

Effects of tourism on marine mammals in New Zealand

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Abstract

There has been a rapid growth in marine mammal based tourism around the world, because marine mammals have a wide appeal for many people and are readily found around many coastal areas and are therefore readily accessible.

Marine mammal based tourism in New Zealand is a wide-ranging, species-diverse industry with an increasing demand for permits from land, boat and air-based platforms. A total of 74 permits at 26 sites have been issued from Maunganui to Stewart Island. The region with the most concentrated effort is Kaikoura.

Past and current research projects in New Zealand evaluating the effects of tourism on marine mammals are reviewed. The only current ones deal with the New Zealand sea lions of the Catlins, and Northland's bottlenose dolphin population.

In New Zealand, toothed cetaceans and pinnipeds form the basis of the marine mammal based tourism industry. We are one of few countries which permit swimming with dolphins and seals.

Boat and aircraft noise has been shown to affect some species of marine mammals. There is an inadequate database on the acoustic impacts of both recreational and commercial vessels on dolphins and sperm and Bryde's whales. As the ability of cetaceans to communicate and forage is frequently dependent on their acoustic perceptions, this area of research should not be underestimated. Research overseas has focused on baleen cetaceans but research on sperm whales in Kaikoura conducted in the early 1990s provided valuable management information.

One of the most important aspects of evaluating the effects of tourism on marine mammals is the presence of pre-disturbance baseline data on the population size, habitat use, home range and behavioural ecology of the target species. Fortunately these data exist for some species (for example the Hector's dolphins near Banks Peninsula), but for many others (for example bottlenose dolphins in the Bay of Islands) similar data were not collected prior to tourism being established.

As management of this industry is still in its infancy, both in New Zealand and overseas, many areas are finding difficulty with enforcement of the regulations and guidelines. New Zealand's Marine Mammals Protection Act 1978 and Marine Mammals Protection Regulations 1992 fully protect marine mammals. The issuing of permits has caused some debate about rights under the Treaty of Waitangi.

The majority of Department of Conservation Conservancies expressed some concern over the number of permits being issued and the lack of knowledge about their impacts. There is very little information on the effectiveness of the educational material provided by commercial operators. Research on the most efficient and effective management system could resolve some of the issues currently facing the industry.

It is important to assess the costs and benefits of this kind of tourism. Issuing permits for marine mammal based tourism makes the operators a stakeholder in

the animals' welfare and may act as a conservation measure in the long run, but only if it does not cause any harassment to the animals. Examples where this is of some urgency due to the threatened status of the species are the New Zealand sea lion and the Hector's dolphins.

The 1990 Marine Mammals Protection Regulations were originally designed to provide the Director-General of Conservation with guidelines for whale-watching, and they were then revised in 1992 to cope with the increase in dolphin-watching. Given the recent findings of species-specific research on responses to marine mammal based tourism and the rapid growth of this industry, the need to consider further revisions to the regulations has been identified and is being actioned.

1. Introduction

Marine mammals are charismatic animals with a wide appeal for many people. They are readily found around many coastal areas of the world (Jefferson et al. 1993) and are therefore accessible to many people. This has resulted in financially viable businesses based on taking tourists to see them. The combination of these factors has led to the rapid growth in marine mammal based tourism.

In New Zealand, since the first commercial operation began at Kaikoura in 1987 with a single six metre vessel taking commercial tours to watch sperm whales (*Physeter macrocephalus*), the marine mammal based tourism industry has experienced a massive increase in the number of operators and the number of tourists (Donoghue 1994). Currently 74 permits are operational in ten DOC Conservancies. There has also been a major but unquantified increase in the viewing of marine mammals from private recreational vessels. In 1993, 45,000 visitors went whale-watching, which accounted for 4% of activities undertaken by tourists whilst in New Zealand (New Zealand Tourism Board 1993). In 1996, 8% of visitors to New Zealand went whale-watching and 14% of visitors participated in dolphin-watching and/or swimming activities (New Zealand Tourism Board 1996). Donoghue (1994) provided a conservative estimate of the economic value of whale-watching to the New Zealand economy in the year 2000 of \$15 million direct income (payment of trips) and \$45-50 million indirect income to local communities via accommodation, transport costs, souvenirs and food.

The increased interest in marine mammals as a tourist attraction has occurred not only within New Zealand, but appears to be a global trend. For example, in 1991, an estimated 4 million people world-wide went whale-watching. By 1994 this had increased to 5.4 million, with total revenues estimated to be US\$504.3 million (Hoyt 1995). In 1983, approximately 12 countries offered whale-watching tours (Hoyt 1994) but by 1995, over 50 countries and overseas territories were offering whale-watching (which includes whales, dolphins and

porpoises) (IFAW 1995). International recognition of the extent and rapid development of whale-watching came from the 1983 and 1984 International Whaling Commission (IWC) meetings, where the Commission considered a Report on the Non-Consumptive Utilisation of Cetacean Resources (IFAW 1995). Ten years later, at their 1993 meeting the Commission both recognised whale-watching as a tourist industry which contributed to the economies of a number of countries and supported the development of whale-watching as a sustainable use of resources (IFAW 1995). In recognising the development of such an industry, undertaking a scientific review, and providing advice to members, the IWC acknowledged their role on whale-watching, but considered each coastal state to be responsible for management of their own industry. Twenty-seven of the 40 member countries of the IWC currently host some form of whale-watching (Hoyt 1995). As a result, the IWC has an increasingly important role in guiding this industry (IWC 1997).

There are concerns over impacts of this growing industry on both the animals (Beach & Weinrich 1989, Blane 1990, Corkeron 1995, Constantine & Baker 1997) and tourists (Orams 1995, 1996). In order to minimise these impacts, management strategies have been developed. In 1978 the Marine Mammals Protection Act was passed to protect all marine mammals in New Zealand waters. In 1990 the Marine Mammals Protection Regulations were drafted to provide a series of guidelines for issuing permits and for regulating human behaviour around marine mammals (Donoghue 1996); they include minimum approach distances, the number of vessels allowed near marine mammals, the speed of those vessels and whether or not swimming is allowed. These Regulations were reviewed in 1992 in response to the rapid increases in recreational vessels targeting marine mammals and in commercial operators applying for permits to conduct tours to watch and/or swim with seals, sea lions, dolphins and whales.

Species involved in ongoing studies in New Zealand which have been conducted prior to commercial tourism beginning are the dusky dolphins of Kaikoura (Cipriano 1992, Würsig et al. 1991, Würsig et al. 1998), South Island Hector's dolphins (Dawson & Thorpe 1990, Sooten 1990a, Sooten & Ladd 1990b, Bräger & Schneider 1998) and New Zealand (Hooker's) sea lions (Cawthorn 1993, Gales 1995), but for the majority of marine mammal species there is little information currently available.

An important aspect of maintaining management policies which are relevant is a knowledge of the species and ecosystems concerned (Mangel et al. 1996, Yaffee 1997). This is where research is vital to enable changes in the abundance, habitat use, and behaviour of the species involved to be monitored. With regards to marine mammals, many of them, particularly the great whales, are recovering from years of uncontrolled exploitation which has left stocks dangerously low (Beach & Weinrich 1989). We are only in the early stages of understanding the animals, the ecosystems in which they live, and the impacts upon them (Hofman 1995).

We know little about the long-term, or even short-term, effects of humans interacting with marine mammals in the wild. More specifically, issues such as the impacts of noise produced by vessels, boat handling practices, numbers and proximity of boats and humans, effects of swimmers in the water, continual

disturbance vs. sporadic disturbance, differences in responses of different species, age classes, sexes, individuals, or seasonal changes are not known. Research, therefore, has an important role in the future management of this industry. Research programmes with long-term goals can assist with the attainment of conservation and protection goals for marine mammals. If there is not the correct balance between minimising the negative impacts of marine mammal based tourism, allowing for commercial and non-commercial activities, and utilising opportunities to educate participants, then this industry will contribute little to the long-term welfare and health of marine mammal populations. Instead it may become another form of exploitation.

This report reviews the status of the marine mammal based tourism industry in New Zealand as at 1997 and makes recommendations to help DOC guide its future. A review of current and past research both in New Zealand and overseas has been conducted as thoroughly as possible, given that many sources of information exist as unpublished reports. This review has been divided into sections on different species and aspects of marine mammal based tourism. An assessment of New Zealand's management strategy and a brief comparison with those overseas, with an emphasis on the USA and Australia, has been provided. This has been discussed with reference to inter-species differences, current regulations, and research needs. The overseas research and management experience are given in the Appendices.

2. Background to marine mammal based tourism in New Zealand

2.1 LEGISLATION

The legislation under which marine mammal based tourism in New Zealand is controlled is the Marine Mammals Protection Act 1978 and the Marine Mammals Protection Regulations 1992. The purpose of these regulations is:

... to make provision for the protection, conservation, and management of marine mammals and, in particular:

(a) to regulate human contact or behaviour with marine mammals either by commercial operators or other persons, in order to prevent adverse effects on the interference with marine mammals;

(b) to prescribe appropriate behaviour by commercial operators and other persons seeking to come into contact with marine mammals.

The primary mechanism used to control commercial marine mammal tourism operators is by permit. There are several criteria under which permits are issued, summarised as:

- Permits should not be contrary to any conservation management strategies or plans under section 3 of the Act.
- They should not have any significant adverse effect on the species targeted.

- They should be in the interests of conservation, management or protection of marine mammals.
- The operator and staff should have sufficient experience with marine mammals and the local area, and should have no convictions for offences involving the mistreatment of animals.
- The commercial operation should have sufficient educational value.

Under the Regulations, these criteria must be met, in conjunction with others, before a permit is issued. In addition, these criteria must continue to be met throughout the duration of the commercial operation issued with this permit.

These Regulations provide a basis for equal evaluation of permit applicants.

2.2 EXTENT OF MARINE MAMMAL BASED TOURISM

In New Zealand it is possible to watch and/or swim with, on a regular basis, five species of dolphins, six species of whales and two species of pinnipeds. These include:

 dusky dolphins (*Lagenorhynchus obscurus*)

 common dolphins (*Delphinus delphis*)

 bottlenose dolphins (*Tursiops truncatus*)

 Hector's dolphins (*Cephalorhynchus hectori*)

 killer whales (*Orcinus orca*)

 sperm whales (*Physeter macrocephalus*)

 Bryde's whales (*Balaenoptera edeni*)

 New Zealand fur seals (*Arctocephalus forsteri*)

 New Zealand (Hooker's) sea lions (*Phocarctos hookeri*)

In addition, the following may occasionally be encountered:

 pilot whales (*Globicephala melas*)

 southern right whale dolphins (*Lissodelphis peronii*)

 false killer whales (*Pseudorca crassidens*)

 minke whales (*Balaenoptera acutorostrata*)

Out of 14 DOC Conservancies, ten (Northland, Waikato, Bay of Plenty, Wanganui/Taranaki, Wellington, Nelson/Marlborough, West Coast, Canterbury, Otago and Southland) have some form of commercial wild marine mammal based tourism. Only Auckland, East Coast, Hawke's Bay and the land-locked Tongariro/Taupo Conservancies have none.

In May 1997, a survey was posted to the officer responsible for marine mammal protection in each of the DOC Conservancies with the potential for marine mammal based tourism (Tongariro/Taupo was the only Conservancy not sent a questionnaire). All surveys were completed and promptly returned. The survey asked questions about the number of permits issued and currently operational, how many permits were pending, which species of marine mammal were targeted, whether the permit allowed the use of a boat or aircraft or was land-based, what season the permits were operational, whether a levy system was in

place and if not, whether the Conservancy would support the establishment of a levy, whether the Conservancy had any research currently under way on marine mammals and if not, whether they would like to see research being conducted, and finally, which aspects of the industry they felt needed evaluation.

Table 1 shows the current number of permits issued for marine mammal based tourism and the extent of the operations. 'Permits Pending' shows the number of full applications that have been received for consideration for a permit, but this does not necessarily mean that permits will be issued. The actual number of tourists wishing to go on trips means that the majority do not utilise the total number of trips allowable under their permits during the off-peak seasons.

Northland

There are ten permits which allow twelve vessels to operate. Permits have been issued for interaction with all species, but the commercial operators primarily operate (year-round) swim-with-dolphin tours based on bottlenose and common dolphins. During spring there is a peak in sightings of Bryde's whales, which are opportunistically sighted by the operators. Humpbacks are seen occasionally. Four of these permits (five vessels) are not solely dedicated to swim-with-dolphin tours but are part of day sailing and diving trips.

Auckland

Currently there are no permits issued in the Auckland Conservancy area, although one is pending.

TABLE 1. SUMMARY OF THE STATUS OF THE NUMBER OF PERMITS AND APPLICATIONS RECEIVED IN EACH DOC CONSERVANCY.

	PERMITS ISSUED					PERMITS PENDING					PERMITS FOR AIRCRAFT				
	S	D	W	S/D	All	S	D	W	S/D	All	S	D	W	S/D	All
Northland					10		4								
Auckland															
Waikato					1					1					
Bay of Plenty					4					3					
East Coast															
Hawke's Bay															
Wanganui				2					1						
Wellington	1L, 1b				1										
Nelson/Marlborough	4L, 4b			8	18	3		20	4					5	
West Coast					7	1			1						
Canterbury							5								
Otago	5L	1		2	1	1L			1	2					
Southland	1L			1	2	1			10	2					
TOTAL	16	1	0	13	44	16	9	20	17	8	0	0	0	0	5

S, seals; D, dolphins; W, whales; S/D, seals and dolphins; All, all species of marine mammals; L, land-based operation; b, boat-based operation

Waikato

A single permit has been issued for all marine mammals, but the operator primarily runs year round swim-with-dolphin tours targeting common and bottlenose dolphins off Whitianga.

Bay of Plenty

Permits have been issued for interaction with all species, but the operators primarily run year-round tours based on common dolphins. None of the permits allows swimming with seals. One of the permits is for marine mammal viewing only, i.e. no swimming with dolphins or seals. All permits pending are for swimming with and viewing marine mammals. One of these applications is for a change to a current viewing-only permit to also allow swimming.

East Coast

Currently there are no permits issued within the East Coast Conservancy, although some of the operators permitted by the Bay of Plenty conservancy utilise East Coast waters. There are no permits pending.

Hawke's Bay

Currently there are no permits issued to interact with wild marine mammals within the Hawke's Bay Conservancy and no permits are pending. Napier has the only captive dolphin facility in New Zealand and it is possible to swim with four common dolphins at Napier Marineland. They allow five one-hour sessions per day with no more than four swimmers in the water at any time. The swim is constantly supervised, but the dolphins are not directed by the trainer. One end of the pool is excluded to the swimmers to allow the dolphins a form of 'sanctuary'. This is available year-round but during the winter months only three sessions per day occur (G. McDonald pers. comm.).

Wanganui

Permits have been issued for boat-based interaction with seals and dolphins. One permit involves fur seal watching for 80% of the year. The other permit is issued as part of a diving trip and allows swimming with dolphins and seals. Common dolphins are observed primarily during summer and are encountered on only 10% of trips.

Wellington

Of the three permits issued (one for Cape Palliser and two for Kapiti Island), one is for boat-based seal-watching, one is for land-based seal-swimming and one is for viewing all species of marine mammals. All three permits encompass interaction with marine mammals as part of their tours but not as the main focus. Operators are able to opportunistically view marine mammals year-round. There are seals present year-round, but the operator is required to avoid known breeding areas in order to minimise harassment.

Nelson/Marlborough

The majority of permits issued are for the Kaikoura area. Many of the on-water and aircraft permits have been issued for all species of marine mammals. Some

	PERMITS OPERATING				
	S	D	W	S/D	All
					10
					1
					4
			2		
1L,1b					1
4L,4b			8		16
					4
	5				
5	1				
1			1		2
	16	6	0	11	38

companies operate more than one vessel from their permits, e.g. Kaikoura Whale Watch operates four vessels from two permits. All permits are operational year-round, but there is a notable decline in dolphin and seal-swimming operations over winter. Some of the applications are for seals, dolphins and also for killer whales, which are included under the regulations regarding whales. The decision to include killer whales and not all species of whale in some permits was made in order to decrease the number of vessels interacting with sperm whales off Kaikoura. All permits 'pending' are applicants and all of these applications for land, boat and aircraft operations are currently on hold. Only three of the applications (for seal-watching) are outside the Kaikoura region.

Species targeted are primarily sperm whales, dusky dolphins and New Zealand fur seals. A summary of the maximum permitted number of trips per week in Kaikoura showed a potential total of 365 trips per week to watch or swim with marine mammals. This includes:

- whale-watch boats (1 company, 4 boats)—112 trips per week,
- dolphin/seal watch/swim boats (3 operators, 4 boats)—78 trips per week,
- boat-based seal swimming (4 operators, 4 boats)—119 trips per week,
- land-based seal swimming (2 operators)—35 trips per week,
- land-based seal watching (2 operators)—21 trips per week (average estimate).

West Coast

Of the seven permits issued, there are currently only four which are operational but the remainder will commence operations in the summer of 1997-98. All operators are primarily targeting Hector's dolphins and New Zealand fur seals but are permitted to encounter all species of marine mammals. Only one commercial operator is permitted to swim with seals and dolphins, but swimming with Hector's dolphins is not permitted in this conservancy. Of the two permits pending, one is for land-based seal-watching and one for boat-based seal and dolphin watching.

Canterbury

Five operators are currently taking commercial dolphin watching/swimming tours to interact primarily with Hector's dolphins in the Banks Peninsula area over the summer and autumn months. None of these operators has been issued a permit and currently all five permits are pending. Permits have not been issued to these operators because of a High Court ruling regarding Maori rights to marine mammal based tourism under the Treaty of Waitangi.

Otago

Many of these permits have been issued to interact with marine mammals as part of their normal operations. Viewing of sea lions is increasing in popularity on the Otago Peninsula.

Southland

Of the four permits currently issued, only one is specifically targeting marine mammals and this is for viewing only. The other permitted operators run boat trips and opportunistically encounter marine mammals as part of their tour. All

operators are permitted year round but most tours run regularly from November to April and primarily encounter dusky dolphins, common dolphins, bottlenose dolphins, New Zealand fur seals, New Zealand sea lions, and Hector's dolphins. Only one operator is permitted to focus on Hector's dolphins and swimming is not allowed. Two of the permits pending are for the use of helicopters to watch all species of marine mammals. The Southland Conservancy is responsible for management of New Zealand's sub-Antarctic Islands.

2.3 OVERVIEW

Marine mammal based tourism in New Zealand is a wide-ranging, species-diverse industry with an increasing demand for permits from land, boat and air-based platforms. A total of 74 permits have been issued from the far north to Stewart Island. The region with the most concentrated effort is Kaikoura. The Nelson/Marlborough Conservancy is the only one with marine mammal watching from aircraft, although there are applications for consideration in the Southland Conservancy. Even though operators focus on a number of species, a recent comprehensive survey of 60 marine mammal based tourism operators found the most popular activity reported was seal-watching (53%), then wildlife viewing cruises (44%) (Beasley 1997). This survey found 58% of operators never swam with seals or sea lions, which suggests that, while viewing was popular, swimming was generally not. New Zealand fur seals were the most frequently targeted species (28%) followed by bottlenose dolphins (23%). Beasley (1997) found 62% of the operators in her survey remained open for tours year round although there was a decline in tourist numbers during the winter months (April-October).

There are a variety of permits for commercial marine mammal tourism issued by DOC including viewing all species of marine mammals and swimming with dolphins and seals (for example Northland); marine mammal viewing only (for example Bay of Plenty); interacting with dolphins, seals and killer whales only (for example Kaikoura); viewing dolphins and seals only (for example West Coast); viewing dolphins only (for example Southland). There are operators with permits which include marine mammals on an opportunistic basis as part of an overall sight-seeing tour (for example Southland). Some operators have times when they are excluded from interacting with certain animals, e.g. the New Zealand fur seals during the breeding season off Wellington. If all criteria of the Marine Mammals Protection Regulations are fulfilled, permits are issued on the basis of the plan of operation which is required as part of the application (R. Suisted pers. comm.) and which operators are bound to observe as a condition of their permit.

In addition to the commercial tours there is an as yet unquantified number of recreational and non-permitted charter vessels interacting with marine mammals in response to growing tourist demand. These operations, too, are bound by the Marine Mammals Protection Act 1978 and must be managed so as to minimise impacts. On-water monitoring of vessels coming into contact with marine mammals occurs in a few areas, e.g. Kaikoura and the Bay of Islands, but is limited by financial constraints despite providing an effective public education opportunity.

3. Research on the impacts of tourism on marine mammals in New Zealand

Research has only recently begun to address the non-lethal effects of human activities on marine mammals. Despite the rapid increase in marine mammal based tourism ventures, the effects of the underwater noise created by boats and aircraft and the physical presence of swimmers and land-based visitors are poorly understood. Research on the effects of tourism has tended to focus on baleen whales exposed to the well-established whale-watching industry off coastal USA (Beach & Weinrich 1989, IFAW 1995). As the development of commercial dolphin-watching and seal-watching is a relatively new occurrence in most places, information on the effects of tourism on these animals is limited.

3.1 PINNIPEDS

There has been little research effort on the impact of tourism on seal and sea lion populations, either in New Zealand or globally. The New Zealand fur seal and the New Zealand (Hooker's) sea lion are the species primarily targeted by operators.

3.1.1 Impacts on sea lions

Research on the New Zealand sea lion has been concentrated in the sub-Antarctic Auckland Islands, where the main breeding colonies are found (Cawthorn 1993, Gales 1995, Gales & Mattlin 1997). There are few recent records of breeding on the New Zealand mainland, but predominantly sub-adult males are known to haul-out on Stewart Island, the Otago Peninsula and The Catlins (McConkey 1994, Gales 1995). DOC has produced a long-term conservation strategy aimed at increasing the numbers of sea lions by reducing potential threats, primarily from the 'take' of sea lions as bycatch in the sub-Antarctic squid fishery (Gales 1995). The overall aim is to have sea lions removed from their current threatened status, and the establishment of two new breeding colonies outside the Auckland Islands will contribute to this. Establishment in other areas will decrease the potential for a sudden catastrophic event, e.g. disease, to cause the population to decline to a non-viable number.

Tourism targets the sea lions at Enderby Island (Auckland Islands), The Catlins and the Otago Peninsula. The number of sea lions on the mainland has been slowly increasing, with animals regularly seen on 14 beaches along the Otago Peninsula (McConkey 1994) and at two beaches at The Catlins (Heinrich 1996a). These mainland haul-out sites have been the subject of recent and ongoing research into the effects of tourism on the sea lions.

Research on the impact of eco-tourism on the yellow-eyed penguins and New Zealand sea lions at Sandfly Bay and Papanui Beach on the Otago Peninsula was completed in 1996 (Wright 1998). One of the aims of this research was to assess whether approaches by people had any short-term or immediate effect on the sea lions. This study was conducted over a short (eight day) period during February 1996 and assessed the responses of male sea lions only. A series of controlled approaches by two people to a distance of 5, 10 and 20 metres were conducted. No differences were found in the behaviour of sea lions with proximity of people. These results differed from those of Beentjes (1989), who found that the sea lions at the same beach would not tolerate an approach much closer than 10 metres. One possibility is that the sea lions in this area have become habituated to close approaches by humans, as the Papanui sea lions are accessible over private land and mainly exposed to controlled tour groups of 6-10 people.

Wright (1998) recommended further research on the behaviour of female sea lions, as it differs considerably from that of males. She also recommended continued monitoring of sea lions in other areas to assess the levels of tolerance to human visitation and possible changes over time. If numbers continue to increase on the mainland, this may result in the sea lions being crowded into preferred areas. Males tend to defend a space around themselves as a territory, but the behavioural implications of crowding and aggression towards humans are unknown.

Research by Sonja Heinrich is focusing on the population dynamics and effects of interactions between visitors and male sea lions at haul-out sites on The Catlins (Heinrich 1996a). In an unpublished preliminary report of encounters between sea lions and visitors at Roaring Bay, Nugget Point, from December 1995 to March 1996, Heinrich (1996b) observed 706 visitors, who were mainly unguided travellers and residents from The Catlins area. Only 38 of them were accompanied by guides. Although the majority of visitors remained at a distance to observe the sea lions, she witnessed three instances where people accidentally approached them and eleven cases of deliberate harassment. People approached or aroused sea lions to get them to sit up for photographs, and on five occasions threw stones at animals to upset them. Many of these close approaches or harassment events resulted in the sea lion charging at the people or moving away from them.

Deliberate harassment of sea lions at The Catlins and the Otago Peninsula has also been reported by Gales (1995). Instances where sea lions have been shot and run over with a vehicle have been reported on the Otago Peninsula (S. Childerhouse pers. comm.). There is concern that harassment could have an impact on the establishment of breeding colonies by females (A. Pillai pers. comm.); to date, breeding on the Otago Peninsula has been limited to one female (McConkey 1994).

Responsiveness to humans varies with breeding status of sea lions (Richardson et al. 1995). The peak in tourist numbers coincides with the breeding season of sea lions, when levels of aggression in males are elevated (Gales 1995, M. Cawthorn pers. comm.). This poses a potential danger to visitors coming too close to the animals, and recommendations have been made to erect information

boards about the sea lions and appropriate behaviour when observing them (Heinrich 1996b).

3.1.2 Impacts on seals

There is no reported research on the impact of human disturbance on New Zealand fur seals. Richardson et al. (1995) reported short-term responses of fur seals to human disturbance. This may be seen as temporary displacement from haul-out sites or increased vigilance by sitting up or moving away from the source of disturbance. Seals have been known to habituate to the presence of tour boats but will remain vigilant in other areas. This may be related to breeding stage or age and experience of the animals (Richardson et al. 1995).

Increasing numbers of tourists to the Kaikoura area cause increased pressure on the seals found along exposed highways and public viewing areas (S. Edmunds pers. comm.). As the peak in tourist numbers coincides with the summer breeding months for New Zealand fur seals, disturbance to breeding males and females with pups is likely. Fortunately, habitat excludes tourists from accessing many seal colonies (R. Mattlin pers. comm.).

There has been no research on the commercial operators' impact on the fur seals, although there are reports of commercial operators chasing fur seals into the water in order to swim with them (S. Edmunds pers. comm.). In Kaikoura, where there are both land- and boat-based operators with a maximum allowance of 154 trips per week (although this maximum number of trips is rarely fulfilled), the cumulative effect of these tours combined with the visitors encountering seals along the Peninsula walk is unknown. Seals hauled-out along this area of coast have been subjected to close approaches by unguided land-based visitors, but when attempting to avoid this disturbance by moving into the nearest water, they encounter guided swim-with-seal tourists (pers. obs.). The effects of such harassment are unknown but could result in an aggressive response by the animals such as charging or biting. The consequences of such responses are quite serious and incidents involving tourists being bitten by fur seals have been reported (S. Edmunds pers. comm.).

3.2 EFFECTS OF VESSELS ON CETACEANS

The long-term impacts on cetacean populations from behavioural changes associated with boat disturbance are currently poorly known. The effects may be seen as avoidance of areas at certain times (e.g. humpback whales near Maui (Corkeron 1995) and the bottlenose dolphins of Sarasota Bay (Wells 1993)), disruption to behavioural patterns (e.g. interruption of feeding or resting behaviour), or changes in habitat use and population viability.

There are currently four research projects assessing the impact of boat traffic on dolphins in New Zealand.

3.2.1 Hector's dolphins, Porpoise Bay

Data on the impact of dolphin-watching vessels on the Hector's dolphins found in Porpoise Bay, Southland, were collected over two summer seasons from 1995

to 1997 (Bejder 1997). A theodolite was used to track the dolphins' behaviour and movement patterns, both with and without the presence of boats (commercial and recreational) and recreational swimmers. Bejder & Dawson (1998) reported that dolphins were accompanied by one or more vessels for 12.4% of the total observation period (251 hours). They found that dolphins were not displaced by the presence of boats but did respond to the presence of the dolphin-watching boat. Analyses showed that the dolphins approached the vessel mainly during the initial stages of the encounter (10–50 minutes). Even though they did approach the boat during the first 10 minutes, this was not at a significant level. The research showed that after 70 minutes the dolphins did not approach the boat as frequently as expected and that even though they weren't necessarily avoiding the boat, their interest decreased beyond 70 minutes interaction time. Even though the dolphins were interacting with the vessel they formed significantly tighter pods when the boat was present. This behaviour has been observed in other species (Irvine et al. 1981, Au & Perryman 1982) and could be an indicator of the need for greater protection within the group as they may perceive the vessel to be a threat. So even though the dolphins do not avoid the boats, interactions with boats may still be stressful for them.

3.2.2 Dusky dolphins, Kaikoura

The dusky dolphins of Kaikoura are currently the subject of two research projects on the impacts of tourism on the population. One project has involved the use of a theodolite to track the movements over four extended summer seasons (October–May) of the main group of dolphins and any small satellite groups which frequently comprise mother/calf pairs (Würsig & Yin 1994). Data on the movement of tour, recreational and fishing vessels were also collected. Analyses of dolphin movements, speed and behaviour relative to boat movements and speed are under way. In addition, boat-based photo-identification data and acoustic data were collected to better understand the population (Würsig & Yin 1994). Because of the number of tourist boats interacting with the dolphins, it has often been difficult to collect data from control situations in which no boats were present (pers. obs., S. Yin pers. comm.). Fortunately the dusky dolphins of Kaikoura were the subject of a four-year (1984–1988) research project on their habitat use, foraging ecology and behaviour (Cipriano 1992, Würsig et al. 1991). This research was conducted prior to the development of commercial swim-with-dolphin tours, and the dolphins were exposed to only moderate levels of fishing and recreational traffic at that time. The research used theodolite tracking as the primary method of data collection, although some individuals were fitted with a radio transmitter to track their movements; this showed that one dolphin tagged in Kaikoura travelled at least as far north as Cape Palliser (B. Würsig, pers. comm.). This research provides a useful baseline for the comparison of dusky dolphin movements before they were regularly targeted by boats.

DOC -commissioned research on the movements of the main group of dusky dolphins has been completed by Kirsty Barr (Barr 1997). This research involved two extended summer seasons (October–April) of data collection using a theodolite as the primary research tool. Data on movements of the main group of dusky dolphins with the presence and absence of tourist, recreational and

fishing vessels were analysed. Barr (1997) found that dolphins were accompanied by vessels for 72% of the observation period. This figure significantly increased from the first field season (65.23%) to the second field season (78.28%) and was due to increased communication between vessels telling the dolphins position and thereby reducing search time for the pod (Barr & Slooten 1998). Commercial dolphin and whale watching vessels made up the majority of boats encountering the dolphins (84.4%) whereas recreational vessels only accounted for 9.4% of the vessels present.

Barr (1997) found an increase in aerial activity with the presence of boats. This increase in activity may be due to excitement, an attempt to improve visual and acoustic communication due to the increase in underwater noise with the presence of boats, or may have indicated disturbance. Barr & Slooten (1998) found the dolphins formed tighter pods in the presence of boats during mid to late afternoon and suggested that disturbance of dolphins in the early afternoon may be detrimental as they normally enter a rest period during this time which may make them more sensitive to vessel presence.

3.2.3 Bottlenose and common dolphins, Bay of Islands

Research was completed in 1995 on the bottlenose and common dolphins in the Bay of Islands and the effects of commercial swim-with-dolphin tours on these populations (Constantine & Baker 1997). This DOC -commissioned research evaluated a number of aspects of these operations, including behavioural responses to the presence and absence of boats. The specific responses to swimmers are reviewed below. Over the 12 month research period, feeding behaviour by bottlenose dolphins was the behaviour least likely to change as the boat approached from 400 m to 100 m. Socialising behaviour was most likely to change. For common dolphins, resting was the behaviour least likely to change and socialising was most likely to change. There was a significant difference between species as bottlenose dolphins changed their behavioural state on 32% of approaches and common dolphins changed their behaviour on 52% of approaches.

Even though a number of the behavioural changes were to approach the boat and bowride and there were few avoidance responses observed, it is possible that the dolphins avoided the boat before they were observed. Observations were conducted from a commercial swim-with-dolphin vessel, so this type of avoidance behaviour was difficult to assess. Dusky dolphins have been observed changing direction away from approaching vessels and subsequently were not seen by the boat (S. Yin pers. comm.). It must also be considered that not all dolphins from all groups encountered would bowride, so it is most likely that less interactive individuals would distance themselves from the vessel whilst still maintaining contact with their group. This subtle form of avoidance is difficult to account for, but the research in Kaikoura may be able to determine the frequency of this behaviour.

During DOC monitoring and enforcement of the Marine Mammals Protection Regulations in the Bay of Islands from 1 March to 31 May 1997, Berghan (1997) found that the permitted operators accounted for 74% of the total contact duration with the dolphins and remained with the dolphins for an average of 57 minutes per interaction. Recreational vessels spent 14% of total contact duration

with the dolphins for an average of 8 minutes per interaction. This shows that the permitted operators account for the majority of time in which a vessel is in close proximity to the dolphins.

One of the limitations of conducting research on levels of boat disturbance in the Bay of Islands is the absence of suitable sites from which theodolite observations can be made. This means that the methods of data collection must account for the disturbance levels created by the presence of the research vessel (Shane 1990). Current research by Rochelle Constantine in Northland involves data collection on bottlenose dolphin responses to vessel traffic in order to determine if there are any long-term effects on the population.

3.2.4 Sperm whales

New Zealand is one of few places where sperm whales can be regularly sighted close to shore, and Kaikoura is the only place where regular sperm whale watching tours operate (MacGibbon 1991, Gordon et al. 1992). DOC-commissioned research showed sperm whales respond to the presence of whale-watching boats by having shorter respiratory intervals and decreased surface intervals (MacGibbon 1991). The study also found that whales responded negatively to rapid approaches, sudden changes in speed, and close approaches. Recommendations were made to modify boat handling around the whales and the use of hydrophones to allow better positioning of the vessel before the whale surfaced.

Many of the recommendations by MacGibbon (1991) were implemented, and in 1992, DOC commissioned a further study on the behavioural and acoustic effects of whale-watching vessels on the Kaikoura sperm whales (Gordon et al. 1992). This research found a considerable difference between responses of individual whales. Some were more tolerant of whale-watching vessels and subsequently received a greater amount of attention from these boats. Whales less tolerant of vessel traffic generally spent shorter periods of time at the surface and had shorter respiratory intervals. Whales subject to insensitive boat handling would often submerge without fluking (Gaskin 1964, MacGibbon 1991, Gordon et al. 1992, pers. obs.). Gordon et al. (1992) expressed concern that the reduced surface duration might result in shorter dive times for the whales and a subsequent reduction in foraging efficiency. They also noted the small six metre rigid hulled inflatable vessels used at that time by the whale-watch industry produced an engine noise at frequencies close to the creak vocalisations of whales. However, they were unable to assess the potential impact of this noise in masking the whales' vocalisations.

A DOC report on the effects of underwater noise from tourist operations (Marrett 1992) focused on the effects of noise on the sperm whales exposed to tourism off Kaikoura. In a series of controlled pass-bys by boats, planes and helicopters, it was found that noise levels at a depth of 75 m were not particularly loud and would probably constitute minimal harassment, although at this depth boats were noisier underwater than helicopters, and helicopters were noisier than planes. At the surface, vessels with low frequency sounds produced least noise, and it was suggested that if the whale remained at or near the surface this noise should be kept to a minimum. At a distance of 75 m from a whale on the surface, helicopters and planes were noisier than boats.

Marrett (1992) concluded that the noise levels produced by tourist traffic in Kaikoura were well within the range of current background noise levels, e.g. shipping and ambient sound, but recommended that sudden noises in the presence of whales must be avoided. Helicopters should not hover over a whale at the surface as this increases the noise levels, and planes should not 'buzz' whales. By circling around the whales, aircraft could minimise the potential for harassment.

3.2.5 Dolphins and porpoises

Dolphins in coastal waters, particularly bottlenose dolphins, are increasingly the target for commercial dolphin-watching tours and recreational boat users. They are often tolerant of close approaches by boats and sometimes will initiate the approach to boats in order to bowride, but are they also known to avoid boats (Shane et al. 1986, pers. obs.).

Common dolphins sometimes avoid approaching ships, beginning evasive behaviours at some distance, and appearing to change their travel as the ships' course changed (Au & Perryman 1982). It appears that some dolphins react to the sound of an approaching vessel to optimise their avoidance behaviour (Salvado et al. 1992). Cases of avoidance could occur before observers spotted the dolphins and lead to an overall underestimate of negative responses to the presence of boats (Constantine 1995). The type of grouping together and fleeing behaviour observed overseas on occasion is consistent with that reported for dolphins in the eastern tropical Pacific (Au & Perryman 1982) and in the Bay of Islands when disturbed (Constantine 1995).

The effects of these evasive manoeuvres on shipboard censuses of dolphins is discussed by Hewitt (1985). With the use of a helicopter to determine the accuracy of line transect sampling from a research ship, it was found that 8% of dolphin groups moved to avoid the ship before being detected by onboard observers. Theodolite tracking of dolphins from land allows a more accurate assessment of dolphin response to the presence of vessels as the researchers are not themselves a potential source of disturbance (Würsig & Yin 1995, Bejder 1997). Overseas land-based research of harbour porpoise (Evans et al. 1993), suggested that a decrease in avoidance behaviour later in the season may have occurred because the animals had habituated to the presence of vessels or because the calves had grown and were less vulnerable.

Land-based observations of bottlenose dolphins in the Moray Firth, Scotland showed a significant decrease in the number of surfacings by dolphins after a boat had encountered them (Janik & Thompson 1996). Research on the same population of dolphins showed an increase in the behaviours 'stop' (milling), 'change of direction' and 'prolonged diving' when vessels were present (Lütkebohle 1995). 'Changing direction' and 'prolonged dives' were interpreted as avoidance behaviour and were similar to those seen in the Bay of Islands (Constantine 1995).

Individual differences between dolphins are no doubt a major contributor to tolerance levels and responses to vessel traffic. The behaviour of the group prior to approach also has an effect on the response (Shane 1990, Constantine 1995, Ritter 1996, S. Yin pers. comm.). Generally, feeding and socialising dolphins are

more tolerant of the presence of boats and less likely to show an avoidance response.

There are few study sites with detailed long-term observations, and the long-term impacts on cetacean populations from behavioural changes associated with boat disturbance are currently poorly known. Land-based research on spinner dolphins in Kealahou Bay, Hawaii, (Barber 1993) suggests that dolphins exposed to repeated visits by boats and swimmers will shorten their periods of resting behaviour (Würsig 1996). Other effects may be seen as avoidance of areas at certain times (e.g., humpback whales near Maui and the bottlenose dolphins of Sarasota Bay), disruption to behavioural patterns (e.g., interruption of feeding or resting behaviour) or changes in habitat use and population viability.

Populations of resident or semi-resident dolphins as found in Doubtful Sound (Williams et al. 1993, Schneider 1995) are likely to be exposed to greater impacts from boat traffic. These dolphins may avoid boats or may habituate to the presence of boats.

3.3 VESSEL NOISE

As the majority of dolphin- and whale-watching is conducted by motorised vessels, the effects of vessel noise and presence is a primary concern. Reeves (1992) undertook a DOC-commissioned review of whale responses to anthropogenic sounds.

As part of a report for DOC on the impacts of marine mammal watching in the Bay of Islands (see Constantine & Baker 1997), research was conducted on the acoustic impact of vessels on the bottlenose and common dolphins (Helweg 1995). This research aimed to assess noise levels from three swim-with-dolphin vessels; *Tutunui*, a 14 m jet propelled diesel engine catamaran; *Discovery I* and *Discovery II*, two 6.6 m aluminium hulled vessels, one propelled by two 90 hp outboard engines and the other by a single 175 hp engine. Data were collected during a controlled series of pass-bys and engine start-ups.

All three vessels had a peak frequency of sound below the highest sound detectable by both species of dolphins. As the dolphins are sensitive to the sounds produced by the vessels, Helweg (1995) suggested that they could learn to identify the vessels by their sound. Irvine et al. (1981) found that dolphins could identify the vessel involved in their capture for research, and would avoid this vessel.

Helweg (1995) found no detectable changes in the acoustic behaviour of common dolphins with the presence of swim-with-dolphin vessels. Bottlenose dolphin acoustics were recorded on three occasions. On two occasions, a high-intensity burst-pulse sound known as a 'ratchet' was recorded, once when a vessel started its engine, and once when swimmers entered the water. This sound has been recorded in situations where there are high levels of stress, and it has been suggested that this may be a sound associated with alarm or 'anger' (Dreher & Evans 1964, in Finley et al. 1990, Herman & Tavolga 1980). Similar sounds by beluga whales were heard during periods of disturbance by shipping

in the Arctic. The coincidence of these sounds with panic movement, suggested the calls were a type of alarm signal (Finley et al. 1990). Helweg (1995) mentions the interpretation of bottlenose dolphin ratchet sounds should be made with caution as knowledge of the intended receiver was uncertain and the sample size small.

On two of three recorded occasions when swimmers entered the water in the Bay of Islands, bottlenose dolphins went silent (Helweg 1995). Whether this silence is a type of 'freeze' response as seen with narwhals when disturbed by vessel traffic in the Arctic (Finley et al. 1990) or a period in which the dolphins are assessing the disturbance of the swimmers is unknown.

3.4 SWIMMING WITH DOLPHINS

Commercial tours which allow watching or swimming with dolphins are a more recent form of marine mammal based tourism. As almost all swim-with-dolphin tours are conducted from a boat, it is difficult to isolate the dolphins' response to the swimmers from the confounding effect of vessel presence. Many countries do not have commercial swim-with-dolphin tours even though dolphin watching is increasing in popularity, but it is possible to swim with both captive and wild dolphins in New Zealand.

3.4.1 **Swimming with wild dolphins**

New Zealand currently has four research projects: bottlenose dolphins of Northland, Hector's dolphins of Porpoise Bay, and two studies on the dusky dolphins near Kaikoura, assessing the impact of swimmers on dolphin behaviour. Three of the projects involve data collection on the impact of the swim-with-dolphin boats as well as swimmers from them. The research on the Hector's dolphins of Porpoise Bay, Southland, is assessing the impact of recreational swimmers, as the commercial dolphin-watching operator is not permitted to offer swims with the dolphins.

Bottlenose and common dolphins, Bay of Islands

A one year preliminary study on the bottlenose and common dolphins in the Bay of Islands assessed the method of swimmer placement, i.e. in the path of travel, line abreast, or when the dolphins were around the boat, and its impact on dolphin response, i.e. approach, avoidance, or neutral (Constantine & Baker 1997). A swim was attempted with only 37% of all dolphin groups encountered, which reduced the potential impact from swimmers. As was observed for the bottlenose dolphins of Port Phillip Bay, Australia (Weir et al. 1996), the strategy for swimmer entry into the water influenced the dolphins' response. The risk of bottlenose and common dolphins avoiding swimmers was greatest for the 'in path' strategy for swimmer placement. This strategy is in direct conflict with the Marine Mammal Regulations 1992, Regulation 18 (k), under which it is illegal to cut off the path of travel of a dolphin. The 'line abreast' strategy resulted in the lowest rate of avoidance by the dolphins but also had a lower rate of sustained interaction (i.e. where at least one dolphin came within 5 m of at least one swimmer).

The 48% sustained interaction rate found in the Bay of Islands bottlenose dolphin study (Constantine 1995) contrasts with the low rate in Port Phillip Bay, Australia (Weir et al. 1996). A possible reason is the small group sizes of dolphins most commonly seen in Port Phillip Bay, which may be less tolerant of disturbance by swimmers. The lower interaction rate could also be a result of attempts to swim with groups containing juveniles, or with dolphins engaged in all behaviours including resting and feeding in Port Phillip Bay. In the Bay of Islands, regulations prohibit swimming in these situations.

Hector's dolphins, Porpoise Bay

Over two summer seasons, data were collected on swimmers entering the water from the beach to swim with Hector's dolphins in Porpoise Bay (Bejder 1997). A total of 56 swim attempts were observed and swimmers were within 200m of the dolphins for 11.2% of the total observation time. There were no boat-based swim attempts as this is not allowed in Porpoise Bay.

Bejder (1997) found that dolphins remained within 200 m of the swimmers for more than five minutes on 57.1 % of swim attempts. Because the swimmers enter the water from the beach, the impact was minimised, as swimmers were unable to pursue a dolphin in the same manner as swimmers entering the water from a vessel. The research found that dolphins formed significantly tighter pods when the boat was present and that the presence of swimmers also increased the probability of the group remaining in a tight state. Bejder (1997) found that the dolphins extensively used a small area at the southern end of the Bay and concluded that it is an important area for them. This is also the preferred area for recreational swimming and was where the majority of encounters took place. Given that there was some impact from the swimmers, an increase in the number of recreational swimmers in this preferred area of the Bay may have an impact in the long term.

Dusky dolphins, Kaikoura

Research by Kirsty Barr on the dusky dolphins off the Kaikoura coast involved data collection from the commercial swim-with-dolphin operators boats as well as land-based observations. Boat-based data collected on the number of dolphins interacting with the swimmers found, on average, nine out of an average group size of 350 dolphins would interact with swimmers (Barr 1997). As photo-identification was not used in Barr's research, the exact number of dolphins interacting with swimmers would have been difficult to count, so this number should be interpreted with caution. Barr (1997) found that commercial swim-with-dolphin vessels would spend an average of 43 minutes with the dolphins per trip and the swimmers spent an average of 40 minutes of this time in the water. Similar observations that only a small percentage of the total group of dusky dolphins would interact with swimmers are reported from the four year study by Suzanne Yin (S. Yin pers. comm.).

The observations made by Yin and Barr of only a small number of dolphins interacting with swimmers is consistent with observations of both bottlenose and common dolphins in the Bay of Islands (pers. obs.). The issue of exactly which dolphins are interacting with swimmers (i.e. are certain individuals more likely to interact with swimmers than others?) is being addressed by Rochelle Constantine as part of her research on bottlenose dolphins of Northland.

3.4.2 Swimming with captive dolphins

In New Zealand it is possible to swim with four captive common dolphins at Napier Marineland. There are up to five one hour swim sessions per day which are supervised by a trainer, but the dolphins are not directed by the trainer during the swim. One end of the pool has been restricted for dolphins only to provide a sanctuary area for them. There has been no research conducted on behavioural responses to swimmers outside standard husbandry practices (G. MacDonald pers. comm.).

3.5 FEEDING WILD DOLPHINS

In New Zealand, the Marine Mammals Protection Regulations 1992, section 18(d) state “no rubbish or food shall be thrown near or around any marine mammal”, making it illegal to feed dolphins, seals or whales. Although commercial dolphin feeding tourism does not exist in New Zealand, the increased public interest in marine mammals has resulted in situations where members of the public have attempted to feed dolphins (pers. obs.).

3.6 LONE SOCIABLE WILD DOLPHINS

There are a number of examples of lone, sociable dolphins (see Lockyer 1990 for a review), some of which have received considerable public attention and become the focus of tourism. Occasionally an apparently solitary dolphin will actively seek out human contact on a regular basis. Even though these dolphins have the freedom to swim away, they will often allow people to touch them and will involve them in apparent play activities (Alpers 1960, Lockyer 1990, Doak 1995).

For many years there have been recorded cases of lone, sociable dolphins off the coast of New Zealand (see Doak 1995, for a review). One of the best known was Opo, a female bottlenose dolphin from the Hokianga Harbour (Alpers 1960, Lee-Johnson & Lee-Johnson 1994). Opo attracted up to two thousand tourists per weekend to come to observe or interact with her during the mid-1950s. Fisheries (Dolphin Protection) Regulations became law in 1956 with a special provision making it illegal to take or molest any dolphin in the Hokianga Harbour. Shortly after this law became effective, Opo was found dead. Some reports suggest she became trapped in a tidal pool when the tide went out (Alpers 1960). Others suggest an underwater explosive device was detonated and harmed the dolphin (Doak 1995).

Maui or Woody is a female bottlenose dolphin which has a minimum home range which extends from the Mikiui River, south of Kaikoura to the Marlborough Sounds. Maui was first seen interacting with people in the Kaikoura area around 1992 (D. Buurman pers. comm.). At that time there were two companies taking regular swim-with-dolphin tours. One company made a policy of not targeting Maui for tourism (B. McFadden pers. comm.). When the other company encountered Maui, they would only allow small groups of swimmers in the water (D. Buurman pers. comm.). Similar caution was exercised by the dolphin-

watching operator in the Marlborough Sounds. The general caution by all tour boats and local boaties combined with strict enforcement of the regulations by DOC resulted in Maui receiving a limited amount of contact with people, which minimised the potential for harassment. In early 1994, Maui was observed interacting less with people and more with the dusky dolphins (D. Buurman pers. comm.). Since this time there has been less interaction between Maui and swimmers, even though she is frequently seen bowriding and interacting with vessels. Her behaviour toward swimmers has changed and now she is less interactive with humans on most occasions. In March 1997, Maui was observed with a newborn calf in the Marlborough Sounds (Z. Battersby pers. comm.).

3.7 VISITOR ATTITUDES AND EXPECTATIONS FROM MARINE MAMMAL BASED TOURISM

Commercial operators have the objective of providing a good experience for their passengers. They also have the responsibility to adhere to regulations and to minimise their impact on the wildlife. In her research on commercial wildlife viewing, Paula Wilson found that operators were the crucial link between the administrators charged with protecting wildlife, i.e. DOC, and the tourists who utilise the natural resources for recreation (Wilson 1993). In a survey of tourists partaking in a variety of wildlife based tours, she found that generally participants were well educated and from upper socio-economic groups. This finding was supported by Amante-Helweg (1995) and Beasley (1997). Her research also found that DOC had greater control over the actions of the operators of marine mammal based tours than other types of tours because of the permit required under the Marine Mammals Protection Act 1978. This was found to be a crucial factor in the planning and management of tours by these operators, and resulted in a relatively consistent standard of operation (Wilson 1993).

In 1995, Verna Amante-Helweg investigated the cultural perspectives of people aboard one of the swim-with-dolphin tours offered in the Bay of Islands. Of the 306 people interviewed after the tour, 96% stated they enjoyed the experience, even though 53% of them did not get to swim with dolphins (Amante-Helweg 1995). Analyses of data collected on participants' beliefs, knowledge, personal values and demographic characteristics, showed that most people interpreted dolphin behaviour anthropomorphically, and 11% of the respondents were of the opinion that "dolphins are here for my enjoyment" (Amante-Helweg 1995 p.73). Most expressed altruistic opinions, but, although 58% of participants were confident about their knowledge of animals, only 33% correctly answered factual questions relating to cetaceans. Because an increase in knowledge about cetaceans based on the commentary provided by the operator could be expected, 33% of correct responses is probably higher than if the participants had been questioned before the trip.

In a comprehensive study on the educational implications and legislation regarding marine mammal tourism (Beasley 1997), 60 permitted marine mammal tourism operators were surveyed, as well as 285 participants on swim-with-dolphin tours at Akaroa, Banks Peninsula. The research sought to identify the

quality and sources of information provided by operators and the awareness of the visitors. Beasley (1997) found that the majority (70%) of operators focused their education on aspects of conservation and threats to marine mammals and conservation of the environment (68%). Approximately 60% of operators placed emphasis on marine mammal feeding, social behaviour, and prey. Surveys of the participants showed that this information was of the greatest interest, so it appeared that the operators were consistent with the tourists' expectations of the commentary. The operators' information was obtained mainly from books and personal experience and was not checked for scientific accuracy. Very few operators relied on DOC for access to information despite the DOC production of a booklet on marine mammals (Beasley 1997). Most operators provided inadequate additional information outside the tour commentary for the tourists. The provision of commentary and extra information was highlighted by tourists as being important.

A comparison of the tourists in Akaroa Harbour and Hong Kong found that both groups were generally well educated and from higher socio-economic groups (Beasley 1997). Questionnaires answered prior to the tour were compared with those answered at the conclusion of the tour. This comparison showed an increase in overall knowledge of marine mammals and the environment by the tourists, at least in the short-term.

3.8 OVERVIEW OF RESEARCH

There are currently only two research projects in New Zealand evaluating the effects of tourism on marine mammals: Sonja Heinrich's research on the New Zealand sea lions of the Catlins and Rochelle Constantine's research on Northland's bottlenose dolphin population. Given the rapid increase in the number of permits issued for marine mammal based tourism and the findings of recent research that species respond in different ways to vessels, a more diverse range of research projects should be considered.

The majority of research overseas has focused on the effects of vessels and aircraft on baleen cetaceans (see Appendix 1). In New Zealand, toothed cetaceans and pinnipeds form the basis of the marine mammal based tourism industry. We are one of few countries which allow swimming with dolphins and seals. Given that there are few published data on the effects of swim-with-seal tours, perhaps this is an area of research that should be considered, especially with fur seals being the most frequently encountered marine mammal (and this peaks during their summer breeding season) and with reports of people being bitten and chased by seals and sea lions.

Boat and aircraft noise has been shown to affect some species of marine mammals. There is an inadequate database on the acoustic impacts of both recreational and commercial vessels on dolphins and sperm whales. As the ability of cetaceans to communicate and forage is frequently dependent on their acoustic perceptions, this area of research should not be underestimated. Research overseas has focused on baleen cetaceans but research on sperm whales in Kaikoura conducted in the early 1990s provided valuable management

information. A repeat of this work would be helpful, as Kaikoura Whale Watch has changed the boats used on their tours.

One of the most important aspects of evaluating the effects of tourism on marine mammals is the presence of pre-disturbance baseline data on the population size, habitat use, home range and behavioural ecology of the target species. Fortunately these data exist for some species (for example the Hector's dolphins near Banks Peninsula), but for many others (for example bottlenose dolphins in the Bay of Islands) similar data were not collected prior to tourism being established. This makes it difficult to assess information on the sensitisation or habituation of a population exposed to tourism. As marine mammals are long-lived species with a complex social system and complex interaction with their environment, it may take many years until the effects of tourism are observed.

Given that New Zealand has quite strong legislation which fully protects marine mammals and very little information is available on the effectiveness of the educational material provided by commercial operators, perhaps a precautionary approach would be advisable. It may be that marine mammal based tourism does not protect and conserve marine mammals, but conversely reduces the viability of the species targeted by tourism. Only research will provide these answers and possible solutions to problems.

4. Management of marine mammal based tourism in New Zealand

The New Zealand Marine Mammals Protection Act 1978 (MMPA) has jurisdiction over the fourth largest Exclusive Economic Zone in the world (Donoghue 1996) and is considered one of the most progressive pieces of legislation for the protection of marine mammals (B. Würsig pers. comm.). In 1987, the newly formed DOC gained responsibility for implementing the MMPA from the Ministry of Agriculture and Fisheries. It was at about this time that the first commercial marine mammal based tourism venture began. In 1990 the Marine Mammals Protection Regulations were drafted to aid in controlling the developing whale-watching industry in Kaikoura. These regulations were revised in 1992 in response to the growth in marine mammal based tourism throughout New Zealand (Donoghue 1996).

The regulations are divided into sections relating to: the interpretation, application and purpose of the regulations; requirements for issuing permits; the suspension, revocation, restriction and amendment of permits; behaviour around marine mammals by boats, aircraft and vehicles, with special conditions for whales and dolphins and seals; and miscellaneous provisions.

4.1 WHALE-WATCHING

In New Zealand, the only place currently offering regular tours to encounter whales is Kaikoura. Many companies around New Zealand have whales which may occasionally be seen in their area included in their permit but this is not the main focus, although some interest has been expressed in the Bay of Islands area with regards to watching Bryde's whales. Given that there is one area of concentrated whale-watching, the industry is small in scale compared to the USA and Australia.

New Zealand has included all species commonly known as whales, i.e. baleen whales, sperm whales, beaked whales, killer whales and pilot whales, within its Marine Mammals Protection Regulations 1992. The commercial operators generally treat encounters with killer whales, false killer whales, and pilot whales as if they were dolphins (pers. obs.), and on a few occasions commercial operators have placed swimmers in the water with these species (J. Berghan pers. comm.). Although encounters with these species are generally infrequent, the continued interpretation of these species as whales rather than dolphins is advisable, given knowledge of their attacks on other cetacean species (Jefferson et al. 1991, Palacios & Mate 1996, Weller et al. 1996, Constantine et al. 1998) and one DOC unmented report of an attack on a swimmer (Shane 1993).

4.2 DOLPHINS

New Zealand is one of few countries which allow commercial swim-with-dolphin tours in the wild controlled by a permit based system. Research by Weir et al. (1996) in Port Phillip, Australia, highlighted avoidance behaviours by dolphins when swimmers were placed in the water in situations which are deemed illegal under the New Zealand regulations (e.g. towing swimmers through a pod of dolphins (NZ Regulation 20(a)) and swimming with juveniles (NZ Regulation 20 (b))). These preliminary observations suggest that the current New Zealand regulations may be effective in minimising some forms of disturbance to bottlenose dolphins from swim-with-dolphin tours.

Research by Beasley (1997) found that, although some permitted marine mammal tour operators thought the current DOC permit system was neither efficient nor well structured, positive responses slightly outweighed negative responses when operators were asked if the Marine Mammal Protection Regulations 1992 provided adequate protection for marine mammals in New Zealand; however, many operators provided a neutral response. Almost all operators agreed DOC should be the agency responsible for managing marine mammal tourism.

4.3 EDUCATION

The Marine Mammals Regulations 1992 section 6(e) states:

“That the proposed operator, and such of the operator's staff who may come into contact with marine mammals, should have sufficient experience with marine mammals.”

and section 6(h) states:

“That the commercial operation should have sufficient educational value to participants or to the public.”

These requirements are the link whereby marine mammals can benefit from this form of tourism. Guides providing factual information about the animals, their environment, aspects of the local ecology, and what people can do to improve the environment fulfil this requirement of the Regulations.

4.4 OTHER MANAGEMENT OPTIONS

Currently the industry is managed primarily by regulatory approaches which are often difficult to enforce. Other possible management options include the use of fees, creating special protected areas or seasons based on the marine mammals' behaviour, e.g. migration routes, or on species, e.g. the Banks Peninsula Sanctuary for Hector's dolphins.

Many forms of ecotourism have the potential to generate income for the protection and management of resources through the implementation of user fees or charges for the issuing of permits (Wells 1997). Marine mammal based tourism has high appeal to tourists and therefore provides the potential for a community to maximise the economic benefit from these animals, but this must be balanced with the conservation needs of the animals (Hvenegaard 1997).

In some circumstances the protection of an area, e.g. the gray whale breeding areas in the lagoons of Baja California Sur, Mexico, has not only given protection to the whales and their habitat but has instilled a guardianship role in local residents (Dedina & Young 1995). With the rapid growth in whale watching in this area (an 18.8% increase from 1996-1997) and the implementation of new regulations which require foreign vessels to hire local vessels and guides, local economies are benefiting from the presence of the whales and this has in turn has increased the value of the presence of the whales (Sánchez Pacheco 1997).

4.5 OVERVIEW OF MANAGEMENT STRATEGIES

There has been a rapid growth of this industry worldwide, although it appears to have reached a plateau in New Zealand. This growth has been responded to with a wide variation in management approaches, from none at all (Belize) to strongly legislative (New Zealand). In the USA there is strong legislation but an inflexible system with very little enforcement and this results in severe problems particularly with interactions with dolphins and pinnipeds (see Appendix 2). The rationale in the USA that it is illegal to harass whales and therefore there is no reason to issue permits to interact with whales is an interesting one. The problem is that it allows little control of the industry but has an advantage in that it does not differentiate in any way between commercial operators and recreational vessels. In Australia the multitude of differing laws, guidelines and regulations for each State has led to an uncoordinated industry which is growing rapidly, with few consistent

nationwide controls and in some cases differences between the public and commercial operators. The issuing of permits has caused some debate about rights under the Treaty of Waitangi.

Of the countries that are actively managing their marine mammal based tourism industries, the majority are using regulations to try and control approach distances, and numbers of vessels/aircraft; these vary depending on the types of marine mammals encountered. There is little information available on whether this industry educates participants about the animals encountered and their environment and if this is transferred into participant behavioural changes which improve the environment.

As management of this industry is still in its infancy, both in New Zealand and overseas, many areas are finding difficulty with enforcement of the regulations and guidelines. Research on the most efficient and effective management system could resolve some of the issues currently facing the industry.

In New Zealand, the majority of DOC Conservancies expressed some concern over the number of permits being issued and the lack of knowledge about the impacts of them. This attitude needs to be changed to one where a precautionary approach is instilled and the burden of proof shifts from those conserving the resource (DOC) to those wanting to use the resource (the permit applicants) (Mangel et al. 1996).

There are some variations in interpretation of the Regulations by DOC staff and operators, and in many cases these differ by species and area: some Conservancies have assisted with the development of a Code of Conduct, but in other Conservancies the operators have developed their own, independent of DOC input. The Southland Conservancy has produced a management strategy for commercial marine mammal viewing, and Northland and Waikato Conservancies have draft plans under way. These Conservation Management Strategies are in order to provide strategic direction to help guide the management of the local marine mammal based tourism industry and do not supersede the Marine Mammals Protection Act or Regulations. A few Conservancies expressed interest in implementing a moratorium on issuing new permits, and one has been issued recently on whale watching in Kaikoura, while others are being investigated (R. Suisted pers. comm.).

New Zealand has no standards relating to the quality of information given to the public and participants on marine mammal based tourism ventures. The portrayal of false expectations on advertising material from tourist operators, e.g. people reaching out to touch the animals or dolphins bowriding a fast moving vessel (Beasley 1996, pers. obs.), mislead the public. These images of often illegal acts do not reinforce appropriate behaviour around marine mammals, despite the other messages the tour may present. According to Beasley (1997), very few of the operators consult with DOC when obtaining information for their commentary. It would seem that better co-ordination of information between operators and DOC would ultimately be the best situation for protection of the marine mammals.

DOC needs to consider a nationwide approach to educating the general public about marine mammal legislation and appropriate behaviour around marine mammals. With the increased interest in marine mammals have come a number

of incidents whereby they are harassed, but this is more often through ignorance than intention to harm the animals.

It is important to assess the costs and benefits of this kind of tourism. Issuing permits for marine mammal based tourism makes the operators a stakeholder in the animals' welfare and may act as a conservation measure in the long run, but only if it does not cause any harassment to the animals. If the ability to profit from the mere presence of marine mammals were worth money to a local community, it might encourage a community to protect the animals from direct harassment or bycatch.

Examples where this is of some urgency due to the threatened status of the species are the New Zealand sea lion and the Hector's dolphins. Heinrich's (1996b) report is of some concern, as harassment by predominantly unguided tourists and locals could result in the sea lions avoiding this haul-out site. This is in direct contravention of the Marine Mammals Protection Act 1978 and the DOC recovery plan for removing New Zealand sea lions from the IUCN threatened species list (Gales 1995).

The issuing of permits has had several benefits, not least the change in attitude that has been brought about and which has resulted in an appreciation of the intrinsic value of marine mammals and a high degree of self-policing for avoiding harm to them, for example by fishers off Kaikoura and recreational tuna fishers in the Bay of Islands. Most permits are not issued for dedicated marine mammal viewing trips, but for water taxis and other tourist vessels, for example, the tourist vessels that have been operating in Milford Sound for many years: the issuing of permits gives DOC some degree of control over these operations (R. Suisted, pers. comm.).

Mangel et al. (1996) discuss the common occurrence where the use of wildlife often begins without knowledge of the possible effects on the target species. The 1990 regulations were originally designed to provide the Director-General of Conservation with guidelines for whale-watching, and they were then revised in 1992 to cope with the increase in dolphin-watching (Donoghue 1996). Given the recent findings of species-specific research on responses to marine mammal based tourism and the rapid growth of this industry, there is a need to consider further revisions to the regulations. The Department of Conservation is now undertaking a review of the regulations (R. Suisted, pers. comm.).

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7. Appendices

7.1 INTERNATIONAL RESEARCH ON EFFECTS OF TOURISM ON MARINE MAMMALS

Sea lions

Increased levels of aggression directed towards humans have been recorded for sea lions targeted by tourists at the Galapagos Islands (Boo 1990, in Wright 1996). In some areas off the coast of California, sea lions have become used to fish handouts and are now considered to be a threatening nuisance as they pursue people for food (NMFS 1995).

Research on the reactions of Californian sea lions to weekly human disturbance found many females and pups relocated (Stewart 1982, in Richardson et al. 1995). It was found that this species of sea lion was less disturbed by human presence than those on the Galapagos Islands, which could indicate some degree of habituation. The Australian sea lions at breeding sites were more wary of humans than those at a nearby nature reserve with a higher level of human contact (Stirling 1972). Lewis (1987, in Richardson et al. 1995) reported 22 out of 23 stampedes of northern sea lions were caused by human disturbance during censuses. Although not many pups were killed, there were changes in some animals' behaviour which included reduced mother-pup contact.

Seals

The United Kingdom and Ireland have at least 117 boat-based and land-based seal watching operations with an estimated 500,000 visitors in 1996 (Young 1997). Many of these tours operate without written regulations or guidelines for operation and the impact of these tours is relatively unknown. In 1993, an estimated 10,000 people visited the grey seal rookery at Donna Nook, England. This led to research by Lidgard (1996) on the effects of disturbance on the maternal behaviour of female grey seals at this site. In his preliminary report to the British Ecological Society, Lidgard notes that females in areas of high disturbance were more protective towards their pups, and this increased the chances of aggression directed at humans. He also noted a preference by seals to give birth in areas of low disturbance. Females in areas of high disturbance often gave birth later in the season and had a shorter lactation period. The increase in visitors in such areas may accentuate the increased vigilance of mother seals and the chance of harassment by males, and contribute to shorter lactation times and subsequently pups with a lowered growth rate. Similar research on harbour seals in California found that females hauling-out at disturbed sites had lower

pup production and higher pup mortality than those at non-disturbed sites (Allen & King 1991, in Lidgard 1996).

Aggressive responses by harassed seals have been seen off Long Island, New York, where, for example, seven cases of people being bitten by seals were reported to the National Marine Fisheries Service in 1994 (NMFS 1995).

Research on harp seals exposed to seal watching tours in the Gulf of St. Lawrence found that behaviour by mothers and pups, at least in the short-term, was altered by the presence of tourists (Kovacs & Innes 1990). The environmental conditions, numbers of seals and behaviour of the tourists all affected responses to human presence. Almost all aspects of mother-pup behaviour were affected; females attended their pups less, or when they did, they were more vigilant and spent less time suckling their pup. Pups were more active with the presence of humans, engaged in an increased level of agonistic behaviours, and rested less. With fewer seals, more people focused their attention on a small number of individuals, which resulted in a higher potential for disturbance to the animals. Kovacs and Innes (1990) suggested tourists should maintain a distance from the seals and reduce noise levels in order to minimise disturbance.

Effects of vessels on cetaceans

A comprehensive review by Richardson et al. (1995) discusses the effects of industrial activities such as seismic exploration, oil exploration and drilling, marine geophysical surveys, underwater explosions, sonars and vessel noise on marine mammals.

Little is known about the effects of aircraft on cetaceans. The behavioural state of the cetaceans and the type of aircraft often have an effect on the responses observed (Richardson et al. 1995). Some whales responded by diving or reducing their surface intervals, but only when the aircraft circled overhead. The altitude of the aircraft seemed to affect bowhead whale response, with lower altitudes (300 m) resulting in more conspicuous reactions than higher altitude (Richardson 1985, Richardson & Malme 1993).

Baleen whales

Gray whales

Whale watching based on gray whales began in the mid-1950s off the coast of the California. Since then the industry has grown rapidly and in recent years a number of studies focusing on the impact of whale watching vessels have been undertaken. A comprehensive five year research project on the impact of cruise boats taking tourists to watch gray whales in Laguna San Ignacio, Mexico, was prompted by claims of severe harassment of the whales using the lagoons for their winter breeding grounds (Wolman & Rice 1979). Restricted access was enforced in some of the lagoons and research on the population of gray whales and their response to vessel traffic began in 1977 (Jones & Swartz 1984). Responses of whales were influenced by the speed of approach and their behavioural state at the time. But even though the whales would sometimes respond to the presence of vessels, it was concluded that there was no major disruption to the breeding population in this area (Jones & Swartz 1984).

Generally, it was found that tour operators avoided disrupting whale behaviour as it caused the whales to flee and defeat the purpose of the trip. The researchers observed 'friendly' whales which would approach boats very closely and on occasion allow themselves to be touched by people. From this, and the general decline in avoidance response by the whales to boat traffic, Jones & Swartz (1984) concluded that the gray whales had, to some degree, become habituated.

Recent research on gray whales' foraging and movement patterns in Clayoquot Sound, British Columbia has shown that, during the period 1991-1994, the whales moved 20 km further away from the main commercial whale watching port of Tofino (Duffus 1996). This study was unable to attribute the change in habitat use to the presence of the vessels, as the animals appeared not to return to the area each year and therefore were not subject to the annual pressures of whale-watching vessels. Research on the population and habitat use during the 1993-1994 season found only 25-50% of photo-identified animals returned to the area. The researchers considered that a mixture of ecological and human influences affected the whales' use of the area, and recommended ongoing monitoring of movements and responses to whale-watching boats.

Humpback whales

Research conducted over a 25 year period off the coast of Cape Cod, Massachusetts found a degree of habituation by humpback, minke, fin and northern right whales (Watkins 1986). This research began in 1956, before whale-watching activities began in the 1970s. The researchers concluded that individuals in local waters had considerable exposure to boating activities, and a change in behaviour over time was evident. These responses varied from minke whales' initial interest in vessels changing to generally uninterested responses and humpback whales' frequently negative responses changing to often strongly interested or positive responses.

Humpback whales are subject to considerable levels of vessel traffic due to their frequent near-shore habitat use. The Cape Cod area is one example of relatively tolerant whales, but off southeast Alaska, the whales seem less tolerant of vessel traffic, e.g. in Glacier Bay National Park, which forms part of their summer feeding grounds. In the summer of 1970 only four large ships entered Glacier Bay, but in 1977, there were 143 large ships and a number of small recreational and tour vessels (NPS/NMFS, 1984, Baker et al. 1988). In midsummer 1978 all but three out of approximately 23 whales suddenly left Glacier Bay. This behaviour combined with the increase in boat traffic led to concern that the whales were being harassed. The resultant research found predictable short-term responses by whales to vessels operating at distances of less than four km; the speed, size, distance and number of vessels affected responses, which were observed as decreased blow intervals, increased dive times and avoidance of the vessels (Baker & Herman 1989).

Humpback whales wintering near the Hawaiian coast experience considerable levels of recreational and tour boat traffic. There was some concern that the movements of mother/calf pairs off the coast of Maui were affected by levels of boat traffic (Glockner-Ferrari & Ferrari 1985, in Reeves 1992). As the nearshore calf encounter rate decreased, there was an increase in sightings three to four

km. offshore, which suggested a shift to the less congested offshore waters (Salden 1988). Although there was no decrease in population size, the effects of boat traffic on mother/calf pairs could in the long term result in them being displaced to other areas. As the humpback whales encountered in Hawaii migrate to south east Alaska, research has shown that they receive disturbance at both ends of their range and it is argued the cumulative impact of this should be considered (Bauer et al. 1993). During a series of controlled experiments off Hawaii, Norris (1994) found that both song phase duration and unit duration were significantly affected with boat presence. Whether there is any significance to the breeding success of affected individuals is unknown. Herman & Antinaja (1977, in Reeves 1992) expressed concern about the levels of commercial and recreational boat traffic, planes and helicopters targeting the whales and an increase in boat strikes was noted by Glockner-Ferrari et al. (1987).

There are similar concerns about the levels and impact of whale watching vessels on humpback whales entering Hervey Bay, Queensland, Australia. From 1991-1992 there was a 47% increase in the number of tourists viewing whales. This resulted in a 16% increase in frequency of trips and a 14% rise in contact with pods of whales (Great Barrier Reef Marine Park Authority 1993). Research conducted by Corkeron (1995) found a number of short-term behavioural changes by the whales associated with the presence of whale-watching vessels. Pods containing calves dived when vessels were present, a behaviour rarely seen when boats were not present. Non-calf pods which were engaged in surface activities changed these activities when boats approached within 300 m. The increase in pectoral slaps and breaches may be attributed to increased levels of agonistic interactions and may increase underwater noise for communication between individuals. These hypotheses need further testing. The fact that there was a change in rates of behaviour, at least in the short term, is of concern, as Hervey Bay is frequented by mother/calf pairs on their migration route and, in the long term, displacement such as that seen off the coast of Maui may occur (Corkeron 1995).

Responses of humpback whales to aircraft is poorly studied (Richardson et al. 1995). Limited results from research near Kauai, Hawaii suggested that at least some pods, particularly those containing a calf or near the surface reacted to the presence of a twin-engine Cessna aircraft by increasing swimming speeds and increased changes in orientation (Smultea et al. 1995). The responses were short-term and the dataset was very small (n=10) so the results should be interpreted with caution.

Right whales

Right whales were less responsive than fin or humpback whales to noise off the Cape Cod coast (Watkins 1986). The right whales were consistently silent when boats were nearby, which may be a sign of disturbance. Approximately one third of all northern right whale mortality can be attributed to human activities including boat strikes (Kraus 1990), which indicates that the whales either fail to detect the presence of the vessel or are unable to avoid it in time. Southern right whales are generally tolerant of vessel traffic if the boat is handled cautiously (Richardson et al. 1995, N. Patenaude pers. comm.) and will often closely approach and bump vessels (Payne 1995, N. Patenaude pers. comm.).

Land-based research on the swimming speeds of southern right whales at Peninsula Valdés, Argentina, suggested the whales swam faster when disturbed (Alvarez Colombo et al. 1990, in Reeves 1992). In Patagonia, southern right whales, particularly mother/calf pods, will generally move away from boats circling them or approaching head on (Campagna et al. 1995).

Fin whales

Research on fin whales exposed to whale-watching vessel traffic in the St. Lawrence Estuary, Canada, found the whales responded to boats at distances of a kilometre or more (Edds & MacFarlane 1987). Whales were observed changing their path of travel to distance themselves from vessels, and there was some concern that an increase in the number of whale-watching tours per day could result in certain individuals being disturbed several times a day. Stone et al. (1992) found subtle differences between respiration rates and dive times of fin whales exposed to whale-watching tours off the coast of Maine, USA. The sample sizes for whales with boats present were small and it was concluded that the differences in whales were too small to constitute a definition of harassment.

Toothed cetaceans

Killer whales

Killer whales are subject to intense pressure from whale-watching vessels operating off the British Columbia and San Juan Islands' coastline (Duffus & Dearden 1993). A six week land-based study by Kruse (1991) showed the approach of boats affected the movements of killer whales off West Cracroft Island, British Columbia. The whales increased their swimming speeds as recreational and commercial vessels approached within 400 m of them. This data should be interpreted with caution due to the limited data collection period. Further research in the same area but with a focus on the Robson Bight rubbing beaches showed a disturbance response by the killer whales when vessels approached to within 300 m (Briggs 1991); the whales would rub for shorter periods or leave the area when disturbed by vessel traffic. Phillips & Baird (1993) discuss Otis's long-term research in the San Juan Islands which shows no change in killer whale behaviour in the presence of vessels and suggest that the whales may have become habituated to the presence of boats. A seven-year, land-based research project focusing on the killer whales of Haro Strait, Washington, is investigating different behaviours in the presence or absence of boats (Burgan & Otis 1995). Preliminary analysis has shown that the number and types of boats affected the whales' behaviour. Also behavioural differences were found between commercial and non-commercial boats, but no relationship was found between boat handling and whale behaviour. Designing a research project to adequately link behaviour to certain stimuli such as boat presence is difficult, but well designed long-term projects are more likely to be valuable for management purposes (Duffus & Baird 1995).

Land-based research on the effects of boat traffic on the killer whales of Tysfjord, Northern Norway, is under way, using theodolite tracking and video recording. A preliminary report (DeNardo 1996) shows that Tysfjord supports a population of at least 500 killer whales during October and November, when

they enter the area to feed on the overwintering herring stock. In recent years this has led to a rapid increase in recreational and tourist vessels coming to view the whales. Some observations of direct harassment by fishers have been recorded.

Beluga whales

Responses of beluga whales to tourist vessels on the St. Lawrence River were recorded by Blane (1990). Belugas exhibited avoidance behaviour by decreasing the intervals between surfacings and increasing their swimming speed (Blane & Jaakson 1995). There was a correlation between the increased number of boats present and an increase in intensity of response. Generally responses were short-term and in 75% of cases belugas resumed their pre-disturbance behaviour. Blane (1990) found that when engaged in feeding or travelling behaviours, belugas were less likely to react to boats, but when they did, it was generally a stronger response.

Belugas have also been observed avoiding fast, erratically moving small boats (Richardson et al. 1995). Blane (1990) found speed, direction and the number of vessels influenced the responses of belugas. Even so, they were still found in areas of high vessel use, which led Blane to conclude that these areas must be of considerable importance to the whales. There is a tenuous balance between the ecological significance of a particular area and the stresses placed on the animals. Therefore, it should not be assumed that the regular presence of animals in an area is an indication that the activities in the area have no impact. Caron & Sergeant (1988, in Richardson et al. 1995) found that, with increased levels of vessel activity in the Saguenay River, St. Lawrence Estuary, over a ten year period, there was a decrease in numbers of belugas using this area. In an acoustic study of the St. Lawrence belugas' environment, Scheifele (1997) found that noise levels in two of three study sites exceeded beluga hearing sensitivity curves to the extent that it was possible hearing damage would occur.

Sensitivity of belugas to shipping traffic in the Arctic was demonstrated by Finley et al. (1990). Belugas were found to flee the presence of vessels by undertaking long dives and were displaced by as much as 80 km. The production of 'scream' vocalisations accompanied their flee response. These sounds suggested an alarm signal, and similar sounds by stressed and excited bottlenose dolphins have been heard (Caldwell & Caldwell 1965).

Pilot whales

Research on the impact of whale-watching vessels on pilot whales off Tenerife, Canary Islands, found no significant difference in the behaviour of whales when boats were present or absent (Heimlich-Boran et al. 1994). It was observed that, with the presence of boats, pilot whales delayed surfacing and travelled in tighter groups but these observations were not statistically significant. Behaviours which suggested irritation were directed towards the research boat and could have been a response to harassment.

Dolphins and porpoises

Pelagic dolphins such as spinner dolphins (*Stenella longirostris*), spotted dolphins (*S. attenuata* and *S. coeruleoalba*) and common dolphins are known to avoid approaching ships (Au & Perryman 1982, Hewitt 1985). Avoidance

manoeuvres sometimes began at distances approaching the horizon, and evasive behaviours such as bunching of the group and flight occurred at distances of less than one mile (Au & Perryman 1982). The response of dolphins to approaching vessels suggested they changed their course of travel as the ships' course changed (Au & Perryman 1982). It appears that some dolphins react to the sound of an approaching vessel to optimise their avoidance behaviour (Salvado et al. 1992). The effects of these evasive manoeuvres on ship-board censuses of dolphins is discussed by Hewitt (1985). With the use of a helicopter to determine the accuracy of line transect sampling from a research ship, it was found that 8% of dolphin groups moved to avoid the ship before being detected by onboard observers. Of all groups observed (n=13), 38% reacted to the ships' approach. The dolphins subject to this research had probably been exposed to harassment by tuna seiners and may have become sensitised to the approach of these vessels (Norris et al. 1978, in Richardson et al. 1995).

Dolphins in coastal waters, which are increasingly the target for commercial dolphin-watching tours and recreational boat users will sometimes initiate an approach to boats in order to bowride, but are they also known to avoid boats (Shane et al. 1986, pers. obs.). Cases of avoidance could occur before observers spotted the dolphins and lead to an overall underestimate of negative responses to the presence of boats (Constantine 1995). Theodolite tracking of dolphins from land allows a more accurate assessment of dolphin response to the presence of vessels as the researcher are not themselves a potential source of disturbance (Würsig & Yin 1994, Bejder 1997). Theodolite tracking of harbour porpoise in south-east Shetland showed that avoidance responses to larger vessels and speed boats were more apparent than to slower moving vessels such as yachts (Evans et al. 1993). Although this was a short-term study, avoidance behaviour was observed to decrease later in the season, possibly because the animals had habituated to the presence of vessels or because the calves had grown and were less vulnerable. The latter hypothesis was supported by the greater avoidance response early in the season by mother/calf pairs.

Bottlenose dolphins have been observed avoiding boats which were involved in live-capture operations in Sarasota Bay (Irvine et al. 1981). This type of grouping together and fleeing behaviour is consistent with that reported for dolphins in the eastern tropical Pacific (Au & Perryman 1982) and in the Bay of Islands when disturbed (Constantine 1995). Land-based observations of bottlenose dolphins in the Moray Firth, Scotland showed a significant decrease in the number of surfacings by dolphins after a boat had encountered them (Janik & Thompson 1996). Most vessels targeting the dolphins were small recreational vessels but the 10 m dolphin-watching boat accounted for 22 of 34 (64%) interactions observed. The presence of the dolphin-watching vessel caused a significant decrease in the number of surfacings by the dolphins, but there was no significant change in behaviour with other boat traffic. Given that the dolphin-watching vessel targeted and manoeuvred to stay in contact with the dolphins, this may have increased their potential for harassment. Research on the same population of dolphins showed an increase in the behaviours 'stop' (milling), 'change of direction', and 'prolonged diving' when vessels were present (Lütkebohle 1995). Changing direction and prolonged dives were interpreted as avoidance behaviour and were similar to those seen in the Bay of Islands (Constantine 1995).

Individual differences between dolphins are no doubt a major contributor to tolerance levels and responses to vessel traffic. The behaviour of the group prior to approach also has an effect on the response (Shane 1990, Constantine 1995, Ritter 1996, S. Yin pers. comm.). Generally, feeding and socialising dolphins are more tolerant of the presence of boats and are less likely to show an avoidance response.

Many areas are exposed to high levels of boat traffic. In Sarasota Bay, Florida, resident dolphins often ignore or avoid recreational boats, and data show that individuals avoided channels with high levels of boat activity (Wells 1993). The increased incidence of boat strikes involving dolphins in Sarasota Bay correlated with periods of higher than average boat traffic (Wells & Scott 1997). Many of the dolphins struck by a boat were compromised in some way such as having a young calf present or a deformity which may have limited their ability to respond. Odell (1976, in Wells 1993) suggested that a decrease in abundance of bottlenose dolphins in Biscayne Bay, Florida, could be related to an increase in boat traffic. Populations of resident or semi-resident dolphins as found in the Moray Firth (Wilson 1995), Sarasota Bay (Wells 1991) and Doubtful Sound (Williams et al. 1993, Schneider 1995) are likely to be exposed to greater impacts from boat traffic. These dolphins may avoid boats or may habituate to the presence of boats, as seen in Ensenada De La Paz, Mexico, where the dolphins make no apparent modifications to their behaviour with the close presence of boats (Acevedo 1991).

There are few study sites with detailed long-term observations. Land-based research on the effects of human activities on the spinner dolphins using Kealakekua Bay, Hawaii, is currently under way (Barber 1993). These dolphins are targeted by swimmers and tourists in motorised boats and kayaks, despite this being illegal in the USA (Barber et al. 1995). Theodolite tracking data on the dolphins and their interaction with boats, kayaks and swimmers will be compared to long-term data collected on the population (Norris et al. 1994). The 25 years of data collected on the habitat use, behaviour and movement patterns of the Kealakekua population provide an excellent control with which to compare current observations (A. Barber pers. comm.). Preliminary analyses of these data has shown that dolphins exposed to repeated visits by boats and swimmers will shorten their periods of resting behaviour (Würsig 1996).

The long-term impacts on cetacean populations from behavioural changes associated with boat disturbance are currently poorly known. The effects may be seen as avoidance of areas at certain times (e.g. humpback whales near Maui and the bottlenose dolphins of Sarasota Bay), disruption to behavioural patterns (e.g. interruption of feeding or resting behaviour), or changes in habitat use and population viability.

Swimming with wild dolphins

Bottlenose dolphins - Australia

A recent two month study was conducted on a population of over 100 bottlenose dolphins which use the Port Phillip Bay, Melbourne, area (Weir et al. 1996). These dolphins are exposed to commercial swim-with-dolphin tours and high levels of recreational boat traffic. Three swim-with-dolphin vessels were

used as the research platform, supplemented by shore-based observations. Two of the operators in Port Phillip Bay use 'mermaid lines' to tow the swimmers behind the boat and position them nearer to the dolphins. One company did not use mermaid lines but instead used an underwater scooter to approach the dolphins. This research found an extremely low sustained interaction rate of 10%, i.e. when the dolphins remained within five m of the swimmers. A possible reason is the small group sizes of dolphins most commonly seen in Port Phillip Bay, which may be less tolerant of disturbance by swimmers. The lower interaction rate could also be a result of attempts to swim with groups containing juveniles, or with dolphins engaged in all behaviours including resting and feeding.

Weir et al. (1996) found that the approach strategy for swimmer placement significantly affected dolphin response. These findings are consistent with those of Constantine & Baker (1997) in New Zealand. The highest rate of avoidance behaviour was observed when the operators drove past the dolphins and veered into their path of travel (a 'J' manoeuvre). Even though this approach is quite invasive, it also had the highest rate of active interaction with swimmers. Weir et al. (1996) suggested that because the dolphins were forced to interact, some individuals may have acted as 'decoys' to take the pressure off the rest of the group. Another possibility is that the dolphins were simply unwilling to detour around the swimmers.

There are plans to create a sanctuary zone from Portsea to Nepean Bay in Port Phillip Bay (Weir et al. 1996), as there was a significantly higher rate of avoidance behaviour and a lower rate of interactive behaviour inside this area. Weir et al. (1996) suggested that the frequent presence of mother/calf pairs in this area combined with boat handling which resulted in dolphins being positioned between the shore and the boats may account for the increased levels of avoidance.

Research on the behavioural ecology of the bottlenose dolphins exposed to swim-with-dolphin tours in Western Australia is also under way (R. Donaldson pers. comm.). Although not focusing on the effects of tourism, it will assess the impact of the operation, which uses four underwater scooters and has up to 12 people in the water for up to two hours at a time (R. Donaldson pers. comm.).

Bottlenose dolphins - Japan

Research is being conducted on the bottlenose dolphin population near Mikura Island, Japan (K. Dudzinski & R. Soeda pers. comm.), which has been exposed to swim-with-dolphin tours since 1993. Currently there are no regulations to manage the industry at Mikura Island or at Ogasawara, the only other area where swimming-with-dolphins occurs in Japan. Population data have been collected every summer (May-October) since 1994. The research aims to collect land-based data on the effects of boat movements on the dolphins as well as continuing the boat-based photo-identification of individuals (R. Soeda pers. comm.).

Bottlenose dolphins - Florida

A comparative study on human interactions with free-ranging and captive bottlenose dolphins was conducted from 1990-1991 off the Florida Keys

(Frohoff & Packard 1995). Fourteen hours of video data were collected on free-ranging dolphins and their response to swimmers towed behind the boat. This research showed dolphin behaviour was variable and that the dolphins were in control of the level of interaction with swimmers. Dolphins did not always approach swimmers, but would often remain near them if the vessel's skipper decreased speed so that the swimmers could let go of the mermaid lines. The study did not elaborate on the categories for analysis and was reported in a subjective way which allowed little comparison with other recent studies.

Canary Islands

From September to December 1995, the cetaceans off La Gomera, Canary Islands, and the impacts of whale-watching tourism were the subject of research (Ritter 1996). On 52% of cetacean sightings, there was at least one swim attempt. The behavioural state and species targeted (pilot whales, rough toothed dolphins, bottlenose dolphins, Atlantic spotted dolphins, dense beaked whales, sei whales and sperm whales) affected the response to the swimmers. Atlantic spotted dolphins were most likely to approach swimmers, and pilot whales were most likely to show indifferent or neutral behaviour. Milling behaviour was most likely to result in an interaction between bottlenose dolphins, rough toothed dolphins, and pilot whales and swimmers. Travel and resting behaviours were least likely to result in an interaction (Ritter 1996). Because of the limited duration of this research and, for some species (e.g. sperm whales and sei whales), small sample sizes, some of the responses should be interpreted with caution.

Spotted dolphins - Bahamas

A long-term behavioural study on the spotted dolphins of the Bahamas has monitored the impacts of tour vessels on the population (D. Herzing, pers. comm.). Similar data were collected by Kathleen Duzinski (1996), but results of the impact of swimmers have not yet been published. It was observed that an increased level of boats regularly targeting the dolphins was associated with reports of dolphin aggression directed towards humans. Since then, the level of boat traffic has declined and so have the reports of aggression (D. Herzing pers. comm.).

Swimming with captive dolphins

The United States Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) permits four facilities to conduct swim-with-dolphin programmes with captive dolphins. These programmes were formerly under the jurisdiction of the National Marine Fisheries Service (NMFS), but a 1994 amendment to the Marine Mammals Protection Act transferred responsibility for captive facilities to APHIS (A. Terbush pers. comm.). The permits are subject to the results of research on the impacts of swimmers on the dolphins.

A comprehensive quantitative research project assessing all four facilities and the effects of swimmers on dolphin behaviour was completed for NMFS in 1994 (Samuels & Spradlin 1994, Samuels & Spradlin 1995). Swims were conducted under controlled situations, i.e. with the presence of a trainer regulating dolphins and swimmers, or uncontrolled situations, i.e. without the presence of a trainer. Uncontrolled swims involved a high level of agonistic behaviours

(aggression and submission) and sexual behaviours directed at swimmers. Controlled swims involved a considerably lower rate of such behaviours, and the trainers eliminated any agonistic behaviours that put the swimmers and dolphins at risk. The use of designated refuge areas where swimmers were not permitted to go was found to provide inadequate sanctuary from swimmers, as dolphins did not voluntarily utilise this area at one facility. This study also involved an assessment of dolphin behaviour during their free time, i.e. without swimmers or trainers, which showed the dolphins' behaviour was modified.

Few males are used in these swim programmes as they have been involved in agonistic encounters with swimmers involving serious injury (Marine Mammal Commission 1994, Samuels & Spradlin 1994). Occasional escalation of agonistic behaviours resulted in the swim being terminated for some participants before they sustained a serious injury.

At Sea World Gold Coast, Australia, there was concern at the levels of aggressive responses by bottlenose dolphins during their captive swim programmes (I. Brieze pers. comm.). This prompted a research project by Ilze Brieze, which involved data collection on controlled and uncontrolled swims as well as behaviour during the dolphins' free time. Preliminary analyses have shown results similar to those of Samuels & Spradlin (1994) (I. Brieze pers. comm.). Recommendations were made to Sea World management that swims should be conducted only under trainer-controlled situations. Currently Sea World offers two half hour swim sessions per day, involving up to ten people per session with two dolphins and two trainers (R. Deakin pers. comm.). Every aspect of dolphin and swimmer behaviour is controlled during the swim (pers. obs.). This strict level of control appears to be vital in order to safely manage interactions between captive bottlenose dolphins and humans. Even during controlled situations, agonistic behaviours signalling signs of disturbance or stress sometimes occurred (Samuels & Spradlin 1994, Frohoff & Packard 1995, I. Brieze pers. comm.).

Research on swims with wild bottlenose dolphins have shown avoidance responses and generally low numbers of interactive individuals within the focal group (Constantine 1995, pers. obs, S. Yin pers. comm.). The ability to avoid swimmers by moving away is limited in a captive situation and may account for the increase in aggression noted in captivity that is not apparent in wild swim situations. Future studies on swim-with-wild dolphin tours should evaluate the incidence of agonistic behaviours by the dolphins.

Feeding wild dolphins

USA

The issue of feed-the-dolphin cruises received considerable attention in the USA during the early 1990s, when over 70 commercial operations were active in the waters off Texas, Florida and South Carolina (Bryant 1994). Because of the rapid increase in these tours, the increasing number of private boaters feeding the dolphins, and the development of tours where people would swim with the dolphins and feed them in the water, NMFS commissioned research on the problem (Marine Mammal Commission 1994). This report, which involved consultation with six independent scientists, concluded that feeding wild

dolphins alters their natural behaviour and poses risks to the animals by changing their habitat use, calf-rearing abilities, and loss of wariness to humans (Bryant 1994, Marine Mammal Commission 1994).

In a few cases, individual dolphins had already become dependent on hand-outs from humans and would beg for fish and often become aggressive towards humans if not given any. Some people attempted to feed dolphins beer, pretzels and hooks baited with fish (Bryant 1994). Some of the dolphins were fed bait fish of poor nutritional value and, on occasion, when not fed, they would not resume hunting for themselves and suffered from malnutrition (R. Wells, pers. comm.). Since this report, the feeding of wild dolphins has been made illegal under the United States Marine Mammal Protection Act (1972) on the grounds that it constitutes harassment of the animals (Anon 1993, A. Terbush pers. comm.). Despite it being illegal, feeding dolphins and an increasing number of feed and swim-with-dolphin tours still continue, particularly along the Florida and Texas coasts (Seideman 1997). Seideman reports an increasing number of aggressive incidents by dolphins and harassment of dolphins in these areas.

Australia

In Australia there are three wild dolphin feeding programmes; in Monkey Mia, Western Australia; Bunbury, Western Australia; and Tangalooma, Moreton Island, Queensland. All three areas have a history of human/dolphin interactions which have involved uncontrolled feeding of bottlenose dolphins (Corkeron et al. 1990, Green & Corkeron 1991, Orams 1994, Wilson 1994).

All three areas have had management problems. At Tangalooma it took several months to reduce the level of forceful contact or 'pushy' behaviour directed at people by the dolphins when receiving fish from tourists (Orams et al. 1996). This behaviour has been virtually eliminated by feeding the dolphins in shallow water and using operant conditioning techniques to control behaviour. Research on the sociability of the eight provisioned dolphins when stationed at the hand-feeding area has shown increased levels of agonistic displays by specific individuals during feeding (Allen 1996). Observations of these provisioned dolphins when away from the hand-feeding area has shown no significant behavioural differences between them and non-resident dolphins in the bay (I. Brieze pers. comm.). Ongoing research is designed to detect any changes in the social behaviour and habitat use of the dolphins exposed to provisioning.

At Bunbury, people have fed the dolphins at the beach for a number of years. In the late 1980s an attempt was made to attract dolphins on a regular basis. No comprehensive research has been conducted on these dolphins and the effects of feeding them, but since regular provisioning began, an increase in begging behaviour and bait stealing has been reported (Wilson 1994). Currently, these dolphins are fed infrequently as a result of permit controls imposed by the Department of Conservation and Land Management (CALM), Western Australia.

At Monkey Mia, dolphins have been accepting fish from people for over three decades (Connor & Smolker 1985). Evidence of an abnormally high mortality rate of calves born to provisioned animals prompted CALM to commission a report on the situation (Wilson 1994). Research by Richards (1993, in Wilson 1994) found the survival rate of infants in the first year of life was 36% for

provisioned and 67% for non-provisioned mothers. These data should be interpreted with caution as the sample sizes were small. Differences in foraging strategies, associations, and calf rearing between wild and provisioned dolphins have been observed as part of an ongoing research project in Shark Bay (Smolker et al. 1992, Mann 1995, Wilson 1994, Connor et al. 1992).

Lone sociable wild dolphins

One of the best examples is Fungie or Dorad found near Dingle, Ireland. This male bottlenose dolphin has been regularly sighted in the area for the past ten years, and there are a number of small businesses which operate tours to interact with him (M. Müller pers. comm.).

Dudzinski et al. (1995) have reported an increase in unregulated tourism to encounter Pita, a female bottlenose dolphin in the waters off Belize. She has been seeking human contact for the past four years, and over time the number of people attempting to interact with her has increased. Groups of up to 30 swimmers at a time have entered the water with her and up to four boats at a time have targeted her for attention. One of the concerns with the increased number of people entering the water with Pita is the increased level of aggression aimed at swimmers (Dudzinski et al. 1995). She has pushed and bumped people forcefully with her rostrum and body. She has been observed positioning herself between the boat and swimmers, thereby preventing the swimmers from leaving the water, and on one occasion she pushed a swimmer away from the boat with her rostrum. In 1995, she injured a swimmer, and since then increased levels of aggression and sexual behaviour directed toward swimmers have been observed.

Increased levels of aggressive and sexual behaviours have been recorded for other lone, sociable dolphins and it appears to increase with age and levels of human contact with them (Lockyer 1990, Lockyer & Morris 1986, Bloom 1991). Cases of lone, sociable dolphins pinning divers to the sea bed, towing swimmers out to sea then preventing them from swimming back to shore and directed aggression towards swimmers have been recorded. The most extreme case reported involved Tião, a male bottlenose dolphin in Brazil. This dolphin was severely harassed by a number of people and its aggressive response resulted in 29 people being injured and one fatality (Santos 1997).

7.2 INTERNATIONAL MANAGEMENT OF MARINE MAMMAL BASED TOURISM

USA

In the USA marine mammals are protected under the Marine Mammal Protection Act (MMPA) 1978. It is illegal to 'take' all species of marine mammals except for scientific research, enhancement of species or stock, public display, commercial or educational photography and a small by-catch in commercial fisheries. Subsistence hunting is also permitted. The MMPA regulations (50 CCFR 216.3) defines 'take' to mean:

Harass, hunt, capture, collect or kill, or attempt to harass, hunt, capture, collect or kill any marine mammal. This includes, without limitation, any of the following:...; the negligent or intentional operation of an aircraft or vessel, or the doing of any other negligent or intentional act which results in disturbing or molesting a marine mammal; and feeding or attempting to feed a marine mammal in the wild.

'Harassment' is defined as:

any act of pursuit, torment, or annoyance which —

(i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or

(ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Under this law, the USA does not recognise commercial or recreational marine mammal based tourism ventures as being eligible for 'take' authorisation (A. Terbush pers. comm.). It is also illegal to operate commercial swim-with-marine mammal based tours and dolphin-feeding tours. However, it should be noted that a wide variety of commercial operators do in fact exist, including swim-with-wild dolphin tours and wild dolphin feeding tours. Ironically the MMPA allows a 'take' of marine mammals for aquariums, and in some cases the US Department of Agriculture's Animal and Plant Health Inspection Service (USDA/APHIS) allows both public feeding and swimming with captive dolphins (Samuels & Spradlin 1994).

Pinnipeds

All interactions with pinnipeds are encompassed by the MMPA. Any swim-with-sea lion or seal operations are considered as harassment and are subsequently illegal. People in the vicinity of pinniped haul-out sites may not approach closer than 100 yards and must move to a greater distance if the animals show signs of disturbance (Carlson 1996).

There has been an increase in the number of people feeding seals and sea lions along the coast of the USA. There are reports of sea lions along the California coast which have become accustomed to fish hand-outs and their decreased wariness of humans means they approach people to beg for food (NMFS 1995).

In some areas these animals are now a potentially dangerous nuisance and there are reports of people throwing seal bombs to deter them. NMFS is the government body responsible for enforcing the MMPA, and to help alleviate this problem they have increased their public education campaign on the dangers of feeding and approaching pinnipeds (A. Terbush pers. comm.).

Whale-watching

The USA does not have a permit system for commercial whale-watching tourism. These tours are meant to be conducted in a manner which does not harass ('take') the animals and therefore do not require permits under the MMPA (A. Terbush pers. comm.). It is illegal to swim-with-whales as these activities constitute harassment on the grounds that they involve acts of pursuit and have the potential to disrupt behavioural patterns (US Department of Commerce/NMFS 1990, NMFS 1995, Bryant 1994). This assumes that swimming with whales automatically constitutes harassment whilst boat approaches are assumed to be less likely to involve pursuit of the whales and subsequent harassment.

Under US federal law, all vessels are required to keep a minimum distance of 100 yards from whales.

There are separate guidelines for each of the five NMFS regions, and certain areas have special regulations relating to particularly vulnerable species or areas, e.g. humpback whales in Glacier Bay National Park; Massachusetts' northern right whales. Regulations regarding the angle of approach to the whales (no head-on approach), the numbers of vessels, and minimum approach distance exist in Hawaii for humpback whales.

The main species targeted in the USA are humpback whales (both summer and winter migrations), gray whales, fin whales, northern right whales, minke whales and blue whales. Many of the tours depend on the migration patterns of the target species, so they operate seasonally and many are affiliated with whale-watching organisations and independent cetacean research programmes. Off the Massachusetts coast, 18 of the 21 whale-watching operators offer onboard naturalists providing lectures to the tourists about the whales and the natural history of the area (Hoyt 1994).

Approximately half of the companies carry onboard researchers or provide research groups with regular photographic and positional data on the whales observed. As regulations can only protect the whales in the short term, the exchange of information and use of the whale-watching vessels as a research platform has provided a good opportunity to collect long-term data on the population demographics of the whales. Combined with other research on the impacts of whale-watching and general vessel traffic, there have been a number of studies on the whales targeted and the impacts of whale-watching tourism on these populations. One of the main factors is the long-term health and survival of the population. Many of the whales' responses to harassment are subtle and the effects of vessel presence and engine noise in the long term are currently unknown (Beach & Weinrich 1989).

Dolphins

Dolphin-watching is allowed in the USA, but feeding and swimming with dolphins constitute harassment and are therefore illegal. As with pinnipeds and whales, permits are not issued to interact with dolphins on the grounds that, under the MMPA, commercial operators should not be harassing the animals, therefore a permit to 'take' (harass) is not necessary. Despite the illegality of feeding and swimming with dolphins, there are a number of opportunities in the USA to join tours offering these kinds of activities. In Hawaii, there is research on the impact of humans on the spinner dolphins found in Kealakekua Bay (Barber 1993, Würsig et al. 1995), and the spinner dolphins of Midway Atoll are also the subject of research on the impacts of tourism (S. Yin pers. comm.). The spinner dolphins come close to shore during the day to rest and socialise, so it is considered important that they are able to perform these functions undisturbed (Norris et al. 1994). There are now at least six bays, mainly along the coast of the Big Island, Hawaii, where people can pay to interact with these dolphins (Würsig 1996). Swim-with-dolphin tours are also available off the coast of Florida (Frohoff & Packard 1995, Würsig 1996). Despite a well publicised legal battle to have feeding wild dolphins declared a form of harassment and a recent public education campaign on the issue of feeding wild dolphins and pinnipeds, feed-the-dolphin tours are still available in some parts of the USA and members of the general public often still feed dolphins (Seideman 1997, B. Würsig pers. comm.).

Australia

Whale-watching

Like New Zealand, Australia has a permit system to manage their whale-watching industry. These permits are issued by each State but are bound by the Whale Protection Act 1980. This legislation encompasses regulations regarding the angle of approach to the whales (no head-on approach), the numbers of vessels targeting a whale or whales (no more than three), a minimum approach distance (no less than 100 m) and the minimum distance for aircraft (300 m). These regulations are similar to the New Zealand regulations governing behaviour around whales, and are currently under review.

Each State has drafted its own legislation regarding behaviour around marine mammals.

- In Queensland, a draft document 'Conservation Plans for Whales and Dolphins in Queensland' under section 106 of the Nature Conservation Act 1992 has been prepared. As with all State documents, this encompasses the legislation bound by the Whale Protection Act but disallows the use of helicopters for whale-watching purposes. The maximum penalty for breaching the regulations is A\$6,000.
- New South Wales has legislation protecting whales under the National Parks and Wildlife Act 1974. They have given special consideration to jetskis, which are allowed to approach no closer than 300 m (other vessels are allowed to approach a non-mother/calf pair to 100 m). Helicopters must maintain a distance of 400 m instead of 300 m for other aircraft. The maximum penalty for breaching the regulations is A\$100,000.

- Victoria has legislation encompassed by the Wildlife Regulations 1990, under section 85A of the Wildlife Act 1975. There are no notable differences from the federal legislation, except that the maximum penalty for breaching the regulations is A\$4,000.
- South Australia's legislation is covered by the National Parks and Wildlife Act, Section 68. Their legislation is divided into inshore and offshore guidelines. Inshore guidelines allow a vessel to approach no closer than 300 m to the whale; offshore an approach is permitted no closer than 100 m. Helicopters are not allowed to operate for whale-watching purposes. There is no maximum penalty for infringing the regulations, but a Bill is currently being considered in Parliament.
- Western Australia has a Marine Mammal Interaction (Whale Watch) Licensee system. This system has guidelines similar to those in the Whale Protection Act and is administered by the Department of Conservation and Land Management. The maximum penalty for breaching the licensee system is A\$10,000. Legislation specific to management of marine mammal tourism is currently being drafted (N. Gales pers. comm.).

Whale watching as a tourist activity has grown rapidly in recent years in Australia. It is possible to observe whales off the Queensland, New South Wales, Victoria, South Australia and Western Australian coastlines. These tours are seasonal, and target the migrating humpback and southern right whales. In South Australia it is possible to watch southern right whales from cliffs overlooking the bay area where they congregate during winter. The development of this as a non-invasive method of watching whales is being promoted in Australia.

The most popular whale-watching area is at Hervey Bay, Queensland, where the first commercial whale-watching vessels began operating in 1987. In Hervey Bay, whales are protected under the Marine Parks Act as well as the Fisheries Act and the Whale Protection Act.

Dolphins

In Australia there are commercial dolphin-watching tours available in Victoria, Western Australia, Queensland, New South Wales, Tasmania and South Australia. Dolphin based tourism was estimated to account for approximately 40% of all cetacean based tourism in Australia and primarily targets bottlenose dolphins, humpback dolphins and common dolphins (Anderson et al. 1995). There is no national permit system, but instead the individual States run licensing systems or guidelines under their State legislation. Most tours are for dolphin-watching only, but in Port Phillip Bay, Victoria, and Rockingham, Western Australia, it is possible to swim with dolphins (Weir et al. 1996; R. Donaldson pers. comm.). In 1995 the operators in Port Phillip Bay developed a voluntary code of practice, and this is currently under review as Regulations are being drafted (W. Dunn pers. comm.).

United Kingdom

Pinnipeds

The UK currently has no legislation which directly accounts for the impact of seal watching (Young 1998). There are many statutes under which seals are covered and the Conservation of Seals Act 1970 primarily deals with lethal takes of seals. This Act deals with management of seals as a resource but only with regard to the sale of seal products rather than as a resource for tourism.

In the UK and Ireland, there are currently a total of 117 land and boat-based seal watching operations (Young 1998). The majority of these are in Scotland (79 operators) as this country has the largest grey seal and common seal populations in the UK. Approximately 500,000 tourists visited the seals in 1996, with 36% of the visitors stating that viewing wildlife was the main aim of their visit. Most of the tours included seal watching as part of a general wildlife watching trip and the peak in seal watching was generally from September-October.

Young (1998) found many of the commercial operators belonged to their local tourism boards, but very few had endorsement from other recognised local bodies. With the apparent increase in seal watching activities in this area and the lack of regulations governing the activities of operators, it is possible that seals will face increased levels of harassment. Given that some operators target the haul-out sites with mothers and pups, this should be closely monitored by research on the impacts of human disturbance on these animals, e.g. Lidgard (1996). Young (1998) suggested the development of legislation protecting the seals from human disturbance and enhancing the conservation and education values of such tours.

Dolphins

In Scotland, England and Wales, voluntary guidelines recommending types of approach, allowing no more than three boats within one km of dolphins at any time, and prohibiting touching, feeding or swimming with dolphins have been developed by independent organisations. In Scotland, the Dolphin Space Programme has been established in order to promote an accreditation scheme for wildlife cruise operators in the Moray Firth (Arnold 1997). The accreditation scheme has been designed in the absence of legislation specifically protecting dolphins from the impacts of tourism, and aims to set local standards for minimally invasive dolphin-watching tours. In 1990 there was one boat-based dolphin watching tour in the Moray Firth, but the increase to nine operators offering tours in 1996 led to concern about the growth of this industry and the subsequent need for some form of control. A proposal for standardised guidelines within the United Kingdom was put forward at the 1997 IWC meeting to standardise codes of conduct such as the example in Ceredigion Bay (Tasker et al. 1997).

Other countries

Whale-watching

The global increase in whale-watching has resulted in a wide range of protection laws and methods of regulating the industry. Some nations have laws which specifically protect all marine mammals, e.g. the United States Marine Mammal

Protection Act 1972; Australia's Whale Protection Act 1980, Argentina's Law 2381/84 and the New Zealand Marine Mammals Protection Act 1978. Other nations have marine mammals protected in part under other laws, e.g. South Africa's Sea Fishery Act 1988; the Habitats Regulations of the European Union 1994, and the Ley General del Equilibrio Ecológico y la Protección al Ambiente, Mexico. In South Africa, it is illegal to approach a whale closer than 300 m but there is currently pressure from commercial whale-watching operators to change the law to allow closer approaches (K. Findlay pers. comm.)

Most countries do not protect their marine mammals by law, but in response to the increase in whale-watching tourism some nations are currently developing guidelines to help manage the industry. One example is Norway, where in 1991 there was only one operator targeting the killer whales feeding on herring in Tysfjord, but by 1996 this had increased to eight operators with 13 vessels targeting the whales. No regulations existed to control these operations (C. De Nardo pers. comm.). In 1996 guidelines were introduced to Tysfjord, and guidelines are also in operation on the Lofoten Islands, but there are no national laws or regulations protecting whales from tourism in Norwegian waters (Carlson 1996, DeNardo 1996).

A survey of the regulations and guidelines governing whale-watching around the world was conducted by the International Fund for Animal Welfare (IFAW) (Carlson 1996). This report found the majority of nations have general guidelines that often vary between species and seasons, e.g. in British Columbia, Barkley Sound and Clayoquot Sound have regulations for whale-watching (primarily gray whales) which differ from the Johnstone Strait Whale Watching Guidelines (primarily killer whales). Also guidelines may differ by area, e.g. the humpback whales of Glacier Bay have special regulations as they occupy a National Park area; the humpback whales which frequent the Hervey Bay Marine Park, Australia, area have special regulations because the area is protected; gray whales in the San Ignacio Lagoon and Laguna Ojo de Liebre are afforded special protection by the Instituto Nacional de Ecología, and the Brazilian government have established the Environmental Protection Area of Anhatomirim to protect tucuxi dolphins from tourism and fishing activities. In some areas certain species may be excluded from tourism as a conservation measure, e.g. the St. Lawrence River, where beluga whales must be excluded from the species of whales sought for whale-watching; if a beluga is encountered, the vessel must slow down and proceed at a speed of less than five knots before continuing the direction of travel.

It is possible to swim-with-whales in a few countries, e.g. humpback whales in Tonga and Niue; sperm whales in the Galapagos, and a variety of species of whales (primarily pilot whales and dense beaked whales) off the Canary Islands (Heimlich-Boran et al. 1994, Ritter 1996). These countries have no laws for the protection of whales but do have guidelines to recommend approach types in order to minimise the potential for harassment. Some countries' guidelines explicitly forbid swimming with whales e.g., Turks Islands and Caicos Islands, Caribbean; Ogasawara Islands, Japan.

Dominica and the Galapagos Islands have guidelines relating specifically to behaviour around sperm whales. Neither country has legislation to protect marine mammals, but these guidelines have been developed in conjunction with

local operators, government officials and scientists (Carlson 1996). The guidelines for the Galapagos Islands sperm whales are similar to those in New Zealand, although swimming with the whales is allowed. In Dominic the regulations are more stringent than those in New Zealand; only two vessels are allowed within 300 m of a sperm whale, vessels are only allowed to stay with the whales for three dive sequences, no whale or group of whales is allowed to be visited for more than three dive sequences per day, interaction with a group of socialising whales must be limited to 15 minutes, and helicopters are not allowed to be used for whale-watching purposes.

Dolphins

Dolphin based tourism ventures are increasing in number but still account for a small part of the overall global market for marine mammal based tourism (Hoyt 1995). A few countries include dolphins and porpoises in their laws to protect whales, e.g. Australia, Brazil, and the USA, but the majority of nations have no law for dolphin protection.

Specific guidelines for behaviour around dolphins have been included in the New Zealand regulations, and in guidelines developed in Dominica, the Canary Islands, and the United Kingdom (Sea Watch Foundation, Whale and Dolphin Conservation Society 1995, Carlson 1996, Arnold 1997). Some areas have developed guidelines for operating around dolphins but find these are often not adhered to when there is a lack of legislative enforcement, e.g. in Victoria, Australia (Weir et al. 1996) and the Bahamas (D. Herzing & K. Dudzinski pers. comm.).