTS

8.4.1 Profiles

To check for any bias in the follow-up sample, profiles were compared between all Part 1 participants and the sub-set of follow-up participants. These were compared separately for boat-based and land-based whale-watchers. The profile variables included gender, age, level of education, occupation, whale knowledge, environmental rating (based on the frequency with which respondents performed specific environmentally friendly behaviours) and nature/wildlife interest rating (based on the frequency with which respondents visited wildlife and/or nature areas) See Chapter 6 & 7 for an explanation of the environmental rating and nature/wildlife interest rating. Pearson's Chi-square analysis showed no significant differences between the profiles of follow-up participants and the profile for all Part 1 participants.

8.4.2 Knowledge

Boat-based whale-watchers' were given the same set of multiple-choice questions to answer prior to their whale-watching trip (Part 1) and again after their whale-watching experience (Part 2). Their knowledge of whales increased from Part 1 to Part 2. Respondents were more likely to get all questions correct in Part 2 than in Part 1 (χ^2 = 320.14, df = 4, p <<0.05, *n* = 907 and 828 for Parts 1 and 2 respectively). Most (55%) boat-based participants increased their knowledge from before trip to after trip, 41% stayed the same and 4% decreased (Wilcoxon signed ranks test: z = -17.19, p<<0.05, *n* = 750). Respondents were more likely to improve their knowledge on approach distance (37%) and the reason humpback whales spend summer in Antarctica (30%) than on the name of a baby whale (5%) and the name of a group of whales (7%). Most respondents already knew the answers to the latter two questions (93% and 88%, respectively) prior to their whale-watching trip.

Boat- based follow-up respondents scored better in Part 2 of the survey than in their follow-up survey (Part 3) (χ^2 = 16.19, df = 4, p = 0.003, *n* = 113). Forty-one per cent knew less 6-8 months after their whale-watching trip than they did directly after their trip. Sixty-nine per cent of these people had increased their knowledge from Part 1 to Part 2 of the survey. This indicates that their acquired knowledge was only short term. Forty-five per cent scored the same and only 14% had improved their knowledge since their trip.

There was no significant difference in the number of questions whale-watchers answered correctly in Part 1 of their survey and 6-8 months after their whale-watching experience. The results of the Wilcoxon matched-pairs test indicated that 48% of land-based whale-watchers had answered the same number of questions correctly, 29% had answered fewer questions correctly, and 23% had answered more questions correctly 6-8 months after their whale-watching experience. For boat-based whale-watchers, the Wilcoxon signed-rank test showed that 43% had answered the same number of questions correctly prior to their whale-watching experience as they had 6-8 months after their whale-watching experience, 36% had increased their knowledge of whales and 20% showed a decrease in knowledge 6-8 months later. There was no

significant difference in the number of questions answered correctly by land-based whale-watching follow-up participants and by boat-based whale-watching follow-up participants 6-8 months after their whale-watching experience.

Land-based whale-watchers and boat-based whale-watchers were more likely to forget the answers to why the humpback whales spend their summer in Antarctica and the minimum distance a boat can approach a whale in NSW waters. Of these, 32% and 28% of all follow-up respondents (boat and land combined, n = 250) forgot the reason why humpback whales spend summer in Antarctic waters and the minimum approach distance to whales in NSW waters respectively whereas only 2% and 3 % forgot the name of a baby whale and of a group of whales respectively.

8.4.3 Behaviour

Nine per cent of boat-based whale-watchers in the follow-up group had been whale-watching on a boat since completing their survey and 15% of land-based whale-watchers had been whale-watching from a boat since completing their survey. Fifty per cent of these land-based whale-watching respondents had already been whale-watching on a boat before completing the first survey.

Forty-five per cent of land-based whale-watchers had been whale-watching from land since completing their survey and of these 37% had been 1 - 5 times and 8% have been more than 6 times. Forty-nine per cent of these respondents had not been whale-watching before filling in the survey. For boat-based whale-watchers, 33% had been whale-watching from land since completing the survey. Most of them (74%) had been whale-watching from land before they took their boat trip.

Eighty-seven per cent of land-based whale-watchers had recommended land-based whale-watching to someone and 91% of boat-based whale-watchers had recommended boat-based whale-watching to someone. This is consistent with how many stated they would recommend such behaviour in part 2 of their survey; namely, 87% of land-based and 92% of boat-based whale-watchers.

An ‘environmental rating’ was given to Part 1 respondents based on how frequently they conducted six environmentally friendly activities prior to their whale-

watching experience. The scale used to calculate the environmental rating was 'not at all' = 0 point, 'rarely' = 1 points, 'sometimes' = 2 points, 'frequently' = 3 points and 'always' = 4 (0 is the minimum and 24 is the maximum environmental rating a person can have). Only respondents who answered all six parts of this question with a score other than 'not applicable' were rated. There was no significant difference in environmental rating between land-based whale-watchers (*n* = 1057, median = 18, IQR = 5) and boat-based whale-watchers (*n* = 777, median = 17, IQR = 5) (Mann-Whitney U test: z = -1.68, p = 0.093).

For the majority of the six environmentally friendly activities the proportion of whale-watchers who stated they would increase such actions ranged from 40% to 50%, but was lower for 'donating to and/or be actively involved in helping an environmental group' (Table 8.2). Boat-based whale-watchers were more likely than land-based whale-watchers to state that they would donate to and/or be actively involved in helping an environmental group, chose household products that they think are better for the environment and use alternatives to plastic bags more frequently as a result of their whale-watching experience.

Comparisons of results from the on-site surveys with the results from the follow-up survey shows no notable change in environmentally friendly behaviours of whale-watchers from before their whale-watching experience to 6-8 months after their whale-watching experience (Table 8.3). Wilcoxon matched-pairs test shows that 45% decreased their environmental rating from Part 1 to follow-up, 37% increased and 18% stayed the same.

Table 8.4 shows the proportion of Part 1 and Part 2 respondents who stated they would do five activities directly related to whales or other wildlife more than they already do now as a result of their whale-watching experience. The proportion of boat-based whale-watchers who stated positively ranged from 31% to 70% and the proportion of land-based whale-watchers who stated they would ranged from 28% to 54%. Boat-based whale-watchers were more likely than land-based whale-watchers to state that they would pick up litter that may be harmful to wildlife (χ^2 = 28.36, df = 2, p<<0.001, *n* = 2206), tell people about whales generally (χ^2 = 62.85, df = 2 p<<0.001, *n* = 2206) and tell people about whale conservation (χ^2 = 49.36, p<<0.001, *n* = 2206)

more than they do now as a result of their experience. The number of respondents who stated they would do these activities more as a result of their whale-watching experience was highest for 'telling people about whales generally' and lowest for 'finding out more information on other wildlife' for both boat-based and land-based whale-watchers.

When asked 6-8 months later how often they had done these same activities, most either did these activities more than what they stated they would or were consistent with what they stated they would do as a result of their whale-watching experience (Table 8.4). The proportion of follow-up respondents doing these activities 6-8 months after their whale-watching experience was highest for 'picking up litter that may be harmful to wildlife' and 'telling people about whales generally' and was lowest for 'telling people about whale conservation'.

Table 8.2. The frequency of land-based and boat-based on-site (i.e. Part 1 or Part 2) respondents who said they would do environmentally friendly activities more than they already do now as a result of their whale-watching experience.

Activities	Whale-watching Platform	Percentage (%)	Chi Square test statistics			
			n	df	χ2	p
Donate to and/or be actively involved in helping an environmental group	Land	17	1310	2	11.70	0.003*
	Boat	23	861			
Recycle	Land	43	1314	2	4.44	0.109
	Boat	48	845			
Choose household products that you think are better for the environment	Land	41	1333	2	10.32	0.006*
	Boat	48	870			
Avoid putting things like oil, fat paint or turps down the sink or toilet	Land	47	1333	2	3.89	0.143
	Boat	50	876			
Avoid putting things like litter or detergents into gutters or storm water drains	Land	46	1330	2	1.61	0.447
	Boat	49	876			
Used alternatives to plastic bags when doing the grocery shopping	Land	40	1333	2	8.40	0.015*
	Boat	43	873			

*** significant at $p < 0.05$**

Table 8.3. The frequency with which follow-up respondents stated on their on-site survey (Part 1 or Part 2) that they currently performed six environmentally friendly activities and the frequency with which these same respondents stated they had performed these activities in the six to eight months since their on-site survey. On-site: Land *n* = between 158 and 160, Boat *n* = between 117 and 120. Follow Up: (six to eight months later) land *n* = between 165 and 177, Boat *n* = between 122 and 126.

Activities		**On-site survey response**					**Follow up survey response**				
	Survey	**N**	**R**	**S**	**F**	**A**	**N**	**R**	**S**	**F**	**A**
Donate to and/or be actively involved in helping an environmental group	Part 1	28	17	34	15	6	39	16*	27	9	7
	Follow Up	35	13	32	13	7	57	3	27	7	6
Recycle	Part 1	0	1	1	10	89	1	1	2	11	86
	Follow Up	1	0	2	22*	74	0	0	4	25*	71
Choose household products that you think are better for the environment	Part 1	3	3	18	36	40	2	3	16	42	38
	Follow Up	2	3	29	33	31	5	3	23	42	26
Avoid putting things like oil, fat paint or turps down the sink or toilet	Part 1	1	1	4	16	77	1	2	8	15	73
	Follow Up	1	2	3	18	75	2	0	6	17	75
Avoid putting things like litter or Detergents into gutters or storm water drains	Part 1	1	0	3	11	84	1	0	7	13	79
	Follow Up	1	1	3	11	84	3	0	2	14	80
Used alternatives to plastic bags when doing the grocery shopping	Part 1	14	16	37	17	16	12	18	29	20	22
	Follow Up	9	17	42	22	10	15	8	29	27	21

N = not at all, R = rarely, S = Sometimes, F = frequently, A = Always

* standardised residuals significant at $p < 0.05$

Table 8.4. The frequency with which Part 1 and Part 2 respondents stated that they would do five activities directly related to whales or other wildlife more than they already do now as a result of their whale-watching experience and the frequency with which follow up respondents stated they had performed these activities in the six to eight months since their on-site survey. On-site (i.e. Part 1 or Part 2): Land *n* = between 1311 and 1331, Boat *n* = between 858 and 875. Follow Up (six to eight months later): land *n* = between 169 and 177 , Boat *n* = between 119 and 127.

Activities	Whale- watching Platform	Before (Part 1 or Part 2) (%)	Six to eight months after (Follow Up) (%)
Pick up litter that may be harmful to wildlife	Land	49	94
	Boat	59*	95
Tell people about whales generally	Land	54	64
	Boat	70*	80*
Tell people about whale conservation	Land	33	38
	Boat	48*	46
Find out more information on whales	Land	46	40
	Boat	50	51
Find out more information of other wildlife	Land	28	70
	Boat	31	76

* significantly greater than land at $p < 0.05$.

In 2005 the on-site questionnaire for boat-based whale-watchers included additional questions that asked with what frequency they did these activities in the 12 months prior to their whale-watching experience. For analysis it is assumed that this sub-set of boat-based whale-watchers is representative of entire boat-based whale-watcher sample set. Although the proportion of respondents who stated that they 'always' picked up litter that may be harmful to wildlife was higher in the follow-up group, there was no significant differences between the follow-up group and the 2005 on-site group in the other frequency categories for this activity (Table 8.5). The boat-based whale-watching experience had more of an effect on the frequency with which whale-watchers told people about whales generally. Follow-up respondents were more likely to 'sometimes' or 'frequently' tell people about whales generally than the 2005 on-site group (Table 8.5)

Boat-based whale-watchers told people about whales generally more frequently than land-based whale-watchers ($\chi^2 = 13.43$, df = 4, $p = 0.009$, $n = 299$). There was no difference between how often boat-based and land-based whale-watchers performed the other four activities after their whale-watching experience (Table 8.4).

The median environmental rating for follow-up participants was 17 (n = 288, IQR = 4). High environmental raters were defined as those with a rating above this median, those with an environmental rating below the median were defined as low raters. Follow-up participants' responses from their on-site survey relating to behavioural intentions were crosstabulated with their environmental rating. There was no significant difference in the behavioural intentions of low environmental raters and high environmental raters with the exception that high environmental raters were more likely to say they will donate to and/or be actively involved in helping an environmental organisation as a result of their whale-watching experience (χ^2 = 7.84, df = 2, p = 0.020, n = 246).

8.4.4 Educational brochure

Three hundred and thirty-three boat-based whale-watchers were given the researcher's educational brochure with their survey. Forty-six per cent read part of the brochure on the trip and stated they would read the rest later, 40% did not read any of the brochure on the boat trip but stated they would read it later. Only 12% read the entire brochure during the cruise. Most people (77%) stated they would keep the brochure for future reference.

Fifty-four per cent stated they would show the brochure to others. Respondents were asked to tick the section of the brochure they thought was most helpful in improving their knowledge of whales. Because some respondents chose more than one response, the values sum to >100%. Most people found that the whale facts and information on whale migration most helpful (69% and 66%, respectively). Fifty-two per cent thought that the information on threats to whales was most helpful in improving their knowledge of whales and only 35% thought that section of the brochure on actions to assist in whale conservation most helpful. As a result of reading the entire brochure during the cruise, 69% (n = 36) of readers stated they understood the current threats facing whales, 31% stated they will try and do some of the things suggested on the brochure and 25% stated they will try and do all of them.

Table 8.5. The frequency with which boat-based whale-watchers, surveyed in 2005 only, stated that they currently performed five activities directly related to whales or other wildlife and the frequency that boat-based follow- up respondents stated that had performed these activities since their on-site survey. Numbers in tabulation refer to percentages.

Activities	Survey	Boat-based Whale-watchers					Chi Square test statistics		
		N	R	S	F	A	*n*	df	χ2
Pick up litter that may be harmful to wildlife	Part 1	4	5	30	32	30*	266	4	47.72
	Follow Up	4	1	37	45	13	126		
Tell people about whales generally	Part 1	20	35*	30	9	6	266	4	55.35
	Follow Up	13	7	53*	25*	2	125		
Tell people about whale conservation	Part 1	29	40*	18	9	4	265	4	54.02
	Follow Up	46*	9	39*	6	1	125		
Find out more information on whales	Part 1	18	32*	39	9	3	265	4	41.84
	Follow Up	41*	8	41	10	0	123		
Find out more information of other wildlife	Part 1	11	21*	38	26	5	267	4	29.505
	Follow Up	22*	2	44	30	3	122		

N = not at all, R = rarely, S = Sometimes, F = frequently, A = Always
* standardised residuals significant at $p < 0.05$

Sixty-two follow-up participants received a brochure during their whale-watching trip. Fifty-three of the boat-based follow-up participants stated in their on-site survey that they would read the brochure after the cruise. Six to eight months later, 60% of these respondents had read the entire brochure since their whale-watching trip, 38% had read parts of the brochure and only 2% had not read the brochure. This means that most of the 86% of boat-based whale-watchers who stated in their on-site survey that they would read the brochure after the trip would have done so. Based on the follow-up results about 72% (60% + 12% who read it entirely on the cruise) of people receiving the brochure would have read it in its entirety.

In the follow-up sample (n = 52), 65% kept the brochure, 14% had misplaced it, 17% disposed of it and 4% stated they did not receive a brochure. Forty-four per cent had shown the brochure to other people, 3% stated they intended to (n = 59). Fifty-four per cent showed the brochure to their children, 69% showed the brochure to adult family members, 42% showed the brochure to friends and colleagues and 15% showed it to other people including grandchildren, students and overseas visitors.

In a sample of 58 respondents, 53% stated they had done some of the things the brochure suggested, 40% stated they had not done anything the brochure suggested and 7% stated they had done all of the them.

People who received the brochure did not state they learnt any more about whales than those who did not receive the brochure (χ^2 = 0.023, df = 2, p = 0.989; No brochure: Mean = 2.4, SE = 0.073, n = 62; Brochure: Mean = 2.4, SE = 0.079, n = 55). People who received the brochure did not differ in whether they wanted more information on whales from those who had not received the brochure. (χ^2 = 0.052, df = 2, p = 0.819; No brochure: Mean = 1.4, SE = 0.065, n = 60; Brochure: Mean = 1.5, SE = 0.068, n = 55).

8.5 DISCUSSION

Whale-watching experiences can improve visitors' knowledge about whales (Orams 1996, Neil et al. 2003). However, neither of these studies tested knowledge retention with a follow-up survey. This study shows that this increase in knowledge is short lived. Boat-based whale-watchers were more knowledgeable about whales immediately after their whale-watching trip, but when tested 6-8 months later their knowledge level was back to where it was prior to the whale-watching experience. The information they were most likely to forget was that learnt during their whale-watching experience.

As identified in Chapters 5 & 6, there is a clear need for interpretation at Cape Solander and on board commercial whale-watching vessels on the south coast of NSW to be better developed. Although boat-based whale-watchers learnt more than land-based whale-watchers, many still stated that they learnt 'a little' or 'nothing' about whales and many expressed a desire to learn more. Lack of effective interpretation was identified as one of the factors contributing to low levels of satisfaction at Cape Solander (see Chapter 6). The introduction of ranger talks and the erection of information signs at the viewing platform at Cape Solander improved visitor knowledge (in the short term at least), but many whale-watchers missed this educational material as it was concentrated in a small area and it was away from the shuttle bus drop off and pick up point. A more structured program aimed at reaching all whale-watchers at Cape Solander is required. A better quality interpretation program on board commercial whale-watching vessels and at land-based whale-watching sites could improve the retention level of the information learned whilst whale-watching.

Orams (1996) emphasised the value of a structured education program but the findings of this study indicate that whale-watching experiences with a simple structure containing few conservation themes can still have a positive impact on whale-watchers' behaviour. Most boat-based whale-watchers conveyed general information about whales to others as result of their experience. Many people picked up litter that may be harmful to wildlife once they returned home. However, as there is no data on

the frequency with which land-based whale-watchers did these activities prior to their whale-watching experience caution needs to be taken when interpreting the results. The much higher proportion of people picking up litter six to eight months after watching the whales than what they stated they would as a result of their experience may mean that some of these people were going to do this activity regardless of their whale-watching experience. This seems to be the case for boat-based whale-watchers. A further limitation of this data is that it is based on self-reported behaviour and respondents may not have always given an accurate account of their behaviour.

Land-based and boat-based whale-watching also seemed to play a positive role in encouraging more people to get involved in whale-watching with most people recommending it to others. The experience did not generally encourage people to tell others about whale conservation and it seems to have done little to influence the rate at which whale-watching participants conducted environmentally friendly behaviours not directly related to whales or other wildlife in their daily lives. Likewise, the educational brochure that was handed out to boat-based whale-watchers during the second year of the study had no effect on the frequency with which whale-watchers conducted environmentally friendly behaviours after they returned home. Even so, the brochure succeeded in raising awareness of whale conservation with most people stating that after reading the brochure they understood the current threats facing whales. Furthermore, more than half of whale-watchers who read the brochure thought that the information on threats to whales was helpful in improving their knowledge of whales.

General attitudes are not always consistent with more specific attitudes and so they may or may not be consistent with specific behaviours (McCleery *et al*., 2006). For example, just because a group of people have a specific interest in the conservation of whales does not mean that this attitude extends to that of protection of the environment in general and vice versa. What is not clear yet is whether an improvement to the quality of interpretation offered to whale-watchers could change the general attitudes and in turn behaviours of participants. The conservation messages of the brochure were rarely reinforced in the information given to whale-watchers by the crew of the whale-watching vessels. If it had, then a greater effect on

the behaviours of whale-watchers who received the brochure may have been detected.

Most participants who received the brochure kept it and almost all of them read parts or all of it after the cruise. Forty-two per cent showed the brochure to others. Since whale-watching can increase awareness and appreciation of whales by getting people to talk to others about what they have learnt, a brochure can facilitate this process. The brochure is something that people can show to others and they can refer to it long after the initial whale-watching experience.

The boat-based experience, which provided more structured education, was more successful at promoting environmental appreciation than the land-based experience. Out of the two whale-watching groups, boat-based whale-watchers were more likely to say that their whale-watching experience would result in them becoming more environmentally friendly upon returning home. However the results from the follow-up survey indicate that their intentions did not follow through to action. There was no change in the rate at which they conducted the six environmentally friendly behaviours canvassed six months after their whale-watching experience. These findings are consistent with Beaumont (2001) who demonstrated that interpretation during an ecotourism experience that is predominantly knowledge-based and involves few sensory, message-based or participatory techniques (like the interpretive styles used here) can increase environmental knowledge and will be seen by participants to influence their conservation views and behavioural intentions. However, despite their intentions, no changes in environmentally friendly behaviours or attitudes were detected once they had returned to their daily lives. (Beaumont 2001) also found the least pro-environment group was the most likely to say that their visit had influenced their conservation views and behavioural intentions. However in this study there was no difference in the environmental attitudes between the two groups of whale-watchers (as indicated by their environmental rating).

Whilst the current interpretation material on board whale-watching vessels on the south coast of NSW and at Cape Solander contains elements of a good interpretation program the structure could be improved and the conservation objectives made clearer. In its current form the interpretation results in limited

improvement in knowledge and conservation behaviours of whale-watchers in the long term.

This raises the question as to whether this form of wildlife tourism is ecotourism. The requirements for education and a contribution to conservation distinguish ecotourism from other forms of nature-based tourism. Ecotourism must also be sustainable. Under Higginbottom's (2002) criteria for wildlife tourism to be sustainable it must not cause the wildlife population(s) to decline and if the population may be declining due to other causes, the activities should contribute positively to its conservation.

Humpback whales are a recovering population listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act* 1999 and the threats facing their recovery are many including pollution (noise, chemical and physical), deliberate hunting, harassment by commercial and recreational boats, collisions with large vessels and prey removal. Educating whale-watchers on minimising these threats is one step in ensuring that whale-watching is a sustainable form of wildlife tourism. Thus for whale-watching to be justified in an ecotourism context as being a positive activity for whales and their conservation, interpretation at these sites must be improved.

Successful interpretation in a wildlife tourism setting needs to bring about an intellectual and emotional connection between humans and the wildlife they are viewing. Seeing whales in their natural environment can be a powerful emotional experience but, as (Bierman 2002) noted, without a framework within which to support and expand on the experience its potential long term benefits might be lost. Ways to create successful interpretation have been documented (e.g. Ham 1992; Ham and Weiler 2001; Higginbottom 2002; Oliver 1992). It is important that tour guides at whale-watching sites are appropriately trained in how to best utilise education techniques in order to deliver quality interpretation. A successful interpretation program must have a clear set of objectives and be planned in such a way that these objectives are being met (Kimmel 1999, Higginbottom 2002).

Whale-watching on the south coast NSW and at Cape Solander has the opportunity to acquire more educational and conservational value. Interpretation

which promotes awareness of conservation values and ultimately leads to positive behavioural changes of whale-watchers is one step in ensuring the whale-watching industry in NSW is a sustainable form of wildlife tourism. Models for effective interpretation in marine tourism have been developed by Forestell and Kaufman (1990) and Orams (1995) and applied by Forestell (1993) to whale-watching in Hawai'i and by Orams (1996) to at the Tangalooma Dolphin Resort. It is recommended that Orams' (1995a) model for effective interpretation should be applied to whale-watching vessels on the south coast of NSW and at Cape Solander. Box 8.1 provides an example of how this model might be applied to whale-watching at the study sites using Orams' six steps of how to effectively apply the model. Following implementation, the interpretive program should be evaluated to determine whether it is meeting conservation objectives in both the short and long-term and contributing positively to the sustainability of the industry. This type of program could potentially be implemented across the entire NSW coast. As seen in Chapter 2, most whale-watching operations in NSW are utilising very few interpretative techniques on board their vessels. This would be best achieved by incorporating training for operators, crew members, guides and naturalists into a State, or even, National accreditation program for whale-watching operations.

Box 8.1. Application of Orams' (1995a) model for effective interpretation to whale-watching on the south coast of NSW and Cape Solander.

1) Establish specific objectives
e.g. 1) establish a connection between people and whales 2) create awareness of the current threats facing whales in Australian waters, 3) promote behavioural changes to reduce these threats.

2) Select specific themes, messages
e.g. 1) reduce marine pollution such as toxic chemicals, discarded fishing gear, plastics and other litter 2) promote responsible boating behaviour around whales.

3) Elect techniques (i.e. which media)
Talks by guides trained in the use of effective interpretation using
Posters
Brochures
Visual props
Interactive displays

4) Build on features of model: affective domain, cognitive dissonance, motivations to act, and opportunities to act

<u>Pre-contact</u>

Set expectations, let people know why the whales are here at this time and what sort of behaviours they can expect to observe. Give an orientation of the boat or the land-based viewing area and surrounds. Point out ways that they can be environmentally responsible during their whale-watching experience, e.g. dispose of cigarette butts in ashtrays and bins provided, limit the use of plastic and paper and dispose of it thoughtfully. In the case of boat-based whale-watchers, they should secure their rubbish in their bags and dispose of it once back on shore. Create how, what and when questions in peoples' minds get them thinking about whales and the threats facing them. Give people the opportunity to ask questions.

Delivery of this information

Boat - Talk by guide soon after boarding and whilst searching for whales. Information sheets containing behaviours to look for could be handed out. Posters and props such as discarded fishing nets could be used to demonstrate the threat that marine debris poses to whales. Baleen could be passed around to demonstrate that humpback whales are filter feeders. Discovery Centres (Merimbula, Narooma), the Eden Killer Whale Museum, Visitor Information Centres, and other booking centres at Eden, Merimbula and Narooma could serve as useful pre-contact areas as many whale-watchers are visiting these places (see Chapter 4). Interactive displays, posters, photos, props, brochures and information sheets could contain this pre-contact information.

Land - Talk by guide at the Discovery Centre or on board the shuttle bus ferrying visitors from the Discovery Centre car park to the Cape Solander viewing area. As per boat, information sheets, posters, and props could be used. The Discovery Centre at the Botany Bay National Park could also include interactive displays, posters, props designed to get people thinking about whales and the threats facing them.

Contact

Provide information relevant to what whale-watchers are observing. Guides should be available to answer the many questions likely to be generated at this phase. Need to create an emotional connection between whale-watchers and whales. Information should focus on topics such as birth, death, competition, conflict, sickness and social relationships. Because these are emotional areas for humans, interest and emotional response to other living things struggling with these same issues is likely (Orams, 1995a).

This emotional connection should be strong enough to provide the motivation for whale-watchers to want to act to help with the conservation of humpback whales. The information at this phase is best delivered by guides e.g. crew members, Discovery Rangers.

Post Contact

Create opportunities for whale-watchers to act. Information should focus on ways in which whale-watchers can make a difference to the conservation of humpback whales. Brochures could be handed out containing 1) a list contact details for environmental organisations which are involved in whale conservation 2) opportunities for assisting in whale research as a volunteer, 3) examples of environmentally friendly behaviours that they can implement on returning home and 4) examples of how to be responsible when boating. If they have not visited the centres in the pre contact phase, direct them to do so post contact. This will be a way of reinforcing what they have just learnt and experienced.

5) Design feedback testing

Use surveys for rigorous testing of knowledge, attitudes and behaviours to evaluate whether objectives are being met.

6) Utilize information to improve program

Use the information from the design feedback testing phase to make improvements to the program and retest. Repeat process until satisfied that the programs objectives are being met.

Implementing and maintaining good quality interpretation programs for whale-watching will be costly. To be successful it needs collaboration between all stakeholders as each stand to benefit. Funding for whale interpretation has to compete with funding for many other management requirements of conservation authorities (e.g. park management, feral animal control, conservation on private lands and pollution management). Ensuring that effective interpretation is available at whale-watching sites is the joint responsibility of NSW DECC (the primary management agency for the whale-watching industry in NSW waters), the Commonwealth government as some whale-watching occurs in Commonwealth waters, commercial whale-watching operators, and other stakeholders such as conservation groups and local tourism operators. Commercial operators should benefit from implementing interpretation programs by giving their customers a more satisfying experience. A satisfying experience will mean that visitors are likely to return and recommend the operator to others. If done well enough, the interpretive program can become an attraction in itself especially to school groups. Ultimately the aim of the interpretation program is to promote conservation and protection of whales. This is consistent with the operators' objectives to protect their wildlife attraction in order to ensure that their business is sustainable in the long term. Government agencies with the responsibility of managing the industry and the areas within which whale-watching occurs will also benefit from improvement to interpretation programs. Education can be used as a tool for management by increasing conservation awareness and allied attitudes and behaviours and can be a successful way to lessen inappropriate behaviour on site (Orams 1995a, Orams 1999, Meinhold 2003, Reynolds & Braithwaite 2001, Orams & Hill 1998, Ham & Weiler 2001, Higham et al. 2001).

Ensuring the whale-watching industry is conducted sustainably through the implementation of quality education programs is consistent with the objectives of the National Strategy for the Conservation of Australia's Biological Diversity (Department of the Environment, Sport and Territories, 1996). The Australian National Guidelines for Whale and Dolphin Watching in 2005 developed by Australian, State and Territory governments include the recommendation that operators provide an educational

component to their tours and encourage the training and accreditation of all people involved in the industry. They state that Australian Government State or Territory management authorities also have the responsibility to work with the whale-watching industry to develop and improve the content and quality of educational material provided to clients. Implementing a national interpretation program for whale-watching operations would mean consistency across all States.

It is important that State agencies, local organisations and stakeholders are involved in the development and implementation process as local issues are best addressed at local and State levels. Quality control needs to be maintained by DECC coordinating the distribution of information, based on up-to-date research. NGO's may also wish to collaborate. A partnership between NSW DECC and the International Fund for Animal Welfare (IFAW) is already established at Cape Solander and has seen the development of information signs at the area. Getting local communities, local businesses and local governments involved could prove beneficial, especially in developing interpretation at tourist information centres, booking centres and at the Eden Killer Whale Museum. Governments and stakeholders need to ensure that whale-watching in NSW is an ecotourism experience that minimises its negative impacts whilst maximising the benefits to whales. Better interpretation during whale-watching experiences will help achieve this.

CHAPTER 9: Research implications: a framework for management of whale-people interactions

9.1 ABSTRACT

Management of wildlife-human interactions in tourism is multi-faceted, requiring an understanding of the long-term biological impacts as well as the needs of tourists, industry and other stakeholders. Successful management for the sustainability of wildlife tourism is most likely to succeed under an adaptive management system. The benefits of this type of integrated and holistic approach are widely recognised but rarely adopted in the management of whale-watching. This thesis examined both the human and animal dimensions of whale-watching by incorporating both social and biological sciences and demonstrates the value of the application of multidisciplinary research to wildlife tourism management. Furthermore, this study examined the qualities of the wildlife tourism experience from different platforms – land and boat. These results have greater generality to wildlife tourism management as experiences from stationary or moving platforms are common; e.g. the African 'safari' experience from a vehicle or seated at a waterhole.

The primary aim of this chapter is to provide a framework for management of the New South Wales humpback whale-watching industry based on the findings of this research. This framework aims to maximise the benefits of whale-watching for tourists, industry and conservation while minimising the adverse effects on whales. This study has identified techniques for education, research and vessel management as three fundamental components of sustainable management strategies for the whale-watching industry. Mechanisms by which management can incorporate all three of these components are given. The wildlife viewing platform is a key element in tourist satisfaction and impacts on the wildlife under observation. Thus the principles underlying this framework have broader generality to wildlife tourism management whether on land or on the water.

9.2 INTRODUCTION

Sustainable management of the New South Wales (NSW) whale-watching industry which ensures conservation and protection of the species being viewed, as well as the ecosystem in which it occurs, is an objective of all stakeholders including: government agencies responsible for wildlife management; tourism operators and local communities who stand to benefit financially from ongoing whale-watching tourism; and tourists who want access to whale-watching experiences now and into the future.

The multi-dimensional nature of wildlife tourism requires that sustainable management of the industry is considered at a number of levels. According to Higginbottom (2002), tourism based on viewing free-ranging animals must meet the following criteria to be sustainable: 1) customers must be satisfied with their experiences; 2) operators must make sufficient profits; 3) the activities must not cause the wildlife population(s) to decline, or to become less viewable over time; and 4) if the population were declining due to other causes, the activities should contribute positively to its conservation. The value placed on each of the criteria varies between and within stakeholder groups and it is in these inconsistencies that conflict arises; e.g., operators are likely to object to strategies aimed at mitigating tourism impacts if they will also compromise customer satisfaction and/or the operator's ability to make sufficient profits.

Finding the balance between the needs of wildlife, tourists and industry is the key to successful wildlife tourism management. Research, which provides science on which to base management regimes, is an important step in the process of finding this balance. Wildlife tourism research must provide quantitative measures of the effects of wildlife tourism that can be monitored and provide insight into the perspectives and needs of industry, regional communities and tourists. Thus an understanding of the wildlife-human interactions must draw on research from both social and biological sciences. This type of integrated approach is the basis for adaptive management (Newsome *et al.* 2005) and its importance to marine mammal tourism has been documented by a number of authors (Waples 2003, Orams 1999, e.g. Berrow 2003,

Valentine & Birtles 2004). Adaptive management is a systematic and continuous process of improving management practices based on information learnt through research. Progress is made through testing mechanistic hypotheses and rejecting those that prove false.

It is a widely accepted approach for management of wildlife tourism (Newsome et al. 2005) and is recognised by the Secretariat of the Convention on Biological Diversity as "…an essential part of any management for sustainable use" (Secretariat of the Convention on Biological Diversity 2006 p. 123). Despite this recognition, such an approach is rarely used for managing whale-watching in Australia (Birtles et al. 2001, Valentine & Birtles 2004).

This thesis examined both the human and animal dimensions of the interface between whale-watching tourism and the whales. Three perspectives for management were considered in this study:

1) The biological conservation perspective – is the welfare of the whales being protected?

2) The whale-watchers' perspective – are their needs being satisfied?

3) The ecotourism perspective - does whale-watching educate and contribute to conservation?

This chapter summarises the key findings of this thesis and provides a management framework aimed at sustaining the whale-watching industry in NSW.

9.3 SUMMARY OF RESEARCH FINDINGS AND IMPLICATIONS FOR MANAGEMENT

9.3.1 Biological conservation perspective

This study is only the second to document the responses of the Antarctic Area V population to tour vessels and is the first to describe the responses of humpback whales during the southern end of their migration back to their feeding grounds. Responses of southward migrating humpback whales to vessels were highly variable. Whilst some pods (17%) showed obvious signs of horizontal avoidance (changes in speed of travel and orientation in relation to the vessel), others approached vessels initiating often brief interactions. Pods showing no obvious signs of avoidance still demonstrated changes in diving and surface activity when compared to pods in the absence of a vessel. When both approach and avoidance responses of pods were combined, 40% of the pods encountered altered their behaviour in an obvious way. Mother-calf pods were more sensitive to the presence of vessels than were non-calf pods, spending longer periods submerged when vessels were present. In addition, some surface behaviours such as breaches and pectoral slaps were suppressed in the presence of vessels. Whilst there were increases in dive time and the overall percentage of time spent submerged in the presence of vessels, there were no associated changes in respiration intervals.

Interruptions to behaviour through whale-initiated vessel interactions are not likely to be prolonged, as most approaches by pods were brief, lasting less than 10 minutes. However, these brief interruptions are potentially one of multiple encounters with whale-watching vessels. There are approximately 88 operators currently offering whale-watching in NSW along most of the NSW coastline (Chapter 2) and 43 operators reportedly conducting whale-watching throughout QLD in 2003 (IFAW 2004). Given the large size and extent of the whale-watching industry and that the migration route of this humpback whale population follows the east Australian coast closely (Dawbin 1966, Paterson et al. 2002), the chance that an individual whale will encounter several vessels during its migration is high. Thus, there is the potential

for a cumulative effect of frequent interruptions and changes to behavioural states. Further research into the frequency and duration of whale encounters during the entire migration will be required to assess the importance of this effect.

Seventy-six per cent of all responses (avoidance and approach) occurred within 20 minutes of the vessel moving within 1 km of the pod. Despite this, vessels stayed with a pod showing obvious signs of avoidance for an average of 52 minutes (and a maximum of 115 minutes). Operators generally remained at a minimum approach distance of 100 m from both non-calf and calf pods. Whales were more likely to avoid vessels that were not operating in accordance with the NSW whale-watching regulations and more likely to approach vessels that were operating in accordance with approach regulations. Given that customer satisfaction is fundamental to ensuring the long-term sustainability of the industry, and close viewing correlates with high visitor satisfaction, it is in the operators' best interests to comply with the existing NSW whale-watching regulations for approaching whale pods.

Although, exposure to commercial vessels in this study area at the time of the study was low, cumulative effects through increased exposure to vessel traffic could prove detrimental. In the absence of adequate long-term data, management of the humpback whale-watching industry should adopt a precautionary approach to ensure that the short-term impacts noted in this study do not translate to long-term implications at a population level.

To date, much of the focus of management strategies for the whale-watching industry in Australia has been on minimum approach distances and until now no scientific evidence was available to support these measures. Approach distances are an important part of regulating vessel activities around whales and this study provides justification for the 100 m approach limit. However, the shortcomings with relying too heavily on approach limits must be recognised. Even when vessels were operating in accordance with approach limits, whales were still showing behavioural changes when compared to pods in the absence of vessels. Other research has found that the behaviour of humpback whales is affected by vessels as far away as 4 km (Baker & Herman 1989). The biological effectiveness of the extended approach limits for calf pods is yet to be rigorously tested. Extending approach limits can be a contentious

issue. Operators are unlikely to comply if it compromises their ability to give their customers a 'close enough' view. Nor are they likely to comply if the approach limits are not enforced or if there is no scientific justification for their implementation. Experimental testing of approach distances is required to determine their effectiveness in mitigating the negative impacts of whale-watching and to determine what constitutes a 'close enough' view for whale-watchers.

Although harm to individuals or populations through whale-watching activities are yet to be identified for large whales, the growing body of evidence indicates that vessels can influence their short-term activity patterns and behaviours. Therefore we need to be mindful that cumulative interactions occurring along the migration routes have the potential for greater harm than may be evident at any one whale-watching site. Additional management strategies aimed at limiting whales' exposure to vessels and improving knowledge of the long-term implications of vessel interaction should be considered. Management strategies might include: introducing time limits for close observations of whales from boats, limiting the number of trips per day, limiting the hours of operation, regulating the number of whale-watching vessels through a licensing system, long-term monitoring of the population and developing educational programs for operators and recreational vessel users. Many of these recommendations are consistent with those given in the Australian National Guidelines for Whale and Dolphin Watching 2005 under 'Additional Management Considerations for Vessels' but have not been incorporated into state policy as yet.

As humpback whales are migratory and cross State and Commonwealth jurisdictions, management needs to be considered on a national level to address the potential cumulative impacts of whale-watching activities throughout the species migratory pathway and breeding areas. Licences which regulate the number of whale-watching vessels could be considered on a national scale to limit exposure during the entire migration. An operators' register would also assist with identification of the industry and its growth and help managers liaise with operators. A thorough assessment of the potential benefits, costs and risks associated with a licensing system for the NSW whale-watching industry including a review of the value of other State's

licensing system should be conducted to determine the feasibility of such a management strategy.

Many whale-watching regulations and guidelines around the world include time limits for encounters (Carlson 2004). The most common time limit is 30 minutes (UNEP MAP RAC/SPA 2003). There are no limits for whale-watching operations in Australia. A time limit of 30-40 minutes for each pod encountered in any given trip could be considered. This time limit is consistent with the average time vessels were spending with pods (i.e. 35 min), although observations close to 2 h did occur. Results of this study suggest that if a pod has not approached a vessel within this time frame, then it is unlikely to do so. Time limits will help prevent prolonged pursuit of non-responsive and avoiding pods. To further reduce exposure to traffic the practice of operators calling other vessels to the area should be discouraged. A quiet period for mother-calf pods should be considered when no mother-calf pods should be subjected to whale-watching activities by any vessels (including recreational vessels). This has been recommended for whale-watching in other parts of the world (UNEP MAP RAC/SPA 2003).

Feeding whales need to be given special consideration. In this study interruption to feeding was noted when the vessels approached feeding pods closer than 100 m. Commercial operators and recreational vessel users should be educated on how to manoeuvre vessels around feeding whales. Skippers need to be aware of where the prey patches are and make every attempt not to drive through and disturb these aggregations. Feeding whales often change their direction of travel, which makes it harder for the skipper to predict where they will next surface. It is recommended that operators remain at least 300 m from pods initially and observe the pod for several surfacings before moving to the appropriate approach limit. The skipper should wait for all members of the pod to surface before manoeuvring the vessel to ensure that they do not approach within 100 m of an individual whale.

Educating operators on best practices whilst watching whales should be incorporated in to an accreditation program for responsible whale-watching as discussed below (see Ecotourism Perspective). Providing operators with evidence that good vessel practices around whales led to better experiences and more satisfied

customers is an important step in promoting responsible whale-watching. The commercial operators who participated in this study were very experienced, having operated in the area for more than 16 years. Their experience should be utilised in developing education programs for new operators and recreational vessel users.

Workshops, which include participation from researchers, managers, operators and other members of the regional community, could be incorporated into management plans for the whale-watching industry. These workshops should provide the opportunity for researchers and management to explain current management strategies, propose future strategies and to present findings of research. Workshops of this nature are an important part of the stakeholder participation process (Newsome *et al.* 2005). Operator input into the practicalities of current and proposed recommendations is vital to the success and acceptance of management strategies. This approach has proved successful in the development and implementation of a Code of Practice for commercial swimming-with-dwarf minke whale operations in the Great Barrier Reef (Birtles *et al.* 2002a).

9.3.2 Whale-watchers' perspective

According to the survey of whale-watchers, the two most important features for a good whale-watching experience were consistent for both land- and boat-based whale-watchers and were: 'seeing whales in their natural environment' and 'seeing whales behaving naturally'. Seeing whales up close, having the opportunity to learn more about whales and having a chance to do something new, exciting and different were also considered important for a good whale-watching experience.

Land-based whale-watchers were only moderately satisfied with their experience whilst boat-based whale-watchers were highly satisfied. Some of the factors which influenced whale-watchers' satisfaction included the

- Degree to which expectations were met
- Proximity to whales
- Number of whales
- Whale behavioural displays

- Amount whale-watchers thought they had learnt.

Once these factors are understood, measures can be taken to enhance satisfaction, providing they are consistent with the objectives of sustainable tourism. Managing expectations and improving education should be used to help solve the inconsistencies between tourists' desires and animal welfare needs. For example, whilst the satisfaction of whale-watchers in this study correlated with proximity to whales, giving whale-watchers deliberate close up experiences (i.e. <100 m) is not compatible with animal welfare objectives of the sustainable management of whale-watching. In this instance an increased understanding of reasoning behind approach limits and attainment of realistic expectations through improved education for whale-watchers can be an indirect way of increasing satisfaction without compromising the welfare of the whales. If seeing whales behaving naturally is truly the desire of whale-watchers, then this shift in attitudes should be easily achieved. In addition there are some measures that can be taken to enhance viewing quality without physically imposing on the whales, such as advertising the location of land-based whale-watching sites and the provision of fixed binoculars and/or telescopes at these sites.

Land-based whale-watchers were found to have unrealistically high expectations of their whale-watching experience. Because expectations were found to affect the overall satisfaction levels of whale-watchers, it is expected that managing these expectations by helping people form realistic beliefs about their experience will ultimately lead to a more satisfied tourist. The promotion of realistic expectations should be incorporated into media releases and interviews; on websites; in promotional brochures or other handouts; in any information given prior to the whale-watching experience including telephone enquires; and in any information given when arriving at the whale-watching site or boarding the vessel, including interpretive displays and welcoming commentary. Information should include: what species of whale they should be looking for; how close they can expect to get to the whales; legislation or guidelines governing whale-watching in the area and the rationale behind these; why the whales are in the area; and what behaviours they are likely to see and not see, and why.

The constraints in managing expectations of wildlife tourists are outlined by Higginbottom (2004) and include the difficulty in striking a balance between promoting a tourism product whilst not unduly raising expectations. Most land-based whale-watching occurs in areas managed by the government agency responsible for sustainable management of whale-watching. Therefore managing land-based whale-watchers' expectations should not be constrained by commercial considerations.

Learning about whales was an important aspect of the land-based and boat-based whale-watching experience. Even though learning about whales was considered to be a valuable part of the whale-watching experience, most land-based whale-watchers said they learnt little or nothing about whales and just over half of respondents said they learnt only 'a little' about whales. More information about whales was requested by 44% and 45% of boat-based and land-based whale-watchers, respectively. Thirty-eight per cent of Cape Solander whale-watchers did not even know which type of whales they were watching. The number of boat-based whale-watchers able to correctly identify the whales was much higher. Ninety-three per cent of boat-based whale-watchers knew that they were watching humpback whales. Boat-based whale-watching is a lot more structured and therefore more conducive to a direct-guided experience. Providing effective interpretation at a land-based viewing area provides extra challenges. Nevertheless, it is important that land-based whale-watchers are given the same opportunity to learn about whales and the marine environment as those who go on a commercial whale-watching boat tour.

The value of education in wildlife tourism experiences may be three-fold: not only can it increase visitor satisfaction but it can also lead to a greater awareness about wildlife and its conservation (Orams 1996, Moscardo et al. 2001, Higham et al. 2001, Higginbottom 2002, Duffus & Dearden 1993, Higginbottom et al. 2001a, Lück 2003a, Kimmel 1999, Moscardo & Saltzer 2005, Orams 1995b, Reid 1999) and it has proved to be a valuable tool for management of inappropriate behaviours while watching wildlife (Meinhold 2003, Orams & Hill 1998). Whilst the current interpretative material provided during whale-watching experiences in NSW contains some elements of a good interpretation program, its structure requires improvement and it needs to better incorporate conservation themes. The quality of education

given to whale-watchers must be improved not only to enhance visitor satisfaction but also to satisfy the conservation objectives of sustainable tourism (see next heading).

9.3.3 Ecotourism perspective

By definition ecotourism must be sustainable, educate and contribute to conservation. There is, however, a great deal of debate regarding the validity of the concept of ecotourism. Critics of ecotourism see it as nothing more than a marketing gimmick dressed up under a more appealing 'green' label. (Wight 1993). There are legitimate concerns that the ecotourism label is being used too freely without any evidence to suggest that the activity is compatible with the surrounding environment or that it promotes conservation. Whether whale-watching in NSW in its current form incorporates ecotourism's general principles is an important question that needs to be asked for if the answer is 'no', then the sustainability and integrity of the industry will be compromised.

Many government and non-government organisations (NGOs) involved in the conservation of whales actively support and encourage commercial whale-watching (Corkeron 2006, Corkeron 2004). One of the four main arguments used by these organisations is that whale-watching promotes and induces conservation. The effectiveness of whale-watching to impact positively on biodiversity conservation is largely untested and has led to recent questioning of such sentiment (Corkeron 2004, see Corkeron 2006). This study is the first to assess the effectiveness of both boat-based and land-based whale-watching experiences in promoting a conservation ethic and provides further insight into this debate.

The results of this study revealed that whale-watching in NSW, in its current form, encouraged most people (70%) to talk about whales generally, and encouraged some (45%) to talk to others about whale conservation. It did little to influence the rate at which whale-watching participants conducted environmentally friendly behaviours upon their return home and there was limited addition to knowledge of whales in the long-term.

For whale-watching in NSW to be an ecotourism experience, its ability to impact positively on conservation needs to be improved. Interpretation, which

incorporates effective and cognitive learning processes, is the key in facilitating this. Management of wildlife tourism is often concerned with managing the negative impacts (Higginbottom *et al.* 2001a). Equal effort needs to be applied to maximising the positive contributions of wildlife tourism. The development of effective interpretation that promotes a conservation ethic and understanding of whales is an important step towards ensuring the sustainability of the whale-watching industry in NSW. Models for effective interpretation programs at whale-watching sites have been developed (Orams 1994, Forestell & Kaufman 1990, Forestell & Kaufman 1993, Orams 1996, Reid 1999) but are rarely used. Planned and structured interpretation programs based on these models should be considered.

Implementation would be best achieved by incorporating training for operators, crew members, guides and naturalists into a State, or even, national accreditation program for whale-watching operations. An internationally recognised ecotourism accreditation program 'EcoCertification' already exists in Australia (Ecotourism Australia, 2006). However sustainable management of whale-watching would be best served by developing a specific program aimed at certifying responsible whale-watching operations. One of the benefits of such a program would be consistent and accurate information for whale-watchers. As well as the provision of high quality interpretation, certification should also require the demonstration of best practices when watching whales (e.g. operators' knowledge of and adherence to current state and national whale-watching regulations and guidelines) and may also acknowledge operators' contributions to conservation and research. Promotion of the accreditation program, in a way that highlights its merits and certification criteria, is crucial. Raising awareness amongst tourists and creating a demand for responsible whale-watching tours will help achieve widespread adoption of the program.

It is the responsibility of all stakeholders to ensure that whale-watching in NSW can be accredited as an ecotourism experience that minimises its negative impacts whilst maximising the benefits to whales and tourists. Following implementation, the interpretive program should be evaluated to determine whether it is meeting conservation objectives in both the short and long-term, and contributing positively to the sustainability of the industry.

9.4 FUTURE RESEARCH NEEDS FOR THE MANAGEMENT OF THE NSW WHALE-WATCHING INDUSTRY

The long-term implications of the short-term behavioural responses noted in this study are unknown and will only be understood through further research. Ongoing research should be incorporated into the framework for management of whale-watching in NSW. Table 9.1 summarises the current knowledge gaps and the priorities for future research to inform management of the NSW whale-watching industry.

9.5 CHALLENGES FOR MANAGEMENT OF THE WHALE-WATCHING INDUSTRY

Managers of the whale-watching industry face many challenges. Whilst their primary objective is the conservation of cetaceans, the decisions they make have the potential to impact the lives and livelihoods of individuals, families and communities (Stevens *et al.* 1996). An account of the issues facing whale-watching managers in Australia was provided by Stevens *et al*. (1996) over a decade ago. These include the lack of long-term information on which to base management decisions, the need not to over-regulate and difficulties balancing the welfare and conservation needs of whales with the social and economic needs of industry and regional communities. These issues are still relevant today, highlighting the complexity of the problems and the difficulties of solving them.

Whales hold iconic value for many people and since the 'save the whales' movement of the 1970s have been used as the flagship species for environmental issues world-wide. Because of this, management of human-whale interactions is subject to close scrutiny by many sectors of the community. The diversity of the needs and motivations of interested parties means that it can be extremely difficult to establish appropriate management strategies on which all stakeholders agree, even after extensive public consultation.

Management decisions which are grounded in sound scientific research can help solve this issue, along with socio-economic and cultural considerations**.** Quantifying the effects of whale-watching on animals which have long life spans and

low fecundity requires long-term monitoring. These timeframes are difficult for managers dealing with an expanding industry and public pressure for action. The risk of waiting for adequate long term data is that by the time effects are detected it may be too late to do anything about them. As a consequence, scientists rely on using short-term responses to predict long-term effects. Justifying these predictions for operators and managers understandably can be a difficult. Adding to the difficulties is that the short-term changes in behaviour are not always obvious to operators during their interactions with whales. In this study many of the behavioural changes were only detected after comparing the behaviour of whales around vessels to a data set in which vessels were absent. A major challenge for management is that it be forward looking and predictive rather than reacting to issues after they appear (Stevens *et al*. 1996).

Managing the positive effects of whale-watching is less challenging, but is rarely a priority. Management agencies should take on a pro-active role in ensuring that whale-watching is delivering quality education and promoting a conservation ethic amongst participants. Providing support to whale-watching operators through hosting interpretation training workshops is one way of doing this. Professional interpretation workshops can also be used as a training tool for DECC Discovery Ranger staff employed to give talks at some of the popular land-based whale-watching sites. These will strengthen relationships with whale-watching operators and in turn help with acceptance of industry codes of practice and regulatory management strategies.

Table 9.1. Current knowledge gaps and priorities for future research to inform management of the NSW whale-watching industry.

Knowledge gaps	Research required	Expected outcomes
Long-term implications of exposure to vessels are unknown.	• Long-term monitoring of the distribution and abundance of the east coast humpback whale population, especially in areas were whale-watching occurs.	• Identify any changes in abundance and/or distribution of humpback whale population if they occur.
The importance of southern NSW waters in providing nutritional resources for migrating whales is unknown	• Quantify the proportion of the population feeding in this area as well as the sex and age class of feeding whales • Determine prey type, prey density and seasonal variations in prey availability and how this relates to the migration pathways of humpback whales.	• Identify the relationship between prey availability and whale abundance • Will help interpret any future shifts in whale distribution (e.g. whether changes in whale distribution are related to prey distribution or to the avoidance of vessels).
Resting whales were rarely seen in this study. It is not known if this was a sightability factor (i.e. resting whales are harder to spot and therefore are not being picked up by whale-watching vessels) or if whales are not resting in this area.	• Aerial observations along the east coast of Australia to identify resting areas • Quantify key criteria for suitable resting habitat for humpback whales	• Identify critical resting habitats for humpback whales.
Whale-watching can cause changes in the frequency of surface behaviours for humpback whales but the function of these behaviours and the importance for different sex and age classes is unknown.	• Genetic biopsy studies in conjuction with behavioural observations	• Provide a better understanding of the function of surface behaviours for various age and sex classes and in turn will help make predictions on the effects of whale-watching
The energy expenditure of humpback whales when avoiding vessel-interactions is unknown	• Experimental testing of diving and energy expenditure of migrating humpback whales using Time Depth Recorders (TDRs).	• Provide a better understanding of the energetic cost associated with vessel interactions which will help make predictions of the long-term consequences of whale-watching on migrating humpback whale populations.

Knowledge gaps	Research required	Expected outcomes
The biological effectiveness of regulatory approach conditions needs further testing. No experimental approaches were used in this study.	• Testing of humpback whales responses to experimental approaches i.e. various distances, speeds and angles of approach.	• Determine whether current regulatory approach conditions are effective in mitigating the effects of whales watching.
The attitudes of whale-watchers to various approach distances are unknown.	• Survey of whale-watchers satisfaction levels at various vessel-whale distances.	• Identify observation distances which provide for a satisfactory whale-watching experience.
The effects of recreational vessels on humpback whales were not considered in this study.	• Identify areas where whale interactions with recreational vessel are high. • Quantify whales' responses to recreational vessels. • Profile recreational vessel users including evaluating their knowledge of and adherence to guidelines and regulations	• Identify the impacts of recreational vessel interactions with humpback whales • Help to develop future management strategies to mitigate the impacts (if any) of recreational vessel interactions.

9.6 IMPORTANCE OF SITE SPECIFIC INFORMATION

It is important that management systems for nature-based wildlife tourism are adaptive and are based on sound scientific research. Information from wildlife tourism research around the world tells us that impacts from tourist activities vary both between and within species. The type and severity of effects may be dependent on a variety of factors including species; age; gender; habitat use (e.g. breeding, migrating, resting); level of previous exposure to disturbance; reproductive state; and individual fitness. The attitudes and needs of stakeholders are also likely to vary between geographical areas. It is important, then, that site specific information is gathered when designing an effective management strategy for a particular nature-based wildlife tourism scenario. The consequences of short-term behavioural changes may vary depending on the requirements of the species at a particular site and at a particular time. Thus findings from human-wildlife interaction studies need to be put into the context of the behavioural ecology of the species. For example, Williams *et al. (*2006) found that vessel interactions reduced the foraging time of northern resident killer whales in Johnstone Strait, Canada. They concluded that the energetic consequences of reducing energy acquisition had the potential to be four to six times as great as the cost of avoidance behaviour for this species. The implications of these findings were that the establishment of no-boat zones in important foraging areas would provide far greater conservation benefits for this population than other restrictions would. The unsuccessful attempt to protect the West Indian manatee in Florida from vessel collisions is a good example of how the effectiveness of management strategies can vary depending on the biology of the target species. In spite of years of speed regulations, designed to slow down boats passing through manatee habitats, the number of mortalities and non-lethal collisions continued to increase. Long term acoustic studies revealed that the dominant low frequency sounds of boats fall below the manatees audible range and that those sounds do not transmit well in shallow water (Gerstein *et al.* 2005). Furthermore the ambient conditions of the manatees' habitat mask the sound of quieter vessels. Unlike dolphins, which use sonar to navigate and detect objects, manatees are passive

listeners. Slow speed in turbid waters, with low visibility, actually exacerbated the risks of collision (Gerstein *et al.* 2005). Not only were slow boats inaudible but slow travel times meant an increased time spent in manatee habitat and thus increased opportunities for collisions. A more appropriate management tool for this species in this location was a highly directional acoustical warning device designed to exploit the manatees best hearing abilities and alert them of approaching boats (Gerstein et al. 2005).

Management strategies which are able to adapt as the activity evolves and as new scientific information emerges is the key to successful management of sustainable wildlife tourism.

9.7.1 Adaptive management system

The findings of this study have wider implications than just to inform the management of the whale-watching industry. This study has highlighted the importance of understanding the biological implications of wildlife tourism on the focal species as well as considering the needs and values of the tourists themselves. Whale-watching is an aquatic flagship and thus building a successful model for the sustainable management of whale-watching will benefit the wildlife tourism industry as a whole. General principles have emerged from this study which have relevance to other forms of wildlife tourism. For example, (1) enhancing visitor satisfaction through promoting realistic expectations of the wildlife-viewing experience is likely to be important whether it be watching whales from the coast or viewing wildlife at an inland waterhole. (2) Understanding and creating an awareness of the benefits of complying with management strategies for the protection of the species visitors have come to watch is an important part of any sustainable management framework for wildlife-tourism. (3) The development of effective interpretation that promotes a conservation ethic and understanding of the focal species is imperative for all nature-based wildlife tourism.

There are five steps in the development and implementation of successful management strategies for ongoing management of sustainable tourism (Figure 9.1). This system uses an adaptive management approach (see Newsome *et al.* 2005) and hence is a repeated process requiring ongoing monitoring and improvement of knowledge through long-term research and testing of management recommendations. The five components of this system are outlined in more detail below.

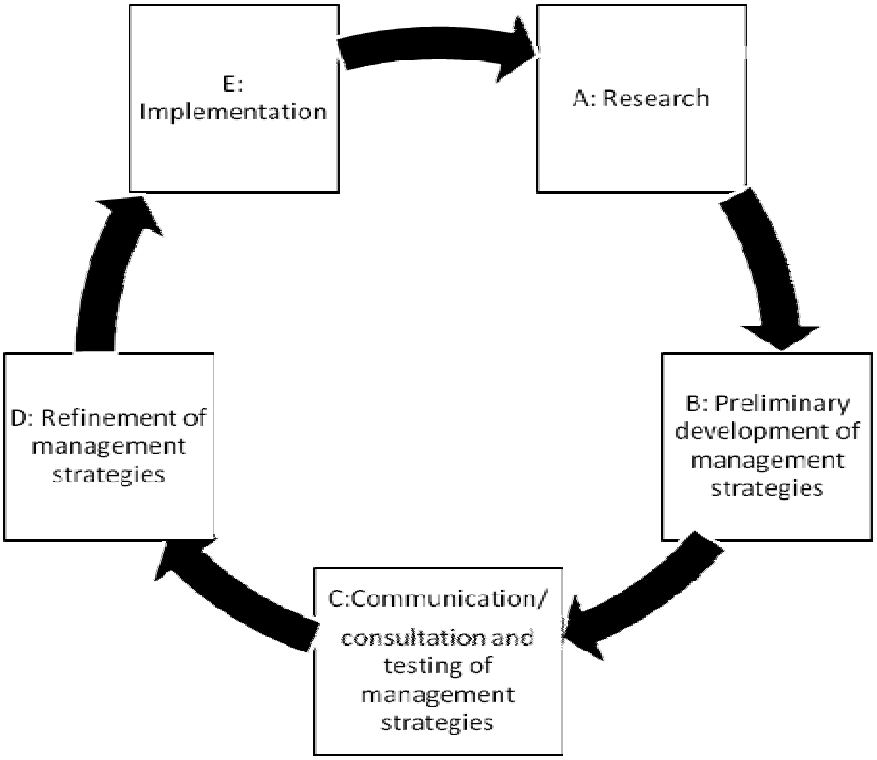

Figure 9.1. The five steps in the development and implementation of successful management strategies for ongoing management of sustainable tourism.

A: Research

Objectives of research should be to:

- Identify threats to the conservation objectives of sustainable tourism and required mitigation.
- Understand the needs, values and attitudes of stakeholders and identify the inconsistencies that cause conflict.

- Evaluate current management strategies to ensure objectives are being met.

B: Preliminary development of management strategies

Management agencies should develop strategies based on findings from phase A which should involve consultation with researchers.

C: Communication between stakeholders and testing of management recommendations

This phase should include participation of all stakeholders including researchers, managers, operators and NGOs. It should be used to:

- Present research findings and proposed management strategies
- Receive input from stakeholders and identify their needs
- Test management strategies
- Establish priorities for sustainable management.

D: Refinement of management strategies

Should be based on A and C.

E: Implementation

The cycle is repeated at periodic intervals.

Sustainable tourism management should not cease at the implementation stage. Evaluation is a key characteristic of adaptive management. Ensuring that objectives of sustainable tourism are being met through a scientific, social and biological monitoring program (i.e. step A) is crucial to the success of sustainable tourism.

9.7.2 Management strategies for the humpback whale-watching industry

This project has identified three fundamental components to be incorporated into the sustainable management strategy for the humpback whale-watching industry:

1) Education

Quality education during whale-watching experiences can be beneficial for whale-watchers, operators, managers and conservation of whales. The provision of effective interpretation programs can help maximise the positive impacts of whale-watching through raising awareness of whales and their conservation, and can also help in the management of the negative impacts of wildlife tourism and manage expectations so that there is less pressure on whales for lengthy and 'close up' experiences. Education for operators on the benefits of good vessel practices around whales and the needs and expectations of whale-watchers is important in encouraging responsible whale-watching practices. Community education programs could also be used to manage expectations prior to whale-watching experiences.

2) Vessel management techniques

Strategies, including the management of vessel behaviour and density around whale pods as well as accreditation opportunities for operators who demonstrate good vessel practices are recommended to minimise any negative impacts of whale-watching.

3) Research

Science to underpin regulatory and other management strategies, and for educational strategies is required to ensure all four components of sustainable wildlife tourism are being met.

To date management of the NSW humpback whale-watching industry has focused only on vessel management techniques. Recommendations based on the results of this research, include education, vessel management techniques and research strategies (Table 9.2). Their intent is to provide a starting point for the development of a management strategy which management agencies in collaboration with industry should refine as they strive for sustainable management of the whale-watching industry.

Lack of adequate funding for research, regulation and monitoring is the biggest factor hindering the adoption of such a complete integrated approach for management of the whale-watching industry. Greater collaborative financial commitment from all stakeholders, especially government and industry, is needed.

This project has helped begin the process for the development of sustainable management of the NSW humpback whale-watching industry. It has provided information for management strategies for whales that can be refined as more knowledge comes to hand to and ensure the continued protection of the humpback whale population

Table 9.2. Recommendations for management of whale-watching based on the findings of this study

Findings	Strategies	Expected outcomes
Short-term behavioural changes detected for whales in the presence of vessels including: Longer periods submerged (especially mother-calf pods). Some surface behaviours were less frequent in the presence of vessels. Behavioural changes around vessels are not always obvious.	• Set time limits for encounters (e.g. 30-40 minutes). • Discourage the practice of operators calling other vessels to the pod. • Establish no-approach times for mothers and calves (e.g. afternoons). • Recommend vessels sit at a conservative distance (e.g. 300 m) and observe whales for several surfacings before moving in to 100 m approach limit. • Conduct an assessment of the effectiveness of a licensing system for the NSW whale-watching industry • Enforce regulations through increased presence of NPWS staff on water. • Develop educational programs for operators and recreational vessel users with opportunities for accreditation of commercial operations demonstrating responsible whale-watching.	• Decrease whales' exposure to vessels along their entire migration. • Mitigate the possible long-term effects of cumulative exposure to vessels. • Increased compliance with regulations. • Increased understanding of regulations and the rationale behind them. • Allow operators to identify the initial behaviour of whales and to better detect any changes in behaviour when in close proximity.
Long-term implications of exposure to vessels are unknown.	• Further research required as per research priorities outlined in this chapter..	• Fill in knowledge gaps to assist the sustainable management of whale-watching into the future.

Feeding whales disrupted by vessels approaching <100 m. Feeding whales disrupted when more than one vessel present. Feeding whales change direction rapidly and surfacings can be hard to predict.	• Set limit of one vessel within 300 m of feeding whales • Discourage vessels driving through bait-fish and krill patches when near feeding whales. • Discourage the manoeuvring of vessels around feeding whales unless all members of the pod have been sighted at the surface >100 m from vessel.	• Limit interruptions to time pods forage.
Satisfaction level of boat-based whale-watchers is high; Satisfaction level of land-based whale-watchers is moderate. Whale-watchers' satisfaction is dependent on the degree to which expectations are met, the amount learnt, the proximity to whales, the number of whales and the whales' behavioural displays.	• Promote realistic expectations • Improve the quality of education offered during whale-watching experiences • Improve viewing quality at land-based sites.	• Increased satisfaction of whale-watchers. • Attainment of realistic expectations for whale-watchers. • Increased understanding of management measures such as approach distances.
Education lacks structure and provides few conservation messages. Whale-watching in NSW has limited impact on whale-watchers' behaviours after their experience and there is limited addition to their knowledge of whales.	• Introduce quality interpretive programs for whale-watching based on developed models which have clear conservation objectives. • Provide training for operators, crew, and guides. • Introduce accreditation programs for whale-watching operations which include the provision of quality education programs • Evaluate and improve (if necessary) interpretive programs to ensure conservation objectives are being met.	• Increased whale-watchers' awareness of the threats facing whales and the marine ecosystem in general. • Increased contribution to conservation and protection of whales, the marine ecosystem and the environment in general. • Whale-watching operations to be accredited as an ecotourism experiences.

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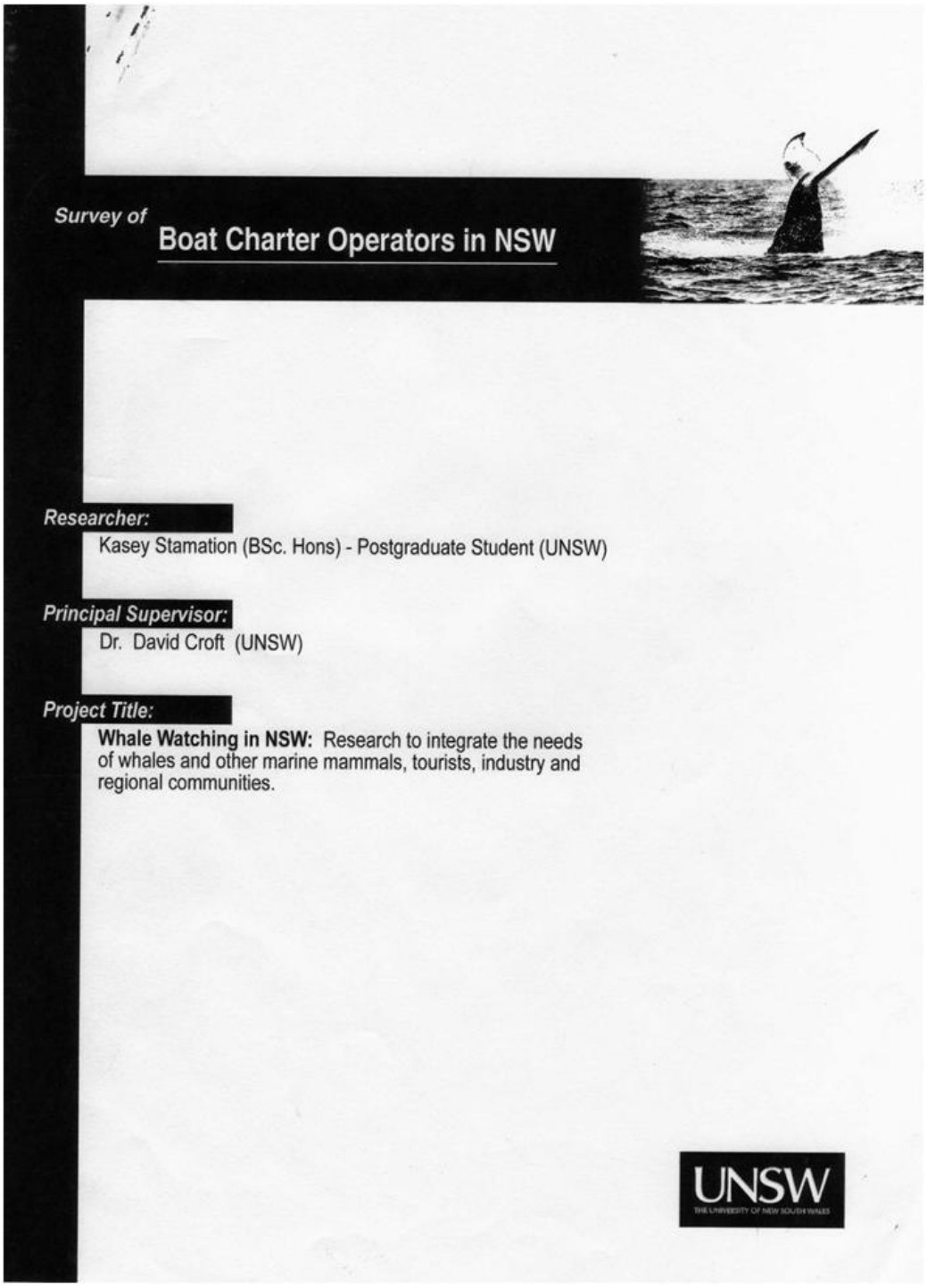
APPENDICES

Appendix 1: NSW whale-watching operator questionnaire



Survey of

Boat Charter Operators in NSW

Researcher:

Kasey Stamation (BSc. Hons) - Postgraduate Student (UNSW)

Principal Supervisor:

Dr. David Croft (UNSW)

Project Title:

Whale Watching in NSW: Research to integrate the needs of whales and other marine mammals, tourists, industry and regional communities.

UNSW

THE UNIVERSITY OF NEW SOUTH WALES

THE UNIVERSITY OF
NEW SOUTH WALES

SCHOOL OF BIOLOGICAL, EARTH AND
ENVIRONMENTAL SCIENCES

SUBJECT INFORMATION STATEMENT

What is the purpose of this survey?
This research is being conducted by Kasey Stamation, a PhD candidate in the School of Biological, Earth & Environmental Sciences at the University of NSW in Sydney. I am interested in learning about the attitudes and actions of tour operators, whale watchers, regulatory and management agencies and local communities in the management of whale watching. I would also like to investigate the effectiveness of using interpretive material as an educational tool for wildlife conservation. I will apply this knowledge to:
1) better understanding of whale-people Interactions that can be used for the future monitoring of the whale watching Industry
2) the development of better educational and interpretive material for whale watchers; and
3) the improvement of understanding about wildlife conservation in the community.

Why have you been selected?
You are invited to participate in a study of whale watching in NSW. You were selected as a potential participant in this study because you run a charter business, which operates in Southern NSW (Narooma - Eden) during the whale - watching season.

What does the survey involve?
The questionnaire should take about 10 minutes to complete. It contains tick box questions as well as some short answer questions. Upon completing the survey, please place it in the pre-paid envelope provided.

Please note that this is a research project and as such its conclusions are to be revealed by appropriate analysis. Therefore we cannot and do not guarantee or promise that you will personally receive any benefits from this study.

Confidentiality and disclosure of information
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or except as required by law. If you give us your permission by participating in this survey, we plan to publish the results in scientific journals and in reports for government agencies and industry. Results will also be documented in my PhD thesis. In any publication, information will be provided in such a way that you cannot be identified.

Complaints may be directed to the Ethics Secretariat, University of New South Wales, SYDNEY 2052 AUSTRALIA (phone 9385 4234, fax 9385 6648, email ethics.sec@unsw.edu.au).

Your consent
Your decision whether or not to participate will not prejudice your future relations with the University of New South Wales. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.

Want to know more?
If you have any additional questions please contact the project supervisor:

Dr. David Croft
University of New South Wales
School of Biological Earth and Environmental Sciences
UNSW Sydney 2052
Ph: (08) 80913809 (Fowlers Gap Research Station)

Researcher: Kasey Stamation (BSc. Hons) - Postgraduate Student (UNSW)

Principal Supervisor: Dr. David Croft (UNSW)

1) Please give the following details of the boat(s) you operate commercially...

a) Boat 1

Boat Type _____

Boat Size (please specify m or ft) _____

Engine(s) Type _____

No.of people licensed to carry _____

b) Boat 2

Boat Type _____

Boat Size (please specify m or ft) _____

Engine(s) Type _____

No.of people licensed to carry _____

c) Boat 3

Boat Type _____

Boat Size (please specify m or ft) _____

Engine(s) Type _____

No.of people licensed to carry _____

d) Boat 4

Boat Type _____

Boat Size (please specify m or ft) _____

Engine(s) Type _____

No.of people licensed to carry _____

2) What is the MAIN purpose you use your boat(s) for?

- ☐ Recreational Fishing
- ☐ Recreational Diving
- ☐ Whale Watching Charter
- ☐ Professional Fishing
- ☐ Professional Diving
- ☐ Dolphin/Seal Watching Charter
- ☐ Fishing Charter
- ☐ Diving Charter
- ☐ Sailing
- ☐ Other (please specify) _____

3a) What year did you start operating your Boat Charter business? _____

b) What year did you start running whale watching cruises (if applicable)? _____

4) Which of the following best describes your business?

- ☐ Dedicated whale watching operation (in season)
- ☐ Run whale watching opportunistically (e.g fishing or diving charter which takes people out to watch whales occasionally)
- ☐ Other (please specify) _____

5) Where do you take your boat(s) out?

- ☐ NSW waters only (<3 nautical miles offshore)
- ☐ Mainly commonweath waters (>3 nautical miles offshore)
- ☐ Both NSW and Commonwealth waters
- ☐ Other (please specify)

6a) When do you commonly encounter whales in your area?

- ☐ Mainly during the whales' northern Migration (i.e May - August)
- ☐ Mainly during the whales' southern Migration (i.e Sept - Nov)
- ☐ During both the whales' Northern and Southern Migration (ie May - Nov)

b) How many days were you on the water off the NSW during this time (your local whale watching season) in 2003?

_____

c) On how many of these days were you on the water specifically to go whale watching?

_____

d) What types of whales did you see during this time (your local whale watching season)?

- ☐ Humpback
- ☐ Southern right
- ☐ Killer (Orcas)
- ☐ Blue
- ☐ Brydes
- ☐ Minke
- ☐ Unable to identify
- ☐ Other (please specify)

_____

e) How many mother/calf humpback whale pairs did you encounter during this period?

☐ 0 ☐ 1-5 ☐ 6-10 ☐ 11-20 ☐ More than 20

7) How would you rate your knowledge of the current NSW regulations for whale watching?

☐ Expert ☐ Good ☐ Moderate ☐ Poor ☐ Not at all

8) How would you rate your knowledge of the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines for cetacean observation?

☐ Expert ☐ Good ☐ Moderate ☐ Poor ☐ Not at all

9) What sort of educational material (if any) do you provide your whale whale watching visitors?

- ☐ None
- ☐ Fact Sheets
- ☐ Live commentary
- ☐ On board video
- ☐ On board books
- ☐ Posters
- ☐ Photos
- ☐ Other (please specify) _____

10) Does the material include information on the following?

- ☐ Whale biology
- ☐ Whale conservation
- ☐ Other local wildlife
- ☐ Marine environment
- ☐ Marine conservation
- ☐ Local history
- ☐ Other (please specify) _____

11a) Does your business make any of the following contributions to conservation of whales?

	Yes	No
Assist with research	☐	☐
Donate to conservation organisations	☐	☐
Fund research projects	☐	☐
Educate whale watchers on conservation issues	☐	☐

b) If you answered 'no' to any of the above, please select one of the reasons against making that type of contribution.

	cost too much	takes up too much time	dont see any benefit to business	haven't thought about it
Assist with research	☐	☐	☐	☐
Donate to conservation organisations	☐	☐	☐	☐
Fund research projects	☐	☐	☐	☐
Educate whale watchers on conservation issues	☐	☐	☐	☐

12) Would making contributions to conservation increase your business by attracting additional and/or higher paying visitors?

O 1	O 2	O 3	O 4	O 5
Strongly agree	Agree	Neutral	Disagree	Strongly Disagree

13) Would market-based incentives such as accreditation programs that recognise and promote best practice ecotourism increase your business by attracting additional and/or higher paying visitors

O 1	O 2	O 3	O 4	O 5
Strongly agree	Agree	Neutral	Disagree	Strongly Disagree

14a) Does education during a whale watching cruise causes the whale watcher to incorporate more environmentally friendly behaviours into their daily lives?

O 1	O 2	O 3	O 4	O 5
Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**

b) If you agree, how long do you think the raised awareness lasts?

☐ Days ☐ Weeks ☐ Months ☐ Years

15) What do you see as the MOST positive effect of whale watching on each of the following?

Whale watching industry _____

Regional communites _____

Whale watchers _____

Whales _____

You Personally _____

16) What do you see as the MOST negative effect of whale watching on each of the following?

Whale watching industry _____

Regional communites _____

Whale watchers _____

Whales _____

You Personally _____

17) Please list any recommendations you may have to improve current management practices/regulations.

18) Any additional comments

Thank you for taking the time to participate in this survey!

Appendix 2: NSW National Parks and Wildlife Amendment (Marine Mammals) Regulation 2006

New South Wales

National Parks and Wildlife Amendment (Marine Mammals) Regulation 2006

under the

National Parks and Wildlife Act 1974

Her Excellency the Governor, with the advice of the Executive Council, has made the following Regulation under the *National Parks and Wildlife Act 1974*.

BOB DEBUS, M.P.,
Minister for the Environment

Explanatory note

The object of this Regulation is to protect and conserve certain marine mammals of the orders of Cetacea (whales, dolphins and porpoises), Sirenia (dugongs) and Pinnipedia (seals and sea-lions) by prescribing the distances for approaching such marine mammals and regulating various other actions taken in respect of them. The Regulation also provides for the issue of penalty notices in respect of offences under section 112G of the *National Parks and Wildlife Act 1974* and offences created by the Regulation.

This Regulation is made under the *National Parks and Wildlife Act 1974*, including sections 112G, 156 and 160 and section 154 (the general regulation-making power), in particular section 154 (g).

s04-302-19.p02 Page 1

National Parks and Wildlife Amendment (Marine Mammals) Regulation 2006

under the

National Parks and Wildlife Act 1974

1 Name of Regulation

This Regulation is the *National Parks and Wildlife Amendment (Marine Mammals) Regulation 2006*.

2 Amendment of National Parks and Wildlife Regulation 2002

The *National Parks and Wildlife Regulation 2002* is amended as set out in Schedule 1.

Schedule 1 Amendments

(Clause 2)

[1] Part 5, Division 3A

Omit clause 57. Insert instead:

Division 3A Protection of certain marine mammals

57 Definitions

In this Division:

aircraft means any airborne craft, including a fixed wing craft, helicopter, gyrocopter, glider, hang glider, hot air balloon and airship.

calf means a whale or dolphin that is not more than half the length of an adult of the same species.

caution zone for a marine mammal means an area around the mammal of a radius of the following:

(a) for a dolphin (including a calf)—150 metres,

(b) for a whale (including a calf)—300 metres.

cetacean means an animal of the order Cetacea.

constant slow speed, in relation to a marine mammal or group of marine mammals that is being approached, means a speed of approach to the marine mammal or group that is constant, slow and leaves negligible wake.

dolphin means an animal of the family Delphinidae or the family Phocoenidae.

operate a vessel includes:

(a) to determine or exercise control over the course or direction of the vessel or over the means of propulsion of the vessel (whether or not the vessel is underway), and

(b) to pilot the vessel.

prohibited vessel means a vessel that is a personal motorised water craft (for example, a jet ski), parasail, hovercraft, wing-in-ground effect craft or a motorised diving aid (for example, a motorised underwater scooter) and includes a remotely operated craft (for example, a remote controlled speed boat).

pup means a seal or sea lion that is not more than half the length of an adult of the same species.

swimming includes snorkelling or diving.

vehicle means a motor car, motor carriage, motor cycle, or other apparatus propelled on land wholly or partly by volatile spirit, steam, gas, oil or electricity or a bicycle.

vessel includes a water craft of any description that is used or capable of being used as a means of transportation on water but does not include an aircraft that is capable of landing on water.

whale means a cetacean other than a dolphin.

57A Application of Division

(1) A person must not be convicted of an offence under this Division if the person proves that the act constituting the offence was:

(a) caused solely by a marine mammal approaching the person, or

(b) an action taken by the person that was reasonably necessary to prevent a risk to human health or to deal with a serious threat to human life or property, or

(c) an action taken by the person as an officer of or person acting on behalf of a law enforcement agency that was reasonably necessary for the purposes of law enforcement, or

(d) an action taken by an officer of the Department of Primary Industries who had been appointed as a fisheries officer under the *Fisheries Management Act 1994* that was reasonably necessary for the purposes of exercising a law enforcement function conferred on the officer under that Act, or

(e) an action taken by the person that occurred as a result of an unavoidable accident, other than an accident caused by the person's negligent or reckless behaviour, or

(f) an action taken by a person that occurred as a result of the person being given a direction by an officer of the Department of Environment and Conservation and that was taken in accordance with that direction.

(2) A person must not be convicted of an offence under this Division if the person proves that the act constituting the offence was done under and in accordance with or by virtue of the authority conferred by:

(a) a general licence under section 120 of the Act, or

(b) a scientific licence under section 132C of the Act, or

(c) a licence under Part 6 of the *Threatened Species Conservation Act 1995*, or

(d) a licence, permit or approval under the *Exhibited Animals Protection Act 1986*.

(3) In this clause:

law enforcement agency means each of the following:

(a) NSW Police,

(b) the police force of another State or a Territory,

(c) the New South Wales Crime Commission,

(d) the Australian Federal Police,

(e) the Australian Crime Commission,

(f) the Waterways Authority,

(g) the Australian Quarantine and Inspection Service,

(h) the Marine Parks Authority,

(i) the Department of Environment and Conservation.

57B Prescribed approach distances to marine mammals

(1) For the purposes of section 112G of the Act, the following distances are prescribed:

(a) 300 metres, if the person is approaching a cetacean and is on, or using, a prohibited vessel,

(b) 100 metres, if the person is approaching a whale and is on, or using, a vessel other than a prohibited vessel,

(c) 50 metres, if the person is approaching a dolphin and is on, or using, a vessel other than a prohibited vessel,

(d) 30 metres, if the person is approaching a cetacean and is swimming,

(e) a height lower than 300 metres within a horizontal radius of 300 metres, if the person is operating an aircraft (other than a helicopter or gyrocopter),

(f) a height lower than 500 metres within a horizontal radius of 500 metres, if the person is operating a helicopter or gyrocopter,

(g) 10 metres, if the person is approaching a seal or sea lion (other than a pup) that is in the water and the person is in, or on, a vessel,

(h) 10 metres, if the person is approaching a seal or sea lion (other than a pup) that is in the water and the person is swimming or is a pedestrian,

(i) 40 metres, if the person is approaching a seal or sea lion (other than a pup) that is hauled out on land and the person is swimming, operating a vessel or vehicle or is a pedestrian,

(j) 80 metres, if the person is approaching a pup.

Note. A person who approaches a marine mammal any closer than the distances prescribed above is guilty of an offence under section 112G of the Act that is punishable by a maximum penalty of 1,000 penalty units or imprisonment for 2 years, or both.

(2) The prescription of a distance under this clause does not apply to a person approaching a marine mammal in the following circumstances:

(a) the person is approaching in the course of taking action that is reasonably necessary to prevent a risk to human health or to deal with a serious threat to human life or property, or

(b) the person is approaching in the course of taking action in the person's capacity as an officer of or person acting on behalf of a law enforcement agency and the action is reasonably necessary for the purposes of law enforcement, or

(c) the person is approaching in the course of taking an action in the person's capacity as an officer of the Department of Primary Industries who has been appointed as a fisheries officer under the *Fisheries Management Act 1994* and the action is reasonably necessary for the purposes of exercising a law enforcement function conferred on the officer under that Act, or

(d) the person is approaching in the course of taking action that is a result of an unavoidable accident, other than an accident caused by the person's negligent or reckless behaviour, or

(e) the person is approaching in the course of taking any action as a result of the person being given a direction by an officer of the Department of Environment and Conservation and that is being taken in accordance with that direction.

57C Operation of prohibited vessels

(1) A prohibited vessel that is being approached by a cetacean must be moved away from the cetacean at a constant slow speed so that the vessel remains at least 300 metres away from the cetacean.

(2) A person who operates a prohibited vessel in a way that contravenes subclause (1) is guilty of an offence.

Maximum penalty: 50 penalty units.

57D Operation of vessels that are not prohibited vessels

(1) Within the caution zone for a cetacean (other than a calf), a person operating a vessel that is not a prohibited vessel:

(a) must operate the vessel at a constant slow speed and in a manner that consistently minimises noise, and

(b) must make sure that the vessel does not drift closer to the cetacean than:

(i) for a dolphin—50 metres, or

(ii) for a whale—100 metres, and

(c) if the cetacean shows signs of being disturbed—must immediately withdraw the vessel from the caution zone at a constant slow speed, and

Note. Signs of being disturbed include regular changes in direction or speed of swimming, hasty dives, changes in breathing patterns, changes in acoustic behaviour or aggressive behaviour such as tail slashing and trumpet blows.

(d) if there is more than one person on the vessel—must post a lookout for cetaceans, and

(e) without limiting paragraph (b), must approach a cetacean only:

(i) from the rear, at an angle of no closer than 30 degrees to its observed direction of travel, or

(ii) by positioning the vessel ahead of the cetacean at more than 30 degrees from its observed direction of travel, and

(f) must make sure the vessel does not restrict the path of the cetacean, and

(g) must make sure the vessel is not used to pursue the cetacean.

(2) A person operating a vessel that is not a prohibited vessel must not allow the vessel to enter the caution zone of a calf.

(3) If a calf brings a vessel that is not a prohibited vessel within the caution zone of the calf by appearing within the area in which the vessel is being operated, the person operating the vessel:

(a) must immediately stop the vessel, and

(b) must:

(i) turn off the vessel's engines, or

(ii) disengage the vessel's gears, or

(iii) withdraw the vessel from the caution zone at a constant slow speed.

(4) A person operating a vessel that is not a prohibited vessel must not enter the caution zone of a cetacean if there are more than 2 vessels in the caution zone.

(5) If a whale (other than a calf) approaches a vessel that is not a prohibited vessel or comes within the limits mentioned in subclause (1) (b), the person operating the vessel must:

(a) disengage the vessel's gears and let the whale approach, or

(b) reduce the speed of the vessel and continue on a course away from the whale.

(6) If a dolphin (other than a calf) approaches a vessel that is not a prohibited vessel or comes within the limits mentioned in subclause (1) (b), the person operating the vessel must not change the course or speed of the vessel suddenly.

Maximum penalty: 50 penalty units.

57E Operation of aircraft in vicinity of marine mammals

(1) A person must not operate any aircraft so as to approach a marine mammal from head on for the purpose of observing a marine mammal.

(2) A person must not land an aircraft on water for the purpose of observing a marine mammal.

Maximum penalty: 50 penalty units.

57F Feeding marine mammals

(1) A person must not intentionally feed or attempt to feed a marine mammal that is in its natural environment.

Maximum penalty: 50 penalty units.

(2) Subclause (1) does not apply to the routine discarding of bycatch by a commercial fisher within the meaning of the *Fisheries Management Act 1994* if he or she makes reasonable efforts to avoid discarding bycatch near a marine mammal.

(3) In this clause:

feed a marine mammal includes throwing food or rubbish in the water near a marine mammal.

57G Swimming with cetaceans

(1) A person must not enter water within 100 metres of a whale or within 50 metres of a dolphin.

(2) If any cetacean comes within 30 metres of a person who is in the water, the person:

(a) must move slowly to avoid startling it, and

(b) must not touch the cetacean or move towards it.

Maximum penalty: 50 penalty units.

57H Approaching special interest marine mammals

(1) The Minister may by order:

(a) declare a marine mammal or group of marine mammals described in the order to be a marine mammal or group of marine mammals to which this clause applies, and

(b) specify the approach distance for that marine mammal or group of marine mammals for the purposes of this clause (the ***special protection approach distance***), and

(c) describe the area of the State to which this clause applies.

(2) The Minister may make an order under this clause only if:

(a) the marine mammal is, or the group is a group that is or includes, any of the following:

(i) a dugong or other rarely sighted species of marine mammal,

(ii) a morphological or colour-variant marine mammal,

(iii) a female marine mammal that has recently given, or is about to give, birth,

(iv) a calf separated from a mother or group of marine mammals,

(v) a sick or injured marine mammal, or

(b) the Minister is satisfied that the marine mammal or group of marine mammals is at risk of harassment, injury or death.

(3) As soon as practicable after making an order under this section, the Minister is:

(a) to cause notice of the order to be broadcast by a television or radio station transmitting to the area of the State concerned and to be published in a newspaper circulating in that area, and

(b) to cause a copy of the order to be published in the Gazette.

(4) An order under this clause has effect for a period of 6 months on and from the day on which notice of it is first published as referred to in subclause (3) (a).

(5) A person must not, without reasonable excuse or the Minister's written permission or the permission of an authorised officer, approach a marine mammal or group of marine mammals to which this clause applies in an area to which this clause applies at any distance that is closer than the special protection approach distance for the marine mammal or group of marine mammals.

Maximum penalty: 50 penalty units.

[2] Schedule 2 Penalty notice offences

Insert in appropriate order in Columns 1 and 2, respectively, under the heading "**Offences under National Parks and Wildlife Regulation 2002**":

Clause 57C (2)	300
Clause 57D (1)	300
Clause 57D (2)	300
Clause 57D (3)	300
Clause 57D (4)	300
Clause 57D (5)	300
Clause 57D (6)	300
Clause 57E (1)	300
Clause 57E (2)	300
Clause 57F (1)	300
Clause 57G (1)	300
Clause 57G (2)	300
Clause 57H (5)	300

[3] Schedule 2

Insert after the matter relating to section 111 in Columns 1 and 2, respectively, under the heading "**Offences under National Parks and Wildlife Act 1974**":

Section 112G (1)	300

Appendix 3: Humpback whale behaviour descriptions

BLOW – Whale exhales above the surface

RISE – whale surfaces with no evidence of exhalation

PEDUNCLE ARCH – whale arches its back exposing most of the tail stock but not the flukes (tail) as it submerges (peduncle = lower portion of whale's body)

FLUKE UP – whale submerges lifting the flukes so that the under side would be exposed to an observer stationed posterior to the whale

BREACH – whale jumps so that most of its body is clear of the water

PECTORAL SLAP – whale strikes the surface of the water with its pectoral fins

PECTORAL WAVE – whale waves pectoral fin above the surface of the water

FLUKE SLAP – whale strikes the surface of the water with the under side of its flukes or dorsal surface of its flukes

FLUKE WAVE – whale waves flukes above the surface of the water

PEDUNCLE SLAP – whale strikes the surface of the water with the upper side of its tail stock

ROLL – whale spins at the water surface; movement is not accompanied by slaps of the pectoral fins

FLUKE DOWN – whale submerges lifting the flukes clear of the surface of the water, but so that the under side would not be exposed to an observer stationed posterior to the whale

SIDE FLUKE – whale is on its side, so that one half of the fluke is visible above the surface of the water

SPY HOP – whale lifts head vertically above the surface of the water

LYING – whale remains on the surface with no other behaviour visible for more than 15 seconds

HEAD LUNGE – whale moves head forwards rapidly above the surface, throat pleats may engorge with water or air but remain taut

LUNGE FEEDING - whale moves head forwards rapidly above the surface, throat pleats are relaxed and grossly distended (unfolded) as the whale engulfs its prey.

PORPOISING - whale pushes its body forwards out of the water striking the surface of the water with its head as it continues to move through the water

HANGING – whale lies head down in the water column with the flukes just breaking the surface of the water

TRUMPET BLOW – whale exhales, accompanying the blow with a loud vocalization

FLUKE SWISH- whale moves flukes forcefully from side to side, flukes at or just below the surface.

SURFACE FLOAT FRONT – Whale floats on the surface of the water with under side facing into the water

SURFACE FLOAT BACK – Whale floats on the surface of the water with under side facing out of the water

FLUKE FLICK – whale rapidly moves flukes in a sideways motion, striking the surface of the water with the upper side of the flukes. The fluke flick is faster and presents a less regular arching movement than the fluke slap.

Appendix 4: Land-based whale-watcher questionnaire

Survey of

Land Based Whale Watchers in NSW

Researcher:

Kasey Stamation (BSc. Hons) - Postgraduate Student (UNSW)

Principal Supervisor:

Dr. David Croft (UNSW)

Project Title:

Whale Watching in NSW: Research to integrate the needs of whales and other marine mammals, tourists, industry and regional communities.

- **Questionnaire contains mainly check box questions.**
- **Questionnaire should take approximately 10 minutes to complete.**
- **When completed questionnaire can be returned to boxes provided at Cape Solander and ticket booth exit or left at the Discovery Center.**
- **Alternatively a completed questionnaire can be returned to:**
  Dr. David Croft
  School of Biological, Earth and Environmental Sciences
  UNSW Sydney 2052

UNSW
THE UNIVERSITY OF NEW SOUTH WALES

THE UNIVERSITY OF
NEW SOUTH WALES

SCHOOL OF BIOLOGICAL, EARTH AND
ENVIRONMENTAL SCIENCES

SUBJECT INFORMATION STATEMENT

What is the purpose of this survey?
This research is being conducted by Kasey Stamation, a PhD candidate in the School of Biological, Earth & Environmental Sciences at the University of NSW in Sydney. I am interested in learning about people's expectations and satisfaction with their whale watching experience. I would also like to investigate the effectiveness of using interpretive material as an educational tool for wildlife conservation. I will apply this knowledge to:
1) the enhancement of the experience of whale watching for many people while maintaining the well-being of whales;
2) the development of better educational and interpretive material for whale watchers; and
3) the improvement of understanding about wildlife conservation in the community.

Why have you been selected?
You are invited to participate in a study of whale watching in NSW. You were selected as a potential participant in this study because you are taking part in a marine mammal watching experience today.

What does the survey involve?
If you decide to participate, I will give you a questionnaire. Attached to this questionnaire will be a consent form asking for your permission to conduct a follow up survey. The follow up survey will be conducted in about 6 months time, by post, email or phone (which ever you prefer). If you would like to participate in the follow up survey, I will need your name and contact details. If you do not want to participate in the follow up survey but would still like to participate in the first questionnaire then I do not need your name or contact details. The questionnaire should take about 10 minutes to complete.

Please note that this is a research project and as such its conclusions are to be revealed by appropriate analysis. Therefore we cannot and do not guarantee or promise that you will personally receive any benefits from this study.

Confidentiality and disclosure of information
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or except as required by law. If you give us your permission by participating in this survey, we plan to publish the results in scientific journals and in reports for government agencies and industry. Results will also be documented in my PhD thesis. In any publication, information will be provided in such a way that you cannot be identified.

Complaints may be directed to the Ethics Secretariat, University of New South Wales, SYDNEY 2052 AUSTRALIA (phone 9385 4234, fax 9385 6648, email ethics.sec@unsw.edu.au).

Your consent
Your decision whether or not to participate will not prejudice your future relations with the University of New South Wales. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.

Want to know more?
If you have any questions, please feel free to ask me now having read this form. If you have any additional questions later contact: Dr. David Croft
University of New South Wales Arid Zone Field Station, Fowlers Gap
Ph: +61 (0) 8 8091 3809

SURVEY OF LAND BASED WHALE WATCHERS

SOME BACKGROUND ON TODAYS VISIT

1. What is the MAIN reason for your visit to the Botany Bay National Park today? (please tick one only)

- ☐ To go whale watching
- ☐ To go on one or more of the walking tracks
- ☐ To go birdwatching
- ☐ To have a picinic or BBQ
- ☐ To visit the Discovery Centre
- ☐ Other (please specify) _____
- ☐ To visit the european and/or aboriginal historic sites
- ☐ To take in the views
- ☐ To take photos of scenery
- ☐ To take photos of wildlife

2. How did you find out about whale watching at Cape Solander?

- ☐ Television
- ☐ Newspaper
- ☐ Tourist information centre
- ☐ Other (please specify) _____
- ☐ Radio
- ☐ Magazine
- ☐ Friends/relatives
- ☐ Internet
- ☐ Tourist brochure
- ☐ Found out upon arrival to the park

3. How did you get to the Botany Bay National Park today?

- ☐ Car
- ☐ Public transport (train + bus)
- ☐ Other (please specify) _____
- ☐ Motorcycle
- ☐ Tour bus
- ☐ Bicycle

4. Which of the following best descibes your travel party?

- ☐ Unaccompanied (single)
- ☐ Adult couple
- ☐ Family (parents and children)
- ☐ Friends/relatives travelling together
- ☐ Business associates travelling together
- ☐ Other (please specify) _____

PREVIOUS VISITS TO BOTANY BAY NATIONAL PARK AND OTHER WILDLIFE AREAS

5. How many times have you done the following before today?

	Not at all	Once	2 - 5 times	6 - 10 times	More than 10 times
Visited Botany Bay National Park	☐	☐	☐	☐	☐
Watched whales from Cape Solander	☐	☐	☐	☐	☐
Watched whales from land elsewhere	☐	☐	☐	☐	☐
Watched whales from a boat	☐	☐	☐	☐	☐

6. In the last 12 months how many times have you done the following?

	Not at all	Once	2-5 times	6 -10 times	More than 10 times
Taken a trip to a zoo/aquarium/wildlife park	☐	☐	☐	☐	☐
Visited a national park/nature reserve	☐	☐	☐	☐	☐
Visited a place specifically to view wildlife	☐	☐	☐	☐	☐

YOUR EXPECTATIONS FOR TODAYS WHALE WATCHING EXPERIENCE

7. Below are some statements describing some things people may look for in a whale watching experience. Please tell us how important each of these are for you when seeking a good whale watching experience.

	Not important	Neutral	Important
Seeing large numbers of whales	☐	☐	☐
Seeing whales up close	☐	☐	☐
Seeing a large variety of marine life	☐	☐	☐
Seeing whales in their natural environment	☐	☐	☐
Seeing whales behaving naturally	☐	☐	☐
An opportunity to learn more about whales	☐	☐	☐
An opportunity to learn more about a variety of marine life	☐	☐	☐
An opportunity to learn more about the marine environment	☐	☐	☐
An opportunity to learn about the local area	☐	☐	☐
Being able to tell people you have seen whales	☐	☐	☐
An opportunity to take photos	☐	☐	☐
A chance to do something exciting, new or different	☐	☐	☐
An opportunity to spend time with family/friends	☐	☐	☐
To feel safe and comfortable whilst viewing whales	☐	☐	☐

8. Before arriving today, what did you think your chances were of seeing the following animals during your visit to Cape Solander?

	Guaranteed	High chance	Medium chance	Low chance	No chance
Humpback Whales	☐	☐	☐	☐	☐
Southern Right Whales	☐	☐	☐	☐	☐
Dolphins	☐	☐	☐	☐	☐
Seals	☐	☐	☐	☐	☐
Sea birds	☐	☐	☐	☐	☐

9. Before arriving today, what did you think your chances were of seeing whales displaying the following behaviours ?

	Guaranteed	High chance	Medium chance	Low chance	No chance
Breach 	☐	☐	☐	☐	☐
Spy hop 	☐	☐	☐	☐	☐
Tail slap 	☐	☐	☐	☐	☐
Blow 	☐	☐	☐	☐	☐

10. Before arriving today, How would you have rated your knowledge of the following topics?

	None	Little	Moderate	Good	Expert
Whales	☐	☐	☐	☐	☐
Other marine life	☐	☐	☐	☐	☐
Marine environment	☐	☐	☐	☐	☐
Birds	☐	☐	☐	☐	☐
Local terrestrial wildlife	☐	☐	☐	☐	☐
Local geology	☐	☐	☐	☐	☐
Local history	☐	☐	☐	☐	☐

WHAT YOU SAW

11. Did you see the following marine mammals on your visit to Cape Solander today?

	Yes	No	Not sure
Humpback whales	☐	☐	☐
Southern right whales	☐	☐	☐
Dolphins	☐	☐	☐

12. Did you see any other marine mammals on your visit to Cape Solander today?

☐ Yes ☐ No

If yes, please list the names (if known) of the marine mammals you saw at Cape Solander today.

_____

13. Did you see any of the following types of animals on your visit to Botany Bay National Park today?

	Yes
Birds	☐
Reptiles	☐
Terrestrial mammals	☐

If you answered yes to any of the above, please list the names of the animals you saw today.

_____

14. Approximately how close (in metres) were the whales you were viewing today? _____

15. a) Do you think that the distance you were from the whale(s) today was ...

☐ Too close ☐ Close enough ☐ Not close enough

b) Please give a reason(s) for your response.

16. Did you see whales displaying the following behaviours?

	Yes	No	Not sure
Breach 	☐	☐	☐
Spy hop 	☐	☐	☐
Tail up 	☐	☐	☐
Blow 	☐	☐	☐

17. What other activities (apart from whale watching) did you do or plan to do in the park today?

	Yes	No	Haven't decided
Monument Track walk	☐	☐	☐
Muru Track walk	☐	☐	☐
Yena Track walk	☐	☐	☐
Banks- Solander Track walk	☐	☐	☐
Cape - Baily Track walk	☐	☐	☐
Visit the Discovery Centre	☐	☐	☐
Picnic or BBQ in the park	☐	☐	☐
Birdwatching	☐	☐	☐
Ranger guided tour	☐	☐	☐

Others (please specify) _____

WHAT YOU LEARNT

18. How much did you learn about the following during you visit to the Botany Bay National Park today?

	Nothing	A little	A lot
Whales	☐	☐	☐
Other marine life	☐	☐	☐
Marine environment	☐	☐	☐
Birds	☐	☐	☐
Local terrestrial wildlife	☐	☐	☐
Local Geology	☐	☐	☐
Local History	☐	☐	☐

19. Below are some multiple choice questions about whales. If you don't know the answer to any of the following questions please tick 'don't know' rather than guessing

a) What is a baby whale called?

☐ Pup ☐ Calf ☐ Cub ☐ Don't know

b) What is a group of whales called?

☐ Pod ☐ Shoal ☐ Raft ☐ Don't know

c) What is the main reason humpback whales spend summer in Antarctica?

☐ To give birth ☐ To feed ☐ To mate ☐ Don't know

d) What is the minimum distance a boat can approach a whale from in NSW waters?

☐ 100 metres ☐ 300 metres ☐ 500 metres ☐ Don't know

e) From the list below, please tick all the factors which you think pose a direct threat to humpback whales in Australia today.

☐ Pollution

☐ Commerical fisheries

☐ Whaling

☐ Boat based whale watching

☐ Land based whale watching

☐ Ozone depletion

YOUR SATISFACTION

20. How do you rate the quality of your whale watching experience today?

O 1	O 2	O 3	O 4	O 5	O 6	O 7
Very boring			Acceptable			Fascinating

21. How did this whale watching experience live up to your expectations?

☐ Exceeded expectations ☐ Met expectations ☐ Fell short of expectations ☐ Not sure

22. How would you rate the quality of the following aspects of your whale watching experience today?

	Very poor	Poor	Neutral	Good	Excellent
Number of whales seen	☐	☐	☐	☐	☐
Distance from whales	☐	☐	☐	☐	☐
Whale behavioural displays	☐	☐	☐	☐	☐
Photo opportunites	☐	☐	☐	☐	☐
Surrounding environment	☐	☐	☐	☐	☐

23. Which of the following topics would you liked to have had more information on?

☐ Whales
☐ Other marine life
☐ Marine environment
☐ Birds
☐ Local terestrial wildlife
☐ Local geology
☐ Local history
☐ Other (please specify)

24. What improvements could be have been made to enhance your enjoyment of this whale watching experience?

_____

25. What was the most memorable aspect of your visit to Botany Bay National Park today?

_____

26. Approximately how long did you watch whales from Cape Solander today?

☐ Up to 30mins ☐ 30mins - I hour ☐ 1hour - 2hours ☐ 2hours - 3hours ☐ More than 3 hours

FUTURE BEHAVIOUR

27. Would you like to go whale watching from land again?

☐ Yes ☐ No ☐ Possibly ☐ Don't know

Please give reasons for your response _____

28. Would you like to go whale watching from a boat?

☐ Yes ☐ No ☐ Possibly ☐ Don't know

Please give reasons for your response _____

29. Would you recommend whale watching from land to someone else?

☐ Yes ☐ No ☐ Possibly ☐ Don't know

30. As a result of your whale watching experience today are you likely to do the following more than you already do now?

	Yes, more than I already do	No, not more than I already do	Not sure
Visit a site specifically to view wildlife	☐	☐	☐
Pick up litter that may be harmful to wildlife	☐	☐	☐
Tell people about whales generally	☐	☐	☐
Tell people about whale conservation	☐	☐	☐
Find out more information on whales	☐	☐	☐
Find out more information on other wildlife	☐	☐	☐
Donate to and/or be actively involved in helping an environmental group	☐	☐	☐
Recycle	☐	☐	☐
Choose household products that you think are better for the environment	☐	☐	☐
Avoid putting things like oil, fat, paint or turps down the sink or toilet	☐	☐	☐
Avoid putting things like litter or detergents into gutters or storm water drains	☐	☐	☐
Use alternatives to plastic bags when doing the grocery shopping	☐	☐	☐

ABOUT YOU

31. Your postcode (add country if not in Australia) _____

32. Gender

☐ Male ☐ Female

33. What is your age?

☐ 15 - 19 ☐ 20 - 24 ☐ 25 - 29 ☐ 30 - 34
☐ 35 - 44 ☐ 45 - 54 ☐ 55 - 64 ☐ 65 or older

34. What is the highest level of education you have completed?

☐ No formal schooling
☐ Primary school
☐ Some secondary school
☐ Completed secondary school
☐ Trade or technical qualifications
☐ University degree, diploma or higher degree

35. What is your occupation?

☐ Executive/ manager ☐ Technical
☐ Teacher/ lecturer ☐ Skilled tradesperson
☐ Other professional ☐ Labourer
☐ Sales ☐ Home duties
☐ Clerical ☐ Student
☐ Farmer/ grazier ☐ Retired/ pensioner
☐ Driver/ machinery operator ☐ Unemployed
☐ Other (please specify)

36. Do you donate to and/or actively involved in helping an environmental organisation or group?

☐ Yes ☐ No

If yes , what is the groups name(s)?

_____

37. From the list below please indicate how often you personally do the following activities

	Not at all	Rarely	Sometimes	Frequently	Always	Not applicable
Donate to and/or actively involved in helping an environmental group	☐	☐	☐	☐	☐	☐
Recycle bottles, cans, paper or plastic instead of throwing them away	☐	☐	☐	☐	☐	☐
Choose household products that you think are better for the environment	☐	☐	☐	☐	☐	☐
Avoid putting things like oil, fat, turps or paints down the sink or toilet	☐	☐	☐	☐	☐	☐
Avoid putting things like litter or detergents, into gutters or storm water drains	☐	☐	☐	☐	☐	☐
Use alternatives to plastic bags when doing the grocery shopping	☐	☐	☐	☐	☐	☐

If you wish to participate in the follow up survey (in approx. 6 months time) then please proceed to the next page.
In addition to our All Park Pass Draw, you will have the chance to win a print of a humpback whale (on display in the discovery centre) as a reward for participating in the follow up survey.

If you do not want to participate in the follow up survey -
Don't forget to tear off the LAST page, fill in your details and enter the draw for an Annual All Park Pass, as a reward for completing the survey today.

Survey of **Land Based Whale Watchers in NSW**

Part 3 - *Follow-Up Survey*

Researcher:

Kasey Stamation (BSc. Hons) - Postgraduate Student (UNSW)

Principal Supervisor:

Dr. David Croft (UNSW)

Project Title:

Whale Watching in NSW: Research to integrate the needs of whales and other marine mammals, tourists, industry and regional communities.

UNSW

THE UNIVERSITY OF
NEW SOUTH WALES

SCHOOL OF BIOLOGICAL, EARTH AND
ENVIRONMENTAL SCIENCES

SUBJECT INFORMATION STATEMENT

What is the purpose of this survey?
This research is being conducted by Kasey Stamation, a PhD candidate in the School of Biological, Earth & Environmental Sciences at the University of NSW in Sydney. I am interested in learning about people's expectations and satisfaction with their whale watching experience. I would also like to investigate the effectiveness of using interpretive material as an educational tool for wildlife conservation. I will apply this knowledge to:
1) the enhancement of the experience of whale watching for many people while maintaining the well-being of whales;
2) the development of better educational and interpretive material for whale watchers; and
3) the improvement of understanding about wildlife conservation in the community.

Why have you been selected?
You are invited to participate in a study of whale watching in NSW. You were selected as a potential participant in this study because in June 2002 you completed part 1 and 2 of the survey on your whale-watching experience at Cape Solander in Botany Bay National Park. When completing Part 2, you gave us permission to contact you with Part 3, approximately 6 months later.

What does the survey involve?
If you decide to participate, you need to complete this questionnaire and return it in the pre-paid envelope provided. This questionnaire should take about 10 minutes to complete.

Please note that this is a research project and as such its conclusions are to be revealed by appropriate analysis. Therefore we cannot and do not guarantee or promise that you will personally receive any benefits from this study.

Confidentiality and disclosure of information
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or except as required by law. If you give us your permission by participating in this survey, we plan to publish the results in scientific journals and in reports for government agencies and industry. Results will also be documented in my PhD thesis. *In any publication, information will be provided in such a way that you cannot be identified.*

Complaints may be directed to the Ethics Secretariat, University of New South Wales, SYDNEY 2052 AUSTRALIA (phone 9385 4234, fax 9385 6648, email ethics.sec@unsw.edu.au).

Your consent
Your decision whether or not to participate will not prejudice your future relations with the University of New South Wales. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.

Want to know more?
If you have any questions, please contact the project supervisor:

Dr. David Croft
University of New South Wales
School of Biological Earth and Environmental Sciences
UNSW Sydney 2052
Ph: (02) 93852132

1. Since your visit to Cape Solander (when you filled in Part 1 and Part 2 of this survey) how often have you done the following activities?

	Not at all	Once	2 - 5 times	6 - 10 times	More than 10 times
Whale watching on a boat	○	○	○	○	○
Whale watching from land	○	○	○	○	○
Taken a trip to a zoo or aquarium	○	○	○	○	○
Taken a trip to a wildlife park	○	○	○	○	○
Visited a National Park	○	○	○	○	○
Visited a place specifically to view wildlife	○	○	○	○	○

2. Have you recommended whale watching at Cape Solander to someone?

☐ No
☐ Yes
☐ No, but I intend to

3. Since your visit to Cape Solander (when you filled in Part 1 and Part 2 of this survey) how often have you done the following?

	Not at all	Rarely	Sometimes	Frequently	Always	Not applicable
Picked up litter that may be harmful to the environment	O	O	O	O	O	O
Told people about whales generally	O	O	O	O	O	O
Told people about whale conservation	O	O	O	O	O	O
Found out more information on whales	O	O	O	O	O	O
Found out more information on other wildlife	O	O	O	O	O	O
Made a donation to and/ or have been actively involved in helping an environmental group	O	O	O	O	O	O
Recycled	O	O	O	O	O	O
Chose household products that you thought were better for the environment	O	O	O	O	O	O
Avoided putting things like oil, fat, turps or paint down the sink or toilet	O	O	O	O	O	O
Avoided putting things like litter and detergents into gutters and storm water drains	O	O	O	O	O	O
Used alternatives to plastic bags when doing the grocery shopping	O	O	O	O	O	O

4. Below are some multiple choice questions about whales. If you don't know the answer to any of the following questions please tick 'Don't know' rather than guessing or looking up the answer

a) What is a baby whale called?

☐ Calf
☐ Cub
☐ Don't know
☐ Pup

b) What is a group of whales called?

☐ Shoal
☐ Raft
☐ Pod
☐ Don't know

c) What is the main reason humpback whales spend summer in Antarctica?

☐ To give birth
☐ To feed
☐ To mate
☐ Don't know

d) What is the minimum distance a boat can approach a whale from in NSW waters?

☐ 100 metres
☐ 300 metres
☐ 500 metres
☐ Don't know

e) From the list below, please tick any which you think pose a threat to humpback whales in Australia today.

☐ Pollution
☐ Commercial fisheries
☐ Whaling
☐ Boat based whale watching
☐ Land based whale watching
☐ Ozone depletion

5 a) Does education during a whale watching event increase visitors' awareness of conservation?

O Strongly agree
O Agree
O Neutral
O Disagree
O Strongly disagree

b) If you agree, how long do you think the raised awareness lasts?

☐ Days
☐ Weeks
☐ Months
☐ Years

6 a) Does education during a whale watching event cause the whale watcher to incorporate more environmentally friendly behaviours into their daily lives?

O Strongly agree
O Agree
O Neutral
O Disagree
O Strongly disagree

b) If you agree, how long do you think this change in behaviour lasts?

☐ Days
☐ Weeks
☐ Months
☐ Years

7. How would you rate your knowledge of the current NSW regulations for whale watching?

☐ Expert
☐ Good
☐ Moderate
☐ Poor
☐ Not at all

8. How would you rate your knowledge of the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines for cetacean observation?

☐ Moderate
☐ Poor
☐ Expert
☐ Good
☐ Not at all

9. What do you see as the MOST positive effect (if any) of whale watching on each of the following?

Regional communites

Whale watchers

Whales

You Personally

10. What do you see as the MOST negative effect (if any) of whale watching on each of the following?

Regional communites

Whale watchers

Whales

You Personally

11. Do you own and/or skipper a boat?

☐ Yes
☐ No

If Yes, then Please continue to Question 12
If No, then Thank you for taking the time to complete this survey!

12. Where do you take your boats out?

☐ NSW Waters only (< 3 nautical miles offshore)
☐ Mainly Commonwealth waters (> 3 nautical miles offshore)
☐ Both NSW and Commonwealth waters
☐ Other (Please specify) _____

13. What type of boat do you own and/or skipper?

14. What is the MAIN purpose you use your boat for?

☐ Recreational Fishing
☐ Recreational Diving
☐ Whale Watching Charter
☐ Professional Fishing
☐ Professional Diving
☐ Fishing Charter
☐ Diving Charter
☐ Sailing
☐ Other (please specify) _____

Thank you for taking the time to participate in this survey!

Appendix 5: List of environmental organisations that land-based whale-watching respondents donated to and/or were actively involved in helping.

Organisation	Number of Respondents
Greenpeace	60
WWF	33
Australian Conservation Foundation	20
NPWS	20
Wilderness Society	18
Bushcare	17
WIRES	15
WSPA	11
RSPCA	9
National Parks Association	8
Birds Australia	6
IFAW	6
Various	5
Bush Heritage Fund	4
Clean Up Australia	3
Friends of the Earth	3
National Heritage Trust	3
ORRCA	3
School-based	3
Surfrider Foundation	3
Zoo Friends	3
Bicyling group	2
Earth Sanctuaries	2
Environmental Protection Association	2
Friends of Botanical Gardens	2
Lifesaving	2
National Geographic Society	2
Oatley Flora and Fauna	2
RSPB	2
Wildlife Conservation Foundation	2
ACTV	1
Adopt Our Historic Drive Campaign	1
Ark	1
Australian Geographical Society	1
Australian Marine Conservation Society	1
Australian National Parks and Wildlife	1

Australian Network for Plant Conservation	1
Australian Plant Society	1
Australian Wildlife Ambulance Rescue Emergencies (AWARE)	1
Born Free Foundation (UK)	1
Bower Reuse and Repair Cooperative	1
Bush Regenerates	1
Bush revegetaion Lower Cove National Park	1
Camden Residents Action Group	1
Coast Action	1
Dolphin Research Institute	1
Dolphin Trust	1
Dutch Green Energy	1
Earthwatch	1
Ecopella	1
Follow that bird	1
Friends of Public Transport	1
Friends of Towra Point Reserve	1
George River Flood Management Committee	1
Greening Australia, NSW	1
Greens	1
Humane Society International	1
Landcare	1
Leichhardt Environmental Committee	1
Local community group	1
Oxfam	1
Recycling Australia	1
Reefcare	1
Royal Botanical Gardens Society	1
Rural Fire Service	1
Sandy Point Progress Association	1
Scouts	1
Sienna Club	1
Surf Aid (NZ)	1
Sydney Metropolitan Wildlife Service	1
UNSW Co-op	1
Warringah Friends of the Bush	1
Wetlands Society	1
Whalewatch	1
Woodland Trust (UK)	1
WSSF	1

Appendix 6: Recommendations for the management of land-based whale-watching activities at Cape Solander.

1) Efforts should be made to promote realistic expectations for land-based whale-watchers and these should be reinforced soon after visitors arrive at the park. Information on what to expect whilst whale-watching at Cape Solander should be incorporated into media releases and interviews, and into the Botany Bay National Park information material including the NSW NPWS and DECC website.
2) The land-based whale-watching experience should be promoted as a low impact form of whale-watching, which has a lot more to offer than just viewing whales. Whale-watching at Cape Solander should be seen as part of a complete national park experience, which also includes spectacular coastline views, nature walks, bird watching and places to picnic.
3) Effective interpretation material should be available to whale-watchers at the Discovery Centre and at the Cape Solander viewing platform. A planned and structured interpretation program, based on Orams' (1995) and Reid's (1999) models should be developed and then tested to determine its effectiveness in achieving its goals.
4) Many whale-watchers mentioned that they would like binoculars and/or telescopes provided at the viewing area. This is something that management should consider especially if they want to promote land-based whale-watching as a more passive alternative to boat-based whale-watching. Enhancing the viewing experience will lead to a greater satisfaction of the land-based experience and thus visitors may be less likely to seek a closer view of the whales from a boat.
5) NPWS should enforce whale-watching guidelines for boats in the area. An education program aimed at creating awareness of whales and their conservation amongst local recreational boat users should be developed and tested.

6) Some additional seating for the elderly and disabled at Cape Solander should be considered. As part of creating realistic expectations, people should be encouraged to bring their own seats or picnic rug. This should be incorporated into the media releases and the current Botany Bay National Park information material.
7) Many people wanted food/drinks provided at Cape Solander. This has the potential to over-commercialise the site and diminish the 'naturalness' and beauty of the area that many whale-watchers value. Instead it is recommended that there be better promotion of the food and drinks available at the Discovery Centre. Again as part of creating realistic expectations people should be encouraged to bring their own food and drinks with them. This should be incorporated into media releases and the current Botany Bay National Park Information.
8) The shuttle bus service should continue to operate during peak times. Overflow from the Cape Solander car park can cause damage to the surrounding cliffs and vegetation and efforts should be made to prevent it. The shuttle bus service helps to minimise this damage as do patrols by NPWS staff to ensure people are parking in the allotted areas.

Appendix 7: Boat-based whale-watcher questionnaire

Survey of

Boat Based Whale Watchers in NSW

Part 1 - *Before whale watching experience*

Researcher:

Kasey Stamation (BSc. Hons) - Postgraduate Student (UNSW)

Principal Supervisor:

Dr. David Croft (UNSW)

Project Title:

Whale Watching in NSW: Research to integrate the needs of whales and other marine mammals, tourists, industry and regional communities.

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NEW SOUTH WALES

SCHOOL OF BIOLOGICAL, EARTH AND
ENVIRONMENTAL SCIENCES

SUBJECT INFORMATION STATEMENT

Marine Mammal Watching in NSW- research to integrate the need of whales and other marine mammals, tourists industry and regional communities

What is the purpose of this survey?
I Kasey Stamation (PhD candidate, UNSW) am interested in learning about peoples' expectations and satisfaction with their whale watching experience. I would also like to investigate the effectiveness of using interpretive material as an educational tool for wildlife conservation.
I will apply this knowledge to:
1) the enhancement of the experience of whale watching for many people;
2) the development of better educational and interpretive material for whale watchers; and
3) increasing understanding of wildlife conservation in the community.

Why have you been selected?
You are invited to participate in a study of Marine Mammal watching in NSW. You were selected as a possible participant in this study because you are taking part in a marine mammal watching experience today.

What does the survey involve?
There are three parts to this survey. If you decide to participate, I will give you the first questionnaire (Part 1) prior to seeing the whales and the second questionnaire (Part 2) shortly after seeing the whales. ***Note the following questionnaire is Part 1.*** Attached to the second questionnaire will be a consent form asking for your permission to conduct a follow up survey (Part 3). The follow up survey will be conducted in about 4 months time, by post, email or phone (which ever you prefer). If you would like to participate in the follow up survey, I will need your name and contact details. If you do not wish to participate in the follow up survey you may still choose to fill in the first two questionnaires (for which I do not require your contact details). Each questionnaire should take about 10 minutes to complete.

We cannot and do not guarantee or promise that you will receive any benefits from this study.

Confidentiality and disclosure of information
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or except as required by law. If you give us your permission by participating in this survey, we plan to publish the results in scientific journals and in reports for government agencies and industry. Results will also be documented in my PhD thesis. In any publication, information will be provided in such a way that you cannot be identified.

Complaints may be directed to the Ethics Secretariat, University of New South Wales, SYDNEY 2052 AUSTRALIA (phone 9385 4234, fax 9385 6648, email ethics.sec@unsw.edu.au).

Your consent
Your decision whether or not to participate will not prejudice your future relations with the University of New South Wales. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.

Want to know more?
If you have any questions, please feel free to ask us. If you have any additional questions later, Kasey Stamation (student) 0403267503 or Dr David Croft (supervisor) (02) 93852132 will be happy to answer them.

You may detach and keep this form for further information.

SURVEY OF BOAT BASED WHALE WATCHERS
PART 1

BACKGROUND ON TODAYS VISIT

1. Please mark any of the following factors that were important for you when picking this trip (you can tick more than one).

- ☐ The price best matched my budget
- ☐ The date and time best suited my schedule
- ☐ The size of the boat
- ☐ The advertisment caught my eye
- ☐ Other (please specify) _____
- ☐ It was the only one I saw advertised
- ☐ It was recommended by others
- ☐ It offered expert commentry and/or naturalist on board
- ☐ Someone organised the trip for me

2. Where have you seen this whale watching tour advertised?

- ☐ Television
- ☐ Radio
- ☐ Internet
- ☐ Magazine
- ☐ Newspaper
- ☐ Tourist info centre
- ☐ Tourist brochure
- ☐ Haven't seen any advertisments
- ☐ Other (please specify) _____

3. Please indicate whether you have received information on whales in the local area from any of the following sources

- ☐ Televison
- ☐ Radio
- ☐ Internet
- ☐ Magazines
- ☐ Newspaper
- ☐ Videos
- ☐ NPWS Discovery Centre
- ☐ Word of mouth
- ☐ NPWS Information signs
- ☐ Books
- ☐ Eden Whale Museum
- ☐ Other (please specify) _____

4. Which of the following best describes your travel party?

- ☐ Unaccompanied (single)
- ☐ Adult couple
- ☐ Family (parents and children)
- ☐ Friends/relatives travelling together
- ☐ Business associates travelling together
- ☐ Other (please specify) _____

5a How many times have you done the following before today?

	Not at all	Once	2-5 Times	6-10 times	More than 10 times
Watched whales from a boat	☐	☐	☐	☐	☐
Watched whales from land	☐	☐	☐	☐	☐

5b. In the last 12 months how many times have you done the following?

	Not at all	Once	2 - 5 times	6 - 10 times	More than 10 times
Taken a trip to a zoo/aquarium/wildlife park	☐	☐	☐	☐	☐
Visited a national park/nature reserve	☐	☐	☐	☐	☐
Visited a place specifically to view wildlife	☐	☐	☐	☐	☐

1

SURVEY OF BOAT BASED WHALE WATCHERS
PART 1

EXPECTATIONS FOR TODAY'S WHALE WATCHING EXPERIENCE

6. Below are some statements describing some of the things people may look for in a whale watching experience. Please tell us how important each of these are for you on this whale watching tour.

	Important	Neutral	Not Important
Seeing large numbers of whales	☐	☐	☐
Seeing whales up close	☐	☐	☐
Seeing a large variety of marine life	☐	☐	☐
Seeing whales in their natural environment	☐	☐	☐
Seeing whales behaving naturally	☐	☐	☐
An opportunity to learn more about whales	☐	☐	☐
An opportunity to learn more about a variety of marine life	☐	☐	☐
An opportunity to learn more about the marine environment	☐	☐	☐
An opportunity to learn about the local area	☐	☐	☐
Being able to tell people you have seen whales	☐	☐	☐
An opportunity to take photos	☐	☐	☐
A chance to do something exciting, new or different	☐	☐	☐
An opportunity to spend time with family/friends	☐	☐	☐
Feeling safe and comfortable whilst viewing whales	☐	☐	☐

7. What do you think the chances are of you seeing whales displaying the following behaviours on this whale watching trip?

	Guaranteed	High chance	Good chance	Slight chance	No chance
Breach 	☐	☐	☐	☐	☐
Spy hop 	☐	☐	☐	☐	☐
Tail up 	☐	☐	☐	☐	☐
Blow 	☐	☐	☐	☐	☐

8. What do you think your chances are of seeing the following animals on this whale watching tour?

	Guaranteed	High chance	Good chance	Slight chance	No chance
Humpback Whales	☐	☐	☐	☐	☐
Southern Right Whales	☐	☐	☐	☐	☐
Killer whales	☐	☐	☐	☐	☐
Dolphins	☐	☐	☐	☐	☐
Seals	☐	☐	☐	☐	☐

SURVEY OF BOAT BASED WHALE WATCHERS
PART 1

9. Below are some multiple choice questions about whales. If you do not know the answer to any of the following please tick 'don't know' rather than guessing

a) What is a baby whale called?

☐ Pup ☐ Calf ☐ Cub ☐ Don't know

b) What is a group of whales called?

☐ Shoal ☐ Raft ☐ Pod ☐ Don't know

c) What is the main reason humpback whales spend summer in Antarctica?

☐ To give birth ☐ To feed ☐ To mate ☐ Don't know

d) What is the minimum distance a boat can approach a whale from in NSW waters?

☐ 100 metres ☐ 300 metres ☐ 500 metres ☐ Don't know

e) From the list below, please tick any which you think pose a threat to humpback whales in Australia today.

☐ Pollution
☐ Commercial fisheries
☐ Whaling
☐ Boat based whale watching
☐ Land based whale watching
☐ Ozone depletion

10. How would you rate your knowledge of the following topics?

	None	Little	Moderate	Good	Expert
Whales	☐	☐	☐	☐	☐
Other marine life	☐	☐	☐	☐	☐
Marine environment	☐	☐	☐	☐	☐
Birds	☐	☐	☐	☐	☐
Local terrestrial wildlife	☐	☐	☐	☐	☐
Local geology	☐	☐	☐	☐	☐
Local history	☐	☐	☐	☐	☐

Survey of

Boat Based Whale Watchers in NSW

Part 2 - *After whale watching experience*

Researcher:

Kasey Stamation (BSc. Hons) - Postgraduate Student (UNSW)

Principal Supervisor:

Dr. David Croft (UNSW)

Project Title:

Whale Watching in NSW: Research to integrate the needs of whales and other marine mammals, tourists, industry and regional communities.

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SURVEY OF BOAT BASED WHALE WATCHERS
PART 2

WHAT YOU SAW

1. Did you see the following marine mammals on your whale watching trip today?

	Yes	No	Not Sure
Humpback whales	☐	☐	☐
Southern right whales	☐	☐	☐
Killer whales	☐	☐	☐
Dolphins	☐	☐	☐
Seals	☐	☐	☐

2. Did you see any other marine mammals on your whale watching trip today?

☐ Yes ☐ No

If yes, please list the names (if known) of the marine mammals you saw on your whale watching trip today.

_____

3. What other wildlife apart from marine mammals did you see on your whale watching trip today?

_____

4. Approximately how close (in meters) were you able to get to the whale(s) today? _____

5. a) Do you think that the distance you were from the whale(s) was ...

☐ Too close ☐ Close enough ☐ Not close enough

b) Please give a reason(s) for your response to question 5a.

_____

SURVEY OF BOAT BASED WHALE WATCHERS
PART 2

WHAT YOU LEARNT

6. Did you see whales displaying the following behaviours?

	Yes	No	Not sure
Breach 	☐	☐	☐
Spy hop 	☐	☐	☐
Tail up 	☐	☐	☐
Blow 	☐	☐	☐

7. How much did you learn about the following on this whalewatching trip?

	Nothing	A little	A lot
Whales	☐	☐	☐
Other marine life	☐	☐	☐
Marine environment	☐	☐	☐
Local area	☐	☐	☐

2

SURVEY OF BOAT BASED WHALE WATCHERS
PART 2

8. Below are some multiple choice questions about whales. If you don't know the answer to any of the following questions please tick 'don't know' rather than guessing.

a) What is a baby whale called?

☐ Pup ☐ Calf ☐ Cub ☐ Don't know

b) What is a group of whales called?

☐ Pod ☐ Shoal ☐ Raft ☐ Don't know

c) What is the main reason humpback whales spend summer in Antarctica?

☐ To give birth ☐ To feed ☐ To mate ☐ Don't know

d) What is the minimum distance a boat can approach a whale from in NSW waters?

☐ 100 metres ☐ 300 metres ☐ 500 metres ☐ Don't know

e) From the list below, please tick any which you think pose a threat to humpback whales in Australia today.

☐ Pollution
☐ Commerical fisheries
☐ Whaling
☐ Boat based whale watching
☐ Land based whale watching
☐ Ozone depletion

YOUR SATISFACTION

9. How do you rate the quality of your whale watching experience today?

O 1 O 2 O 3 O 4 O 5 O 6 O 7

Very boring Acceptable Fascinating

10. To what extent did this whale watching trip live up to your expectations?

☐ Exceeded expectations ☐ Met expectations ☐ Fell short of expectations ☐ Not sure

3

SURVEY OF BOAT BASED WHALE WATCHERS
PART 2

11. How would you rate the quality of the following aspects of your whale watching trip today?

	Very poor	Poor	Neutral	Good	Excellent	Not applicable
Number of whales seen	☐	☐	☐	☐	☐	☐
Distance from whales	☐	☐	☐	☐	☐	☐
Whale behavioural displays	☐	☐	☐	☐	☐	☐
Dolphin viewing	☐	☐	☐	☐	☐	☐
Seal viewing	☐	☐	☐	☐	☐	☐
Photo opportunities	☐	☐	☐	☐	☐	☐
Interpretive style used to convey information	☐	☐	☐	☐	☐	☐
Staff friendliness/helpfulness	☐	☐	☐	☐	☐	☐
Value for money	☐	☐	☐	☐	☐	☐
Safety and comfort	☐	☐	☐	☐	☐	☐

12. Would you have liked more information on the following topics?

	Yes	No
Whales	☐	☐
Other marine life	☐	☐
Marine environment	☐	☐
Local area	☐	☐

13. What other topics (if any) would you have liked more information on?

14. What improvements could be have been made to enhance your enjoyment of this whale watching experience?

15. What was the most memorable aspect of your whale watching experience today?

4

SURVEY OF BOAT BASED WHALE WATCHERS
PART 2

FUTURE BEHAVIOUR

16. Would you like to go on a boat based whale watching tour again?

☐ Yes ☐ Possibly ☐ No

Please give a reason for your response _____

17. Would you like to go whale watching from land?

☐ Yes ☐ Possibly ☐ No

Please give a reason for your response _____

18. Would you recommend a whale watching tour to someone else?

☐ Yes ☐ Possibly ☐ No

19. AS A RESULT OF YOUR WHALE WATCHING EXPERIENCE TODAY are you likely to do the following more than you already do now?

	Yes, more than I already do	No, not more than I already do	Not sure
Visit a site specifically to view wildlife	☐	☐	☐
Pick up litter that may be harmful to wildlife	☐	☐	☐
Tell people about whales generally	☐	☐	☐
Tell people about whale conservation	☐	☐	☐
Find out more information on whales	☐	☐	☐
Find out more information of other wildlife	☐	☐	☐
Donate to and/or be actively involved in helping an environmental group	☐	☐	☐
Recycle	☐	☐	☐
Choose household products that you think are better for the environment	☐	☐	☐
Avoid putting things like oil, fat paint or turps down the sink or toilet	☐	☐	☐
Avoid putting things like litter or Detergents into gutters or storm water drains	☐	☐	☐
Use alternatives to plastic bags when doing the grocery shopping	☐	☐	☐

5

ABOUT YOU

20. Gender

☐ Male ☐ Female

21. What is your age?

☐ 15 - 19 ☐ 20 - 24 ☐ 25 - 29 ☐ 30 - 34
☐ 35 - 44 ☐ 45 - 54 ☐ 55 - 64 ☐ 65 or older

22. What is the highest level of education you have completed?

☐ No formal schooling
☐ Primary school
☐ Some secondary school
☐ Completed secondary school
☐ Trade or technical qualifications
☐ University degree, diploma or higher degree

23. What is your occupation?

☐ Executive/ manager
☐ Technical
☐ Teacher/ lecturer
☐ Skilled tradesperson
☐ Other professional
☐ Labourer
☐ Sales/ personal service
☐ Home duties
☐ Clerical
☐ Student
☐ Farmer/ grazier
☐ Pensioner/ retired
☐ Driver/ machinery operator
☐ Unemployed
☐ Other (please specify)

SURVEY OF BOAT BASED WHALE WATCHERS
PART 2

24. Do you donate to and/or actively invloved in helping an environmental organisation or group?

☐ Yes ☐ No

If yes, what is the groups name(s)? _____

25. From the list below please indicate how often you have personally done that thing in the last twelve months.

	Not at all	Rarely	Sometimes	Frequently	Always	Not applicable
Donated to and/or actively involved in helping an environmental group	☐	☐	☐	☐	☐	☐
Recycled bottles, cans, paper or plastic instead of throwing them away	☐	☐	☐	☐	☐	☐
Chose household products that you think are better for the environment	☐	☐	☐	☐	☐	☐
Avoided putting things like oil, fat, turps or paints down the sink or toilet	☐	☐	☐	☐	☐	☐
Avoided putting things like litter or detergents into gutters or storm water drains	☐	☐	☐	☐	☐	☐
Used alternatives to plastic bags when doing the grocery shopping	☐	☐	☐	☐	☐	☐
Picked up litter that may be harmful to wildlife	☐	☐	☐	☐	☐	☐
Told people about whales generally	☐	☐	☐	☐	☐	☐
Told people about whale conservation	☐	☐	☐	☐	☐	☐
Found out information on whales	☐	☐	☐	☐	☐	☐
Found out information on other wildlife	☐	☐	☐	☐	☐	☐

Thank you for taking the time to participate in this survey today!

Survey of

Boat Based Whale Watchers in NSW

Part 3 - *Follow-Up Survey*

Researcher:

Kasey Stamation (BSc. Hons) - Postgraduate Student (UNSW)

Principal Supervisor:

Dr. David Croft (UNSW)

Project Title:

Whale Watching in NSW: Research to integrate the needs of whales and other marine mammals, tourists, industry and regional communities.

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SUBJECT INFORMATION STATEMENT

What is the purpose of this survey?

This research is being conducted by Kasey Stamation, a PhD candidate in the School of Biological, Earth & Environmental Sciences at the University of NSW in Sydney. I am interested in learning about people's expectations and satisfaction with their whale watching experience. I would also like to investigate the effectiveness of using interpretive material as an educational tool for wildlife conservation. I will apply this knowledge to:

1) the enhancement of the experience of whale watching for many people while maintaining the well-being of whales;
2) the development of better educational and interpretive material for whale watchers; and
3) the improvement of understanding about wildlife conservation in the community.

Why have you been selected?

You are invited to participate in a study of whale watching in NSW. You were selected as a potential participant in this study because in October-November 2002 you completed part 1 and 2 of the survey on your whale-watching experience on a boat off the south coast of NSW. When completing Part 2, you gave us permission to contact you with Part 3, approximately 6 months later.

What does the survey involve?

If you decide to participate, you need to complete this questionnaire and return it in the pre-paid envelope provided. This questionnaire should take about 10 minutes to complete.

Please note that this is a research project and as such its conclusions are to be revealed by appropriate analysis. Therefore we cannot and do not guarantee or promise that you will personally receive any benefits from this study.

Confidentiality and disclosure of information

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or except as required by law. If you give us your permission by participating in this survey, we plan to publish the results in scientific journals and in reports for government agencies and industry. Results will also be documented in my PhD thesis. *In any publication, information will be provided in such a way that you cannot be identified.*

Complaints may be directed to the Ethics Secretariat, University of New South Wales, SYDNEY 2052 AUSTRALIA (phone 9385 4234, fax 9385 6648, email ethics.sec@unsw.edu.au).

Your consent

Your decision whether or not to participate will not prejudice your future relations with the University of New South Wales. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.

Want to know more?

If you have any questions, please contact the project supervisor:

Dr. David Croft
University of New South Wales
School of Biological Earth and Environmental Sciences
UNSW Sydney 2052
Currently at Ph: (08) 80913809

Survey of Boat-based Whale Watchers – Part 3

1. Since your whale-watching cruise (when you filled in Part 1 and Part 2 of this survey) how often have you done the following activities?

	Not at all	Once	2 - 5 times	6 - 10 times	More than 10 times
Whale watching on a boat	☐	☐	☐	☐	☐
Whale watching from land	☐	☐	☐	☐	☐
Taken a trip to a zoo or aquarium	☐	☐	☐	☐	☐
Taken a trip to a wildlife park	☐	☐	☐	☐	☐
Visited a National Park	☐	☐	☐	☐	☐
Visited a place specifically to view wildlife	☐	☐	☐	☐	☐

2. Have you recommended whale watching from a boat to someone?

☐No
☐Yes
☐No, but I intend to

3. Since your whale-watching cruise (when you filled in Part 1 and Part 2 of this survey) how often have you done the following?

	Not at all Rarely	Sometimes	Frequently	Always	Not applicable
Picked up litter that may be harmful to the environment	☐	☐	☐	☐	☐
Told people about whales generally	☐	☐	☐	☐	☐
Told people about whale conservation	☐	☐	☐	☐	☐
Found out more information on whales	☐	☐	☐	☐	☐
Found out more information on other wildlife	☐	☐	☐	☐	☐
Made a donation to and/ or have been actively involved in helping an environmental group	☐	☐	☐	☐	☐
Recycled	☐	☐	☐	☐	☐
Chose household products that you thought were better for the environment	☐	☐	☐	☐	☐
Avoided putting things like oil, fat, turps or paint down the sink or toilet	☐	☐	☐	☐	☐
Avoided putting things like litter and detergents into gutters and storm water drains	☐	☐	☐	☐	☐
Used alternatives to plastic bags when doing the grocery shopping	☐	☐	☐	☐	☐

Survey of Boat-based Whale Watchers – Part 3

4. Below are some multiple choice questions about whales. If you don't know the answer to any of the following questions please tick 'Don't know' rather than guessing or looking up the answer

a) What is a baby whale called?
☐ Calf
☐ Cub
☐ Don't know
☐ Pup

b) What is a group of whales called?
☐ Shoal
☐ Raft
☐ Pod
☐ Don't know

c) What is the main reason humpback whales spend summer in Antarctica?
☐ To give birth
☐ To feed
☐ To mate
☐ Don't know

d) What is the minimum distance a boat can approach a whale from in NSW waters?
☐ 100 metres
☐ 300 metres
☐ 500 metres
☐ Don't know

e) From the list below, please tick any which you think pose a threat to humpback whales in Australia today.
☐ Pollution
☐ Commercial fisheries
☐ Whaling
☐ Boat based whale watching
☐ Land based whale watching
☐ Ozone depletion

Survey of Boat-based Whale Watchers – Part 3

5 a) Does education during a whale watching event increases visitors' awareness of conservation?

☐ 1 **Strongly agree**
☐ 2 **Agree**
☐ 3 **Neutral**
☐ 4 **Disagree**
☐ 5 **Strongly disagree**

b) If you agree, how long do you think the raised awareness lasts?

☐ Days
☐ Weeks
☐ Months
☐ Years

6 a) Does education during a whale watching event causes the whale watcher to incorporate more environmentally friendly behaviours into their daily lives?

☐ 1 **Strongly agree**
☐ 2 **Agree**
☐ 3 **Neutral**
☐ 4 **Disagree**
☐ 5 **Strongly disagree**

b) If you agree, how long do you think this change in behaviour lasts?

☐ Days
☐ Weeks
☐ Months
☐ Years

7. How would you rate your knowledge of the current NSW regulations for whale watching?

☐ Expert
☐ Good
☐ Moderate
☐ Poor
☐ Not at all

Survey of Boat-based Whale Watchers – Part 3

8. How would you rate your knowledge of the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines for cetacean observation?

☐ Moderate
☐ Poor
☐ Expert
☐ Good
☐ Not at all

9. What do you see as the MOST positive effect (if any) of whale watching on each of the following?

Regional communities

Whale watchers

Whales

You Personally

10. What do you see as the MOST negative effect (if any) of whale watching on each of the following?

Regional communities

Whale watchers

Whales

You Personally

11. Do you own and/or skipper a boat?

☐ Yes
☐ No

If Yes Please continue to Question 12

If No Thank you for taking the time to complete this survey!

Survey of Boat-based Whale Watchers – Part 3

12. Where do you take your boat(s) out?

- ☐ NSW waters only (<3 nautical miles offshore)
- ☐ Mainly Commonwealth waters (>3 nautical miles offshore)
- ☐ Both NSW and Commonwealth waters
- ☐ Other (please specify) _____

13. What type of boat do you own and/or skipper?

_____

14. What is the MAIN purpose you use your boat for?

- ☐ Recreational Fishing
- ☐ Recreational Diving
- ☐ Whale Watching Charter
- ☐ Professional Fishing
- ☐ Professional Diving
- ☐ Fishing Charter
- ☐ Diving Charter
- ☐ Sailing
- ☐ Other (please specify) _____

Thank you for taking the time to participate in this survey!

Appendix 8: List of environmental organisations that boat-based whale-watching respondents donated to and/or were actively involved in helping.

Organisation	Number of Respondents
WWF	43
Greenpeace	34
Wilderness Society	14
Landcare	11
Australian Conservation Foundation	9
RSPCA	8
Various	7
WIRES	7
Birds Australia	5
Clean Up Australia Day	5
Bush Heritage Fund	4
NPWS	4
Planet Ark	4
Dolphin Research Institute	3
Farmer/farmhand	3
IFAW	3
WSPA	3
Environmental Commission ACT	2
Friends of the Earth	2
Greens	2
Rotary International	2
Save the Whales	2
Victorian National Parks Association	2
Wildlife Foundation	2
Work on environmental websites	2
Adopted whale in england	1
AG projects	1
An Taisce (In Ireland)	1
Aranda Bushlands	1
Aspiral Foundation UK	1
Ausbirds	1
Australian Geographical Society	1
Australian Plants Bushcare Conservation	1
Bird watching Society	1
BOCA	1
Bower Reuse and Repair Cooperative	1

Brush Tail Rock Wallaby	1
Butterfly Conservation	1
Canberra Ornithologist Group	1
CCF	1
CERES	1
Choose Cruelty Free	1
Clean Ocean	1
Clean Up The World	1
Coast Action	1
Colorado Mountain Club	1
Conservation Fund in Fiji	1
Conservation Society of NSW	1
CUAC	1
Earthwatch	1
Environmental studies	1
Forest Protection	1
Friends of Davidson Whaling Station	1
Friends of Far West Parks	1
Garden Birdwatch	1
Goulbourn Valley Environmental Group	1
Green up and Clean up	1
In Israel	1
In Sweeden	1
Koala Foundation	1
Land for Wildlife	1
Little Tern Task Force	1
Local community group at Hasting Point	1
Local environmental work care groups	1
Local wildlife Group in UK	1
Melbourne Zoo	1
NANMSA	1
National Geographic	1
National Heritage	1
National Heritage in Holland	1
National Parks Association	1
Natuurmonumeter (Dutch)	1
NPA	1
Orchid Society	1
Organisation Cetacea	1
Oriental Bird Club	1
Owl Trust of UK	1
Oxfam	1
Penguin sponsor at local zoo	1
RCPCB	1

Recycling Group	1
Sapphire Coast Marine Society	1
Save The Bears	1
Save The Wildlife Fund	1
School projects	1
Scouts	1
Sierra Club	1
South East Regional Recycling Group	1
Sterilisation of cats - protection of birds	1
SUSSA	1
Switzerland local group	1
Sydney Metropolitan Wildlife Service	1
Taronga Zoo	1
Tidy Towns	1
Tranceplant	1
UNPA	1
Venturers	1
Wadden (Dutch)	1
Wildlife Observer Club	1
Wildlife Trust	1
WSPCA	1

Appendix 9: Information sheet handed out onboard boat 1

Humpback Whales

These acrobatic giants are a favourite with whale watchers and are renowned for their spectacular breach behaviour, where they will leap out of the water, roll in the air with their huge fins outstretched like wings, and then crash noisily back into the water. They have a small dorsal fin located nearly two-thirds of the way down their back, which on the surface, distinguishes them from other whales by the way their backs steeply arch as they dive. This is how the humpback got its name. They also have several other distinguishing features like large pectoral fins (which may be up to a third of the body length), and unique markings of black and white on the underside of the tail flukes. These markings are like the whales fingerprint, no two are the same!

Southern Right Whales

The southern right is a slow swimmer and suffered extensively from whaling earlier last century. It was called the right whale because it was thought of as the 'right' whale to hunt. These days, they delight whale watchers with their peculiar looks and crowd-attracting antics, like breaching and headstands, where they sometimes hitch a free ride from the wind by using their tail as a sail! They have an enormous head that is up to one quarter of total body length with wide flippers and no dorsal fin. Above its snout is a peculiar bonnet with smaller light coloured, rough patches of skin known as "callosities", which are also found on the head, chin, and around the eyes and blowhole. The number, shape, and position of their callosities provide each whale with its own unique marking and are how we can tell them apart!

Quick Facts

Humpback Whale *(Megaptera novaeangliae)*

Length:	Adults: 14m to 18m Calves: 4m to 5m at birth
Weight:	Adults: up to 50 tonnes Calves: 2 tonnes at birth
Gestation:	11 to 11½ months
Weaning age:	Up to 11 months
Calving interval:	2 to 3 years
Physical maturity:	Age: 12 to 15 years
Length:	11.6m Males/12.1m Females
Sexual maturity:	Age: 4 to 10 years
Length:	13.4m Males/13.7m Females
Mating season:	June to October
Calving season:	June to October
Cruising speed:	7km/hr
Blow pattern:	Small and bushy up to 4m
Protected:	Since 1965

Quick Facts

Southern Right Whale *(Eubalaena australis)*

Length:	Adults: 14m to 18m Calves: 5m to 6m at birth
Weight:	Adults: up to 80 tonnes Calves: 1 to 1½ tonnes at birth
Gestation:	11 to 12 months
Weaning age:	11 to 12 months
Calving interval:	Generally 3 years
Physical maturity:	Age: unknown
Length:	12m to 13m
Sexual maturity:	Age: 9 to 10 years
Length:	16m (Males slightly less than Females)
Mating season:	July to August
Calving season:	June to August
Cruising speed:	3km/hr
Blow pattern:	V-shaped bushy blow up to 5m
Protected:	Since 1935

NPWS & IFAW

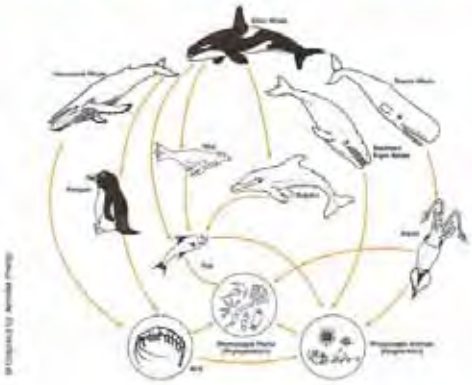
Partners in Community Education

www.nationalparks.nsw.gov.au

IFAW

www.ifaw.org

Top of the Food Chain



The growth of phytoplankton (microscopic floating plants) begins the great food chain of the oceans. In a thin band around the Antarctic, warm waters of the sub-tropical oceans meet the cold waters of Antarctica. The colder waters are heavier and sink, causing a huge up welling of the deep waters that replace the cold sinking water. This up welling carries nutrients that drive the whole food chain of life from the microscopic plants and animals to the swarms of schooling fish and squid. These organisms are in turn, eaten by penguins, seals, dolphins and even toothed whales such as sperm whales.

Humpback and southern right whales on the other hand, are baleen whales that have no teeth to forage on such prey. Instead they have hundreds of rows of fibrous bristle-like baleen plates suspended from their upper jaw that are made from keratin (which is the same material as our fingernails). This unique structure acts like a giant sieve that allows water to pass through but traps small (4 to 8cm) shrimp-like crustaceans known as krill. This food source is found in abundance in the summer months in Antarctic waters.

Whale Migration Patterns

The changing seasons drive the migration of all whales. Humpbacks have a wide geographic range and are found in all the world's oceans. During summer months, populations in the southern hemisphere spend their time in Antarctica feeding until late autumn, when they follow an annual migratory route to their winter breeding and calving grounds in the warmer tropical waters of the Pacific. They return south in spring. Southern right whales are similar in that they feed in Antarctica in the summer and then migrate north to Australia to breed and give birth (especially in southern corners of Australia).

Migration, in terms of energy consumed is a huge commitment by whales, and humpbacks hold the record of having the longest migratory journeys of any mammal on Earth. For example, a humpback whale (off the coast of Columbia) was identified five months earlier feeding off the Antarctic Peninsula – at least 8000km away! So why do whales migrate? There are several reasons why, but probably the strongest is the urge to breed. In simple terms, despite its enormous size at birth, a newborn calf is born without a protective blubber layer, so if it were born in the near-freezing temperatures of the Antarctic waters, it would freeze to death very quickly.

Responsible Whale Watching

Swimmers and divers

- Do not approach closer than 30 metres.

People are advised not to enter the water near whales because of the possibility of being injured.

Vessels – powered and unpowered

- 'No-wake' speed from 300m, approach no closer than 100 metres.
- If a whale is with calf do not approach closer than 200 metres.
- Personal watercraft (jetskis) 'no-wake' speed from 400 metres, approach no closer than 300 metres.

The NPWS is part of the NSW Department of Environment and Conservation

Appendix 10: Information sheet handed out onboard boat 5

Welcome aboard **'CAT BALOU'** for your whale watching cruise at Eden.

Whales and dolphins comprise an order of mammals known as Cetacea which are air breathing, warm blooded and give live birth to their young. They are categorised into two groups, toothed and baleen whales.

The type of whales you are most likely to see today are **HUMPBACK WHALES** (Megaptera novaeangliae) which grow to a length of 15mt and weigh up to 40 tonnes. The female Humpbacks are generally larger than the males. At this time of the year they are migrating southwards to the Antarctic to feed after having spent the winter months in warmer tropical waters where some have mated or given birth to their young. It is possible we will see mothers and calves who often travel close to the coastline.

We ask that you be an active participant in our whale watching cruise today and notify the crew of any possible sightings. Signs we look for are -

- **THE BLOW** Whales have to come to the surface to breath. Breathing is a voluntary act and usually occurs at 5 to 10 minute intervals, however they are able to go longer periods without breathing. The exhaled air form their lungs, combined with some water in the blowhole and respiratory tract is atomized and forms a blow some 4 to 5 mts in height and lingers in the morning air for up to 8 seconds.
- **BREACH** This is one of the most spectacular movements performed by whales when they propel most of their body out of the ocean, crashing back with an enormous splash.
- **ROUND OUT** After a whale has surfaced to breath it usually begins a diving descent. It arches its body slightly, showing the dorsal fin and a large portion of the back.
- **PEC SLAP OR WAVE** The Humpback Whales have very large pectoral (side fins) which are approximately 1/3 of the whales length .These can sometimes be seen extended above water level, waving in the air or slapping the surface.
- **TAIL SLAP** Slapping the fluke (tail) on the surface while the submerged whale is near vertical.
- **SPY HOP** The whale may lift the head so the eyes just rise above the water surface, then slips back underwater.
- **PEDUNCLE SLAP** The rear portion of the whale is thrown up out of the water and brought down sideways. This is sometimes thought to be a sign of aggression.
- **FLUKE UP** When a whale decides to dive it often brings its tail flukes above the surface, exposing entire ventral surface. A good fluke photograph is helpful for researchers in identifying whales.

Appendix 11: Humpback whale brochure

FRONT TOP

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HOW YOU CAN HELP

1) Recycle and reuse
-Choose products with recyclable packaging that can be recycled in your area
-Buy products made from recycled materials

2) Dispose of litter thoughtfully
-Always use rubbish bins. Litter dropped in the streets can be washed down storm water drains and end up in our waterways.
-When throwing away items that form a ring (e.g. six-pack holders, milk bottle rings and box strapping) make sure you cut them first. Then if it escapes and finds it way into the environment, it won't get caught around an animal's neck.
-Always throw cigarette butts in the bin.

3) Pick up any litter that may be harmful to wildlife
- Participate in Clean up Australia Day
- If you live near the coast - participate in local beach clean up days (If your council does not run these encourage them to do so).

4) Use less plastics
-Use alternatives to plastic bags when shopping
-Choose products that have no or minimal plastic packaging

5) Watch what you put down sinks and storm water drains
-Never tip oil or fat down the sink
-Never pour unused paint, solvents or water from washing brushes into storm water drains
-Avoid laundry and other cleaning products that contain phosphates.

6) Be responsible when boating
-Use biodegradable engine oil for two-stoke engines
-Use the correct antifoulant paints
-Store garbage securely and dispose of it on land
-Remove all plastic packaging before taking materials on board
-Use plastic free bait boxes
-Use a holding tank for sewage
-Take time to learn State and Commonwealth regulations for marine mammal watching and always take care to follow them when in the presence of marine mammals.

7) Visit national parks and wildlife reserves
-Experience nature first hand and then you will gain an understanding and appreciation of the environment and the creatures that inhabit it – an important step towards conservation.

8) Join a conservation group and/or become a volunteer
Some groups which support the protection of marine mammals and our coast:

Non-government
Australian Conservation Foundation (ACF)
Australian Marine Conservation Society (AMCS)
International Fund for Animal Welfare (IFAW)
Oceania Project
Whales Alive
Australian Dolphin Research Foundation
Earthwatch Australia
World Wide Fund for Nature (WWF)
Planet Ark

Government
Environment Australia
NSW National Parks and Wildlife Service (NPWS)
Department of Sustainability and Environment (Victoria)
Queensland National Parks and Wildlife Service
Coastcare

9) Find out more information on whales

Some recommended books:

Mead, T. (1994). **The Killers of Eden**. The Killer Whales of Twofold Bay. Dolphin Books.

Bannister, J.L., Kemper, C.M. and Warneke, R.M. (1996). **The Action Plan for Australian Cetaceans**. Australian Nature Conservation Agency, Canberra. http://ea.gov.au/coasts/species/cetaceans/actionplan

Gill, P. and Burke, C. (1999). **Whale Watching in Australian & New Zealand waters**. New Holland Publishers (Australia) Pty Ltd., Sydney

Bryden, M., Marsh, H. and Shaughnessy P. (1998). **Dugongs, Whales, Dolphins and Seals**. Allen and Unwin, St Leonards.

Martin, S (2001). **The Whales' Journey**. Allen and Unwin, Crows Nest.

Some recommended Web Sites:
http://www.whales-online.org
http://www.oceania.org.au
http://www.actonline.org.au/whales
http://whale.wheelock.edu
http://www.mesa.edu.au
http://iaw.org
http://www.enchantedlearning.com/subjects/whales
http://www.ea.gov.au
http://www.nationalparks.nsw.gov.au

UNSW | crc Sustainable Tourism

Author: Kasey Stamation PhD candidate UNSW
Photo: marinethemes.com/Franco Banfi

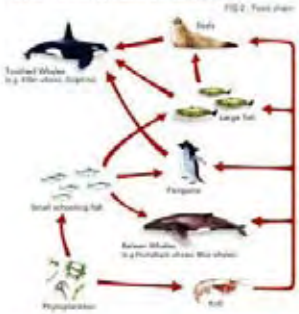
HUMPBACK FEEDING & THE FOOD CHAIN

Humpback whales in the southern hemisphere spend the summer months in Antarctic waters where they feed mainly on Krill (small shrimp like animals). Whilst on the feeding grounds, they consume up to 1 tonne of krill per day. During this time they need to put on a thick layer of blubber (usually 30 cm thick) to sustain them for the journey north to their tropical breeding grounds. During their northern migration humpback whales do not feed, relying completely on their fat reserves. However, humpbacks have been known to feed on small schooling fish in areas near Eden, Merimbula and Narooma whilst travelling south.

Photo: Whale feeding off Eden courtesy of Nick Bull, Cat Balou Cruises

Humpbacks have pleated throats which expand like a pelican's pouch when they gulp their food. They can swallow as much as 2,275 litres of water at a time. The baleen acts like a sieve. Water is forced out through the baleen by the whales contracting their throats and pushing up with their large tongues. The food left behind in the baleen is then swallowed.

FIG 2. Food chain



There is a very good reason why such large animals like humpbacks and blue whales feed on such small prey. Energy is lost with each step to the top of the food chain, so by going to the base of the food chain a greater amount of energy is available to them. They save energy by not having to chase their prey.

CURRENT THREATS

Today, humpback whales are protected from commercial whaling, but unfortunately they now face a new set of threats. Awareness and understanding of the issues threatening humpbacks and other marine life is the first step towards ensuring their continued survival.

1) Entanglement

Many seals, dolphins, whales, turtles, and birds become entangled in common items like plastic shopping bags, fishing line, fishing nets, tuna snapping and six-pack rings in Australian waters each year. These items hamper the mobility of marine animals and, once entangled, animals have trouble eating, breathing and swimming - all of which can have fatal results.

Plastics take hundreds of years to breakdown, so one plastic bag may continue to trap and kill animals year after year.

Australians use 6.9 billion plastic shopping bags per year - if these were tied together they would stretch around the world 27 times.

Photo: Humpback whale badly entangled in fishing net courtesy Centre for Coastal Studies - http://www.coastalstudies.org/rescue/index.htm

This photo shows a young and severely emaciated humpback entangled in fishing gear at Cape Cod Bay (Massachusetts) in June 2002. Over a dozen wraps of synthetic rope were wound around it and these cut deeply into both sides of the flukes. The normally horizontal flukes of the whale were twisted into a vertical position. Although this whale was freed by a whale rescue team the prognosis for its survival was poor. The animal had already lost much body weight and skin on some areas of its body were peeling.

Unfortunately this type of threat is becoming increasingly common in Australian waters with whales becoming entangled in discarded fishing gear, crayfish pots and shark nets as they migrate along our coastline. In 2001, a southern right whale died at the Head of the Great Australian Bight because a heavy net had become entangled around its tail.

2) Ingestion of plastics and other litter

Marine animals often mistake plastics for food or accidentally swallow plastics whilst feeding. When humpback whales feed they take in thousands of litres of water as they gulp their prey. Any plastics in this water will be trapped in their baleen plates and can be swallowed.

Plastics will not be digested or passed and will remain in the whale's stomach, eventually preventing them from eating, causing them to starve to death or in some cases to strand.

In 2002 a Bryde's whale was found stranded in Northern Queensland. An autopsy revealed almost 8 square metres of tightly packed plastic inside the whale's stomach.

Including : Supermarket plastic bags
Garbage bag fragments
3 large sheets of plastic 2 metres long
Food product packaging

Photo: Contents of a Bryde's whale stomach found stranded in Northern Queensland in August 2002. Photo courtesy of Queensland Parks and Wildlife Service (QPWS)

Another form of litter that poses a problem to marine life is cigarette butts. Cigarette filters are designed to trap some of the dangerous by-products of smoking, which means that the butts contain thousands of chemicals. These chemicals can leach into our environment or can be swallowed by birds and marine life. An estimated 4.6 trillion cigarette butts are littered each year worldwide.

3) Toxic chemicals

Many whales and dolphins are found with high levels of heavy metal contamination (mercury, lead, zinc and cadmium) as well as high levels of toxic residues such as DDT and PCBs. Toothed whales such as dolphins and killer whales are more at risk to this kind of contamination as they are high-order predators. This means they consume long-lived fish that are often polluted. Toxic algal blooms and the introduction of nitrates (caused by an increase in nutrients) can further impact on toothed whales by reducing their food supply as fish die.

Toxins accumulate in whale blubber, staying there throughout the whale's lifetime. These pollutants can lead to cancer, damage the nervous and immune systems, and can cause birth defects and reduce fertility. In addition, cetaceans transfer high quantities of these toxins to their calves during feeding.

The main source of coastal pollution comes from industrial and domestic waste, urban storm water, and dumping in run-off of agricultural pesticides and nutrients from land use.

Approximately 250,000 tonnes of polychlorinated biphenyls (PCBs) have been released to the ocean. PCBs can take centuries to break down in the environment.

4) Noise pollution

Coastal seismic operations (blasts of sound used to search for underwater oil and gas), military operations, oil and gas drill platforms and large ships all emit very loud noises, usually in the range of 200 – 240 decibels (the human threshold of pain is around 80 decibels). Whales hear at very low frequencies. These man-made noises are usually low frequency sounds and lie within the bandwidth of maximum sensitivity for baleen whales.

In Australia some of the current and proposed seismic grounds are in critical habitats for southern right whales and blue whales, and are along parts of the migration routes of humpback whales.

5) Harassment by irresponsible boat users

With many commercial and recreational whale-watching vessels on the water during the humpback whale migration, there is the potential for whales to become stressed particularly if whale-watching guidelines are ignored. Humpback whales have been known to show short-term behavioural changes such as increased aggression and avoidance in response to boats but the long-term effects are not well understood.

6) Collision with large vessels

Collisions between whales and ships are not well documented in Australia, but are known to occur. In September 1999, a 4 m long humpback was found dead on a beach south of Mackay, with its jaw broken. It was determined that the most likely cause of death was collision with a vessel. As the number of migrating whales along our coast increases so does the likelihood of a fatal strike with a ship.

CONSERVATION INITIATIVES

Current Research Initiatives

Research into humpback whales in Australia is underway in the following areas:
identification of the migration path, location of breeding areas, estimates of population size and rates of increase, determination of population structure, observation and quantification of behaviour including assessing the impacts of whale watching and understanding whale songs.

Current Management Initiatives

- Establishment of marine parks that include protection for whales.
- Establishment of Commonwealth and State guidelines and regulations for marine mammal watching.
- Education programmes.
- Funding assistance for research programmes leading to important information for the management of humpback whales.
- Encouragement of and assistance to public/private organisations interested in cetacean welfare.

Some of the government supported community initiatives relating to pollution reduction beneficial to whales include Coastcare, Clean Up Australia, Greening Australia, Waterwatch. Recently Commonwealth and State governments announced that they are working towards the goal of reducing plastic bag litter by 75% by the end of 2004 and of reducing plastic bag use by 50%.

Initiatives needed for future management of Humpback whales in Australia

- Issues of coastal pollution are not adequately addressed by government.
- The impact of prolonged exposure of whales to noise pollution in major shipping lanes such as Bass Strait.
- Better understanding of the impacts of the petroleum and gas industry on whales. Current legislation does not require companies to prove that they have no impact on marine life.
- Research is needed on the long-term effects of whale-watching on individual whales.
- Research into alternatives to shark nets to protect swimmers at beaches.
- Education and public awareness programmes for whale protection and conservation need to be expanded.

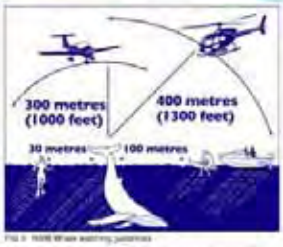


FIG 3. NSW Whale watching guidelines

State and Commonwealth whale watching regulations and guidelines aim to make whale watching enjoyable and safe while minimising the adverse effects of whale watching on whales. They include the following:

- Do not approach whales closer than 100 metres.

- Within 300 metres of a whale move at a constant slow speed, no faster than the slowest whale or all idle, no wake speed.

- Approach whales from a direction parallel and slightly to the rear of the animal.

- Avoid sudden or repeated changes in speed or direction.

- When stopping to watch whales, either place your engines in neutral or allow the motor to idle for short period of one minute before switching off.

- No more than three vessels should attempt to watch a whale or pod of whales at one time.

- When attempting to watch whales, do not "box" the whales in, cut off their path or prevent them from leaving, particularly when more than one vessel is present.

- Do not attempt to approach mothers with young calves closer than 300 metres. When leaving the whales, move off slowly at idle "no wake" speed until at least 300 metres away from the closest whale, before picking up speed.

INSIDE BOTTOM

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DID YOU KNOW ?

- Humpbacks belong to the group of whales called Mysticetes, which means 'with moustaches'. This refers to the 270-400 baleen plates, rows of comb-like structures that hang from the roof of their mouth.
- Humpback whales can live to 50 years of age.
- Humpback whales can weigh up to 45 tonnes, that's more than 6 African elephants.
- Humpback whales can reach a maximum length of 18 metres.
- The tongue of an adult humpback whale weighs about two tonnes, that's the weight of two small cars.
- Whales have three stomach compartments. The fore stomach (where digestion starts), main stomach (contains gastric juices) and pyloric stomach (for further digestion).
- Like all mammals, humpback whales have hair. They have rounded, bump-like knobs called tubercles on top of their head and lower jaw. Each of these tubercles contains at least one stiff hair.
- Humpbacks can sing a series of songs over many hours. It is usually the males who sing and it is thought that they do this to 'serenade' or attract mates. Each humpback whale population has its own unique songs and will vary these songs a little from year to year.
- Male humpbacks compete for females by surface chasing, head butting each other and slapping one another with their tails and pectoral flippers.
- A female humpback is pregnant for 11-11.5 months.
- Humpbacks usually give birth every 2-3 years, but sometimes mate soon after giving birth and thus can have a calf in two consecutive seasons.
- A humpback whale calf is usually born tail first.
- A humpback whale calf measures 4-5 metres at birth and weighs 1 tonne.
- A humpback whale calf can drink between 200 and 600 litres of milk a day. The milk has a thick consistency similar to yogurt and contains around 30% fat.
- A humpback whale calf can grow about 2-3 cm and gain about 45 kg each day.

PAGE 3

- Humpback whales use their blowholes for breathing. The blowholes have two passages (the same as our nose), which close tightly when underwater. Toothed whales, like killer whales and dolphins, only have a single blowhole.
- Whales expel air from their blowholes at 160-480 km/h. In less than two seconds, whales replace 90% of the air in their lungs.
- Whales decide when to breathe (voluntary breathing) unlike humans who breathe without thinking (reflexive breathing).
- Humpback whales sleep whilst floating on the surface and breathing slowly. This behaviour is called 'logging'. It is thought that whales and dolphins sleep by shutting off half of their brain while the other half is awake to ensure that they keep breathing.
- Humpback whales get their name 'humpback' from the way they arch their back as they dive.
- Humpbacks can stay submerged for 45 minutes, but usually dive for 5 to 15 minutes.
- Whalebones are filled with fatty marrow, which means the bones have a low density and float on water.

HUMPBACK WHALE MIGRATION

Each year humpback whales in the southern hemisphere may make a 10,000 km round trip journey from their Antarctic feeding grounds to their tropical breeding grounds.

From May – August, most Group V (those that migrate along the east coast of Australia) humpback whales migrate northward along the continental shelf of Australia coming in close to the coast in some areas before dispersing into waters of the Great Barrier Reef. The exact locations of the breeding areas are not known but it is suspected that humpback whales give birth in the Whitsunday Islands and possibly even further north.

After giving birth, mothers bring their calves into sheltered nursery areas such as Hervey Bay where they can rest before beginning their long journey south back to their feeding grounds. In areas around Narooma, Merimbula and Eden, humpbacks can be seen migrating south from September-November.

PAGE 4

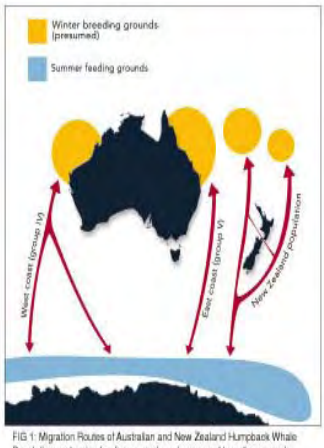

FIG 1: Migration Routes of Australian and New Zealand Humpback Whale Populations - showing feeding grounds and presumed breeding grounds.

POPULATION NUMBERS

Pre-whaling estimates for the size of the Group V population are uncertain but it is thought that there were at least 10,000 individuals. Re-analysis currently underway of whaling fleet catches may see this estimate increase considerably.

Commercial whaling, which began in the mid 1930s, saw the number of Group V humpbacks decrease to about 500 individuals by 1960. Catching of humpback whales from shore stations in eastern Australia continued until 1962. In 1963 the International Whaling Commission (IWC) imposed a ban on whaling in Antarctic waters and since the mid-1970s the Group V population has been recovering. Recent estimates are that the population is increasing by about 10% per year. In 1998, the Group V population was estimated at 4,000.

Although humpback whales are showing good signs of recovery they are still listed as vulnerable by the World Conservation Union (IUCN) and under the Commonwealth's *Environment Protection & Biodiversity Act, 1999* and the *New South Wales Threatened Species Conservation Act, 1995.*