Management of seal tourism in New Zealand – Tourism and the New Zealand fur seal in the Bay of Plenty

Submitted by

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ABSTRACT

Pinniped (seal, sea lion and walrus) tourism is an expanding industry, popularized due to the playful and interactive nature of seals. The industry can have positive outcomes for pinnipeds, through education and the promotion of conservation issues, or negative outcomes, such as causing the animals to abandon sites. The impact of tourism on pinnipeds needs to be minimal for the industry to be considered sustainable. Within New Zealand, pinniped tourism principally targets the New Zealand fur seal (*Arctophoca australis forsteri)*, a recovering species which is increasing in number around New Zealand's coast as it recolonizes parts of its former range. One of these regions is the Bay of Plenty, in New Zealand's North Island, where tour operators take customers to view and swim with the seals. This study investigated human-seal interactions during both seal viewing and seal-swim activities, primarily in the Whakatane region of the Bay of Plenty. The major aim of this study was to evaluate the effects of tourism on the seals and to assess and make recommendations for the sustainability of the industry. It also aimed to determine whether a range of variables influenced seal response during tourism activities, including: location, colony size, sex/age classes, time of day, duration of stay, distance, month and stage in the breeding season. Seals-swims were usually observed from on board a licenced marine mammal tour vessel (*n* = 16 seal-swims), and controlled approaches were conducted from on board an independent research vessel (*n* = 68 surveys). Video footage of seals in the absence of vessels was taken from a land vantage point to collect control seal behavioural data (*n* = 15 surveys).

Seal behaviour (interaction, neutral, avoidance) was monitored at 1-minute intervals, during 16 seal-swim events over a four month period (December 2011 to March 2012), which included a 6-week seal pupping period. Overall, 54% neutral behaviour was observed during seal-swims, followed by 41% interaction and 5% avoidance. The duration of the swim affected seal response, with interaction in seals peaking at 6 minutes into the swims, before declining sharply. The number of seals interacting with swimmers decreased as the number of seals in the water increased. The stage in the breeding season also affected seal response to swimmers: seal interactions peaked in December and were significantly higher during the breeding season in comparison to the non-breeding season. Compliance of tour operators to regulations and permit conditions was also recorded during tourism encounters. Of the seven Marine Mammal Protection Regulations examined; there was 100% compliance with six regulations and 94% with one. And of the four Marine Mammal Permit Conditions tested, there was 100% compliance with three and 81% with one condition.

Seal behaviour during controlled boat approaches was recorded at 1-minute intervals at a breeding site and several non-breeding sites during a 5-month period (December 2011 to March 2012). Control video footage revealed that in the absence of a vessel New Zealand fur seals (excluding pups) spent 65% of their time resting, 16% alert, 6% upright, 9% grooming, 4% in the water and 1% on other activities. In the presence of vessels (measured on board during controlled approaches), the seals spent 61% of their time resting, 8% alert, 8% upright, 5% grooming, 17% in the water and 1% on other activities. In the presence of a vessel, seals spent the same percentage of time resting but significantly less time alert and more time in the water, than in the absence of a vessel. The variables month, distance, minute and time of day were identified as important influencing variables on seal alert and rest behaviour. Seal behaviour was also influenced by the sex and age class of the seals, with pups being the most alert age class, especially when the vessel was 10-20 m away. Males and pups were more likely to shift behaviour than females and juveniles. Seals shifted behaviour more often in the presence of fewer seals and when the boat was closer to the seals.

Overall, the study found that seal-swims in the Whakatane region of the Bay of Plenty were not having a negative impact on the seals in the water, and were likely to be sustainable. This is based on the assumptions that the high levels of compliance observed in this study are maintained and tourism traffic does not change significantly in the future. Results of controlled boat approaches indicated that the overall behavioural budget of New Zealand fur seals in the presence of vessels did not differ negatively from the control behavioural budget. However, operational factors such as distance of the vessel and duration of stay did influence seal behaviour. In the event that boat traffic or the number of permitted vessels increases in the future, it was recommended that further monitoring of pinniped-focused tourism interactions should be implemented. It was also recommended that tour operators and the general public do not approach seals by boat any closer than 20 m and that the development of a site-specific voluntary code of conduct may be beneficial to the seals. This study demonstrated that monitoring the impacts of wildlife tourism can be particularly site and time specific. It is recommended that the approaches trialled in this study be adopted to monitor other wildlife tourism activities at small, establishing sites.

VICTORIA UNIVERSITY

STUDENT DECLARATION

I, Mary Cowling, declare that the Masters by Research thesis entitled [“Management of seal tourism in New Zealand – Tourism and the New Zealand fur seal in the Bay of Plenty”] is no more than 60,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Signature:

Date:

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1.1. The New Zealand fur seal (*Arctophoca australis forsteri)*

Seals, sealions and walruses are classified as pinnipeds (Riedman 1990). The New Zealand fur seal (*Arctophoca australis forsteri)* belongs to the 'otariid' (fur seals and sea lions) pinniped family. It is found in New Zealand and its offshore islands, and in parts of southern Australia, Western Australia and Tasmania (Shaughnessy et al., 1994, Taylor, 1992). Although classified as the same species, the Australian and New Zealand populations are genetically isolated (Lento et al., 1994). Within New Zealand, the species once occupied most coastal regions of both islands, but was eliminated from the North Island by Maori hunting around 1500 AD (Smith, 1989). An unregulated sealing industry which ran through the 1800's caused devastation to seal populations in the South Island and offshore Islands, leading to severe population reductions and local extinctions (Stirling, 1970, Taylor et al., 1995). The population of New Zealand fur seals was estimated to be close to 1.5-2 million in 1800, (Richards, 1994) but was reduced to 20,000 by 1948 (Falla 1969, cited in Lalas & Bradshaw 2001). Since the introduction of a sealing ban in 1894 (Taylor et al., 1995), the New Zealand fur seal population has recovered and is reclaiming its former range, including parts the North Island (Dix, 1993, Shaughnessy and McKeown, 2002). The current number of New Zealand fur seals in New Zealand is unknown, but is suggested by the Department of Conservation to be over 60,000. The Australian population of New Zealand fur seals was also hunted by indigenous peoples prior to European settlement (Reeves et al., 1992) and by European sealers during the late eighteenth to early nineteenth centuries (Kirkwood et al., 2009). The present population estimate for the Australian population is approximately 57,000 (National Seal Strategy Group and Stewardson, 2007).

1.1.1. New Zealand fur seal behaviour/ life history

New Zealand fur seals are most abundant at haul out sites during winter and least abundant during summer (Miller, 1971). Seals appear at breeding sites in November, with males often staking out territories before females arrive (Miller, 1975). During the breeding season, female New Zealand fur seals give birth and then nurse their pups between foraging trips (Miller, 1975). Males actively guard territories, compete for access to females and may fast for up to 63 days during their tenure (Boren et al., 2002, Crawley et al., 1977, Miller, 1975). Juveniles and sub-adult males remain in the water or haul out away from the breeding colony as territorial males do not permit them to enter the breeding site (Miller, 1971). Although these are the most obvious roles of each gender during the breeding season, pioneer studies suggest that males and females spend 74% and 63% of their time (respectively) resting during the breeding season (Crawley et al., 1977). Most interactions between males and females during this time are agonistic and result in threat behaviours (Miller, 1974). Olfactory investigations and herding of females by males are also documented to occur during the breeding season (Miller, 1974). Mating usually takes place 1-2 weeks after a female gives birth to a pup and females will often mate with the male in whose territory she gave birth (Miller, 1971, Riedman, 1990, Stirling, 1971).

Often within an hour after birth, pups make vocalisations termed “mother-attraction calls” and females return the call with “pup-attraction calls” (McNab and Crawley, 1975, Stirling, 1970). These calls, coupled with smell, are used by mother-pup pairs to identify each other (McNab and Crawley, 1975). Females remain with their pup at the breeding colony 6 to 8 days after giving birth, before leaving for two to four days to feed at sea (Miller, 1971, McNab and Crawley, 1975). New Zealand fur seal pups have been observed swimming as early as 10 days after birth (McNab and Crawley, 1975). Other early pup behaviours include grooming, resting, suckling and play-fighting (McNab and Crawley, 1975, Stirling, 1971). New Zealand fur seal pups are nursed for up to 12 months (Miller, 1975). Although there is no documented life span for the New Zealand fur seal, Otariids are thought to live for 17-18 years (Riedman, 1990).

1.1.2. Current threats to the New Zealand fur seal

New Zealand fur seals are currently protected in New Zealand under the Marine Mammals Protection Act 1978, which prohibits capturing, killing and injuring of marine mammals. They are also protected under the Marine Mammals protection regulations. The regulations apply to all human/marine mammal interactions and aim to prescribe appropriate behaviour around marine mammals, in order to prevent disturbance and harassment. Despite its protective status, the species still faces threats from several human based activities. New Zealand fur seals can become entangled in man-made debris, with a high proportion of seals being entangled in trawl net (Boren et al., 2006, Page et al., 2004). Furthermore, incidental kills can occur when seals get caught in nets during fishing operations and are unable to escape and resurface to breathe (Lalas and Bradshaw, 2001). To give an example of the scale of this threat, estimates of the total number of seals killed during fisheries operations in New Zealand range from 401 in 1990/91 to up to 2110 in 1995/96 (Manly et al., 2002). Tourism may also be considered a potential threat to New Zealand fur seals as these activities often coincide with the breeding season and take place at important breeding and haul out sites (Constantine, 1999).

1.2. Wildlife tourism

Tourism is the world's leading industry and encompasses a diverse range of sectors, one of which is wildlife tourism (Shackley, 1996). Wildlife tourism is defined by Newsome *et al.* (2005) as "tourism undertaken to view or encounter wildlife". Wildlife tourism has gained increasing popularity worldwide (Ballantyne et al., 2009, Reynolds and Braithwaite, 2001) and a recent shift from watching animals in captivity to watching them in the wild has contributed to the expansion of the industry (Gauthier, 1993, Newsome et al., 2005). Wildlife tourism relies on a balance between the values of conservation, visitor satisfaction and profitability (Reynolds and Braithwaite, 2001). The industry can have conservation benefits including directly managing wildlife as part of the tourism experience, educating tourists about the conservation issues associated with wildlife and funding conservation initiatives (Higginbottom and Tribe, 2004). Aside from conservation benefits, wildlife tourism can generate jobs, boost the economy and contribute to or support scientific research (Garrod and Wilson, 2003, Gössling, 1999, Krüger, 2005, Wall, 1997). However, the popularity and expansion of this industry can place increasing pressure on wildlife (Shackley, 1996) and may have negative impacts on the targeted species (Lundquist, 2012, Madsen et al., 2009, Maréchal et al., 2011). Adopting sustainable tourism practices is one way to minimize environmental impacts, while ensuring that visitor satisfaction and profit is not negatively impacted (Mowforth and Munt, 2009, Reynolds and Braithwaite, 2001). It is important for tourism ventures to help sustain the environment and the wildlife it supports as the success and continuation of the industry relies on these resources (Harris et al., 2002).

1.2.1. Marine mammal tourism

Marine mammals were historically used for consumptive means – hunted for their meat, oil and skins/furs – but today are utilised as a non-consumptive tourism attraction (Marsh et al., 2003). Marine mammal tourism is a form of wildlife tourism which targets cetaceans (whales and dolphins), pinnipeds (seals, sea lions and walruses) and Sirenia (manatees and dugongs). Sea otters (*Enhydra lutris*) (which do not fit into the above orders) are another species of marine mammal targeted by the industry (Loomis, 2006). Viewing opportunities offered by marine mammal tourism operations may be in the form of land, boat or air-based activities (Constantine, 1999).

1.2.2. Pinniped tourism

Pinniped (seal)-focused wildlife tourism involves otariids (fur seals and sea lions), phocids (true seals) and odobenids (walrus). Pinnipeds appeal to tourists due to their curious, playful and interactive nature (Barton et al., 1998, Renouf, 1993). Pinniped-focused tourism allows tourists to view seals in their natural environment, either from land or onboard a vessel (Back, 2010, Boren et al., 2002, Boren et al., 2009, Cassini et al., 2004). Aside from providing viewing opportunities, many tourism ventures now provide seal-swim activities, allowing tourists to snorkel with seals in the wild (Boren et al., 2009, Stafford-Bell et al., 2012). Many tourism ventures are guided or regulated in some way, however tourists may come across seals during recreational activities, resulting in unguided pinniped encounters (Newsome and Rodger, 2008). Despite the potential for benefits such as seal conservation awareness, pinniped-focused tourism can have negative effects on seals.

1.2.3. Effects of pinniped tourism

Several short term effects of tourism on pinnipeds have been identified in recent literature. The most commonly observed effect is modified seal behaviour, often including increased alertness or vigilance (Back, 2010, Boren et al., 2002, 2009, Cassini, 2001, Cassini et al., 2004, Curtin et al., 2009, Pavez et al., 2011, Petel et al., 2008, Shaughnessy et al., 2008, Stafford-Bell et al., 2012). Escape behaviour or temporary site abandonment can also occur in the presence of tourism (Cassini, 2001, Curtin et al., 2009, Jansen et al., 2010, Johnson and Acevedo-Gutierrez, 2007, Pavez et al., 2011). Stampeding has been documented to occur during tourism interactions with grey seals (*Halichoerus grypus*) in South Devon (Curtin et al., 2009); a behaviour which has the potential to injure or even kill pups (Mattlin, 1978). In some cases, threats and attacks towards tourists have been observed, which questions the safety of tourists during close seal encounters (Cassini, 2001).

It has been suggested that human disturbance that elicits responses involving high energy expenditure, may have negative physiological effects on seals and affect their overall fitness (Pavez et al., 2011). Seals may also be more susceptible to impacts during the breeding season. Reductions in nursing behaviour, suckling bouts and reproductive success have been observed in the presence of tourism activities (Back, 2010, French et al., 2011, Kovacs and Innes, 1990). Repeated interruption during nursing reduces pup milk consumption, which can impact on its chance of survival (Gerrodette and Gilmartin, 1990).These impacts could lead to long-term effects on seals at the population level. Increases in tourism levels also have the potential to pressure seals into long term abandonment of important haul-out and breeding sites (Gerrodette and Gilmartin, 1990, Stevens and Boness, 2003). Human disturbance including recreational beach activities caused Hawaiian monk seals (*Monachus schauinslandi*) to completely abandon sites (Gerrodette and Gilmartin, 1990). Another long term effect of tourism is habituation (Back, 2010, Boren et al., 2002). Seals exposed to frequent tourism over a long period of time can become less sensitive to tourism activities (Back, 2010, Boren et al., 2002).

1.2.4. Factors influencing seal response to tourism

Not all tourism ventures impact seals in the same way, as the extent of the impact is dependent on environmental, biological and anthropogenic variables. There can be variation in seal responses between different sites in the same region (Boren et al., 2002, Shaughnessy et al., 2008). The time of day and stage in the breeding season also affects seal responses to tourism (Andersen et al., 2011, Back, 2010, Orsini et al., 2006). Barton *et al*. (1998) discovered that females are more likely than males to flee in the presence of humans. Orsini *et al*. (2006) found that sea lions react differently to tourists depending on age class, with adults being less vigilant than juveniles. The proximity of seals to the water also effects seal response. Seals located further from the water's edge are more likely to flee than those located close to it (Back, 2010). Rest behaviour of seals in the presence of tour boats has been documented to increase with increasing colony size (Shaughnessy et al., 2008).

The anthropogenic factors affecting seal responses to tourism have also been evaluated. These include: tourist group behaviour and composition (Cassini, 2001, Kovacs and Innes, 1990); distance of vessel or tourists to seals (Back, 2010, Boren et al., 2002, Cassini, 2001, Curtin et al., 2009, Jansen et al., 2010, Pavez et al., 2011, Shaughnessy et al., 2008, Stafford-Bell et al., 2012); tourism type, e.g. boat or land based (Andersen et al., 2011, Boren et al., 2002); approach angle (Jansen et al., 2010); level of boat traffic (Johnson & Acevedo-Gutierrez 2007) and level of tourism exposure (Back, 2010). Boat specifics including vessel size, speed and noise level can also affect seal response (Newsome and Rodger, 2008, Strong and Morris, 2010).

1.2.5. Management / Monitoring of pinniped tourism

In order to ensure minimal disturbance to seals, management strategies are often implemented in areas where pinniped tourism occurs. These range from small site-specific voluntary codes of conduct or viewing guidelines (Curtin et al., 2009, Stafford-Bell et al., 2012) to national regulations (Acevedo-Gutierrez et al., 2010, Boren et al., 2002, Constantine, 1999). Guidelines differ from regulations as they are not governed by law, however both provide a set of rules or recommendations relating to acceptable and unacceptable behaviour near marine mammals. Guidelines and regulations have the potential to reduce tourism impacts if tour operators and tourists comply with the stipulated rules (Newsome and Rodger, 2008).

One way of increasing awareness and compliance to regulations is to produce educational material for tourists stating the guidelines or regulations pertaining to seals in the area (Newsome and Rodger, 2008). Posted signs have been utilised in New Zealand to provide education and help regulate tourism, however this form of management was found to be ineffective in a recent study (Acevedo-Gutierrez et al., 2010). Another way to regulate compliance is to employ a ranger or enforcement officer, but this can be an expensive solution (Acevedo-Gutierrez et al., 2011). Alternatively, posting an official-looking volunteer at sites exposed to pinniped tourism could increase tourist compliance. A recent study found that the presence of such a volunteer decreased harassment of seals by two thirds (Acevedo-Gutierrez et al., 2011).

It is important, where possible, to monitor the effects of tourism on seal colonies, particularly in relation to factors that can be controlled through effective management. For example, Boren *et al.* (2002) monitored the effects of tourist disturbance on New Zealand fur seals and based on results of seal responses to tourist distance, were able to recommend new minimum approach distances to protect seals. Similarly, another study discovered that 90% of harbour seals (*Phoca vitulina*) retreated into the water at the approach distance recommended in voluntary guidelines (Jansen et al., 2010). Based on these results, the authors made recommendations for regulations to be put into place with a much further (five times further) minimum distance than that prescribed in the guidelines (Jansen et al., 2010). Compliance should also be monitored in studies evaluating the effects of tourism to determine if current management practices are sustainable (Scarpaci et al., 2003). However, compliance alone does not accurately imply management effectiveness, unless coupled with observations of animal responses to tourism activities (Smith et al., 2010).

1.2.6. Pinniped tourism in New Zealand

Within New Zealand, seal-swimming and viewing activities are offered on both the North and South Islands, but are more concentrated in the South. There are more than 12 sites which offer pinniped tourism experiences within New Zealand; however the number is likely to increase as seals continue to extend their range and the industry broadens. Aside from abiding by the Marine Mammals Protection Act and the Marine Mammals Protection

Regulations, commercial pinniped-focused tourism operators must also apply for a permit and abide by specific permit conditions pursuant to the regulations.

1.2.7. Pinniped tourism in the Bay of Plenty

New Zealand fur seals were first observed in the Bay of Plenty in small numbers in the late 1970s and have since increased in number (R Cooper 2012, personal communication). Evidence of prior fur seal inhabitance in the North Island (Smith, 1989), suggests the fur seals in the Bay of Plenty may be a recolonizing population. During the breeding season of 2011-2012, a minimum of eight pups were born at Moutohora Island, Whakatane (seven were born at the same haul-out site and one was born further around the island), which is the highest number observed at the island to date (P. van Dusschoten, personal communication 2012). During the summer months, which coincide with the breeding season, the Bay of Plenty fur seals are visited by commercial tourism operations. The first marine mammal viewing permit in the Bay of Plenty was issued in 1994 and in 2009, all the operators in the Bay of Plenty were granted an amendment to be able to swim with seals (L. Christie, personal communication 2012). At the time of this study, nine tour operations held active permits permitting seal viewing and swimming in the Bay of Plenty (three in Whakatane & six in Tauranga), however not all were operating. These tour operations were predominantly dolphin-swim tours and seals were not always targeted on each trip. Permits allowed tour operators to conduct two marine mammal tour trips per day and spend a maximum of 90 minutes viewing seals and 60 minutes swimming with seals per trip.

1.3. Closely related studies and findings

Although there are a number of studies on the behaviour of seals in response to human disturbance and tourism activities only a few relate to the New Zealand fur seal e.g. (Barton et al., 1998, Boren et al., 2002, Boren et al., 2009, Shaughnessy et al., 2008). Barton et al.

(1998) found that 60% of seals actively responded during land based tourist-seal encounters in Kaikoura. A major finding from this study was that gender influenced seal response to tourists. Females fled and entered the sea in all cases but males usually exhibited threat behaviours or moved a few meters away (Barton et al., 1998). Boren *et al.* (2002) conducted a study on tourist disturbance on New Zealand fur seals in New Zealand's South Island and found that seals altered their behaviour most during land based approaches, followed by motor boat and kayak approaches. The study also found that the proportion of seals responding was site dependent and that seals responded most at close distances (Boren et al., 2002). In a further study, Boren *et al*. (2009) discovered that commercial seal-swims and guided walks resulted in less avoidance than independent unguided seal-swims and walks. Larger tourist groups on land elicited more avoidance responses in seals (Boren et al., 2009). A study by Shaughnessy *et al*. (2008) focused on the effects of cruise boats on Australian and New Zealand fur seals in New South Wales and found that the distance of vessel and the seal colony size influenced seal responses.

1.4. Aims of this study

The New Zealand fur seal is a recovering species which is increasing in number around New Zealand's coast as it recolonizes its former range. The major aim of this study was to evaluate the effects of tourism on the New Zealand fur seal in the Bay of Plenty and to assess the sustainability of the industry. The detailed objectives were to:

1) Describe non disturbed (in the absence of tourism activities) seal behaviour.
2) Describe the behavioural response of seals in the presence of commercial tourism vessels and during controlled approaches.

$H1_o$: The behaviour of New Zealand fur seals is not affected by the presence of commercial tourism vessels and research vessels.

$H1_A$: The behaviour of New Zealand fur seals is affected by the presence of commercial tourism vessels and research vessels.

3) Determine which variables influence seal response to tourism. These included: location, colony size, distance, group associations, and sex/age classes, time of day, meteorological variables, month and stage in the breeding season.

$H2_O$: Variables including location, colony size, distance, group associations, and sex/age classes, time of day, month and stage in the breeding season do not influence seal response to tourism.

$H2_A$: Variables including location, colony size, distance, group associations, and sex/age classes, time of day, month and stage in the breeding season do influence seal response to tourism. Seals of different sex/age classes will respond differently, seals will be more responsive in the morning than in the afternoon, during the breeding season, when in smaller groups and when the vessel is closer.

4) Document levels of compliance of tour operations to conditions stipulated in the Marine Mammals Protection Regulations (MMPR).

$H3_O$: Tour operations in the Bay of Plenty will not be compliant, despite the involvement of DOC and researchers.

$H3_A$: Tour operations in the Bay of Plenty will be compliant due to the involvement of DOC and researchers.

5) Assess/investigate sustainability of pinniped tourism in the Bay of Plenty, New Zealand.

1.5. The importance of this study

New Zealand fur seals have been recolonising islands in the Bay of Plenty region since the 1990s and in the mid-2000s, seals began to establish a breeding site at Moutohora Island. Since 1994, the seals in the region have been visited by commercial marine mammal tourism operations, however the effects of these encounters have not been assessed until now. During this study, one operating licenced tour operator in the Whakatane region of the Bay of Plenty had a permit to take tourists to view and swim with New Zealand fur seals at Moutohora Island. Several tourism operators also had permits for pinniped-focused tourism in the Tauranga region. This study focused mainly on seal encounters in the Whakatane region, where the breeding site is establishing.

It is of importance to monitor tourism interactions with seals as tourism may not be benign. Implications of tourism may be further elevated at small establishing seal colonies as seals are less tied to new sites and more vulnerable to disturbance. It is vital that the management regimes implemented protect seals from harassment and support sustainable tourism. This will ensure that the establishing Bay of Plenty fur seals have the opportunity to recover and do not abandon preferable breeding sites for less favourable sites, which could lead to reduced pup survivorship. The overall sustainability of the pinniped-focused tourism industry also relies on the continual occupation of seals in the region, and it is therefore in the interest of both managers and tour operators that the seals are protected from disturbance.

The following factors made the Bay of Plenty an important and ideal location in which to study the effects of tourism on New Zealand fur seals:

- A small recently establishing breeding site was present

- The number of seals at the sites was low, which allowed data to be collected on the responses of individual seals
- There was an opportunity to conduct seal research on board tour vessels. This provided a platform to observe and record seal-swims and operational conduct, and to obtain an understanding of logistical issues that tour operators may encounter.
- There was an opportunity to conduct seal research on board an independent research vessel (Department of Conservation vessel). This allowed controlled approaches to be conducted at different sites, at specific distances and at different times of the day.
- A vantage point on a cliff overlooking the primary study site allowed for control video footage of behaviour to be obtained.
- It was possible to document the effectiveness of current management regimes (MMPR and permit conductions) through documentation of levels of tour-operation compliance and response of seals to vessels.
- There was a partnership of stakeholders (DOC, tour-operation and researchers) aligned to develop a sustainable tourism industry.

When assessing the effects of seal-swims, the behavioural response of seals in the water coupled with the compliance of tour operators to regulations and permit conditions was recorded. Due to the high levels of compliance observed in this study, the effectiveness of current regulations - particularly those relating to seal-swim activities – could be assessed. Furthermore, control behaviour is often difficult to obtain for marine mammal tourism studies. Obtaining control behaviour through the use of a video camera allowed for comparisons to be drawn between seal behaviour in the presence and absence of vessels.

This thesis is important as it is one of the first studies to assess pinniped-focused tourism impacts and sustainability at small establishing sites and is the first study to focus on the New Zealand fur seal in the Bay of Plenty region. The results provide baseline information on seal behavioural responses to vessels and seal-swim activities at establishing sites. The methods used in this study can be utilised in future studies assessing the effects of tourism on seals at sites with recolonising populations or small aggregations. It is important to study the species- and site-specific effects of tourism on the targeted animals in order to develop effective site-specific management regimes. This study holistically measured the suitability and sustainability of pinniped-focused tourism in the Whakatane region of the Bay of Plenty by documenting operational compliance, behaviour of seals during various activities (during seal-swims, in the presence of a vessel and in the absence of vessels) and correlating seal behaviour with biological, seasonal and operational variables.

Chapter 2: The effects of seal-swim activities on the New Zealand fur seal (*Arctophoca australis forsteri*) in the Bay of Plenty, New Zealand, and recommendations for a sustainable tourism industry.

2.1. ABSTRACT

Wildlife tourism (including pinniped tourism) offers people the opportunity to see wildlife in their natural environment. It can provide positive outcomes for the animals, through improved resources for conservation, or negative outcomes, such as inducing the animals to move away. This study assessed the impacts and sustainability of a novel but growing tourism industry, swimming with seals, based on interactions with New Zealand fur seals (*Arctophoca australis forsteri)* in the Bay of Plenty, New Zealand, between December and March 2011-12*.* The behaviour of all seals in the water was monitored (interaction, neutral, avoidance) at 1-minute intervals, during 16 seal-swim events. Seals mostly ignored the swimmers (54% of records), followed by interacted with swimmers (41%); seals rarely avoided the swimmers (5%). Interactions peaked in frequency at six minutes into the swims, then declined. They occurred most frequently during December, corresponding with the pupping period when juvenile seals - the age class most likely to interact - are excluded from breeding areas and so spend much of their time in the water. Compliance of tour operators to regulations was monitored during seal-swim activities and the industry was found to be highly compliant. The results of this study suggest the activities monitored had minimal impact on seals in the water, and are likely to be sustainable in relation to seal conservation. Tourism can be site and time specific, and it is recommended that approaches such as that trialled here be adopted to monitor other wildlife tourism activities to ensure their sustainability. Further research needs to examine potential impacts of the tours on seals ashore.

2.2. INTRODUCTION

Nature-based tourism represents a large portion of the global tourism industry, earning at least US $250 billion a year (Buckley, 2003). Nature-based tourism can have positive outcomes for wildlife, such as contributing to conservation (Buckley et al., 2012, Higginbottom and Tribe, 2004), but can also have negative effects. To be sustainable, nature-based tourism needs to conserve the species at the designated site on which it relies.

Marine mammal tourism is a popular form of nature-based tourism (Curtin and Garrod, 2008). Marine mammals are appealing to tourists due to their charismatic and playful nature (Constantine, 1999). Perhaps the most reliable marine mammals on which to focus tourism is the pinnipeds, which forage at sea but haul-out at predictable locations to rest, socialise and breed. All pinniped species are subject to some form of marine mammal tourism. Pinniped-focused tourism can take several forms: observations at long/moderate distances (from land or motorized boat) and close proximity interactions (kayak or seal-swim tourism) (Boren et al., 2002, Boren et al., 2009, Scarpaci et al., 2005), and can focus on individuals or groups.

Pinniped-focused tourism generates employment, supports research and contributes to pinniped conservation (Orams, 1999, Wall, 1997, Zeppel and Muloin, 2008). Education provided during tours increases tourist awareness and knowledge, leading to interest in the protection of a species (Zeppel and Muloin, 2008). Despite the benefits, negative impacts of tourism on targeted animals have been identified, including modified behaviour (Boren et al., 2002, Petel et al., 2008, Shaughnessy et al., 2008, Stafford-Bell et al., 2012), site abandonment (Cassini et al., 2004, Curtin et al., 2009, Johnson and Acevedo-Gutierrez, 2007), stampeding (Curtin et al., 2009), disturbance to suckling bouts (Back, 2010) and reduced reproductive rates (French et al., 2011).

This study evaluates the sustainability of seal-swim, nature-based, tourism ventures that visit colonies of New Zealand fur seals (*Arctophoca australis forsteri)* that are in an establishment phase*.* While establishing at a site, animals are in low numbers and are more vulnerable to disturbance than seals at established sites, where typically there are more animals. At established sites there is less need for individual vigilance (Bednekoff and Lima, 1998), and more individuals have acquired a level of familiarity and comfort with their surroundings. Abandonment of major breeding sites by otariids is rare (Stevens and Boness, 2003), but groups at minor sites may be more likely to abandon due to their heightened vulnerability.

In New Zealand, pinnipeds are protected (Marine Mammal Protection Regulations, 1992) and are the focus of a tourism industry that in 2002 earned an estimated US$1,038,000 (Kirkwood et al., 2003). It has grown since then (L. Boren, personal communication). The seal species most often viewed is the New Zealand fur seal, due to its abundance and extensive range. New Zealand fur seals are established on the South Island of New Zealand and have been colonising areas of the North Island since the 1980s (Boren et al., 2002).

Like other pinnipeds, New Zealand fur seals display strong site fidelity to natal, or first breeding sites (Stevens and Boness, 2003). Thus, there is inertia to the colonisation of new sites. During the colonisation process, seals may be particularly prone to abandoning the site. A strong trigger for such abandonment even at established sites would be disturbance, and a main cause for disturbance to seals in coastal environments is human activity. This occurred during the 1980s in Hawaii with the Hawaiian monk seal (*Monachus schauinslandi*), which abandoned traditional breeding sites for less favourable haul-outs, following uncontrolled human visitations (Gerrodette and Gilmartin, 1990). The outcome was reduced pup survival and an enhanced rate of population decline.

One form of pinniped-focused tourism is for tourists to enter the water to gain a 'close encounter' with the seals. This form of tourism is termed 'seal-swims'. Typically, the tourists are supplied with snorkelling equipment and, in groups, approach positions where the seals are likely to be in the water. Two previous studies have investigated impacts of tourism on seals during seal-swims. Boren *et al*. (2009) found that New Zealand fur seals at established colonies displayed less 'avoidance and aggression' responses during guided, commercial swims compared to non-guided, independent swims (Boren et al., 2009), and Stafford-Bell *et al.* (2012) noted that a higher number of swimmers in the water influenced a greater number of Australian fur seals (*Arctocephalus pusillus doriferus*) to move out of the water, possibly to avoid swimmers (Stafford-Bell et al., 2012).

Guidelines and regulations have the potential to reduce tourism impacts if tour operators and tourists comply with the stipulated rules (Newsome and Rodger, 2008). When unenforced, regulations can be ineffective, as found in a recent study evaluating the effectiveness of posted signs to regulate pinniped tourism (Acevedo-Gutierrez et al., 2010). Compliance to regulations provides a means to evaluate the effectiveness of management (Quiros, 2007). Compliance alone does not accurately imply effective management, but when coupled with animal responses to tourism activities, can achieve a more precise evaluation of management efficiency (Smith et al., 2010).

Aims of this study are to determine the effect of seal-swim tourism on New Zealand fur seals in the Bay of Plenty, New Zealand, and to provide a case study to monitor the wildlife conservation component of tourism sustainability. The study also aims to document levels of compliance to the current Marine Mammals Protection Regulations. New Zealand fur seals were first observed in the Bay of Plenty in small numbers in the late 1970s (R. Cooper, Department of Conservation, Whakatane, personal communication 2012). During the 1990s, they started to haul-out on several islands in the Bay, and in the late 2000s, pup births were noticed at one location, McEwan’s Bay, on Moutohora Island. Thus, a key component of this study is that the tourism targets seals that are establishing a presence at a site. In this study, biological, seasonal and anthropogenic factors that could modify the behaviour of seals during seal-swims were assessed.

2.3. METHODS

2.3.1. Study sites

Data were collected between December 2011 and March 2012 from two sites in the Bay of Plenty, New Zealand (Figure 2.1). Moutohora Island, 10 km from Whakatane harbour, was the primary study site. In 1965, this island was declared a Wildlife Refuge under private ownership and, in 1991, it became a Wildlife Management Reserve administered by the Department of Conservation. Since 1992, public landings on the island have been prohibited. During this study, one tour operator conducted seal-swims at Moutohora Island three-four times a week, usually near McEwan’s Bay, the only location in the region where New Zealand fur seal pups are born. Two other operators were licensed to swim with seals in this area.

Two seal-swims were observed opportunistically at Tuhua Island, 35 km from Tauranga harbour. This island was designated a Wildlife Refuge in 1953 and, in 1993, a marine reserve was established at its northern end. Landings are permitted at the southern end. New Zealand fur seals haul-out on the island, but do not pup there. Six marine mammal tour operators were permitted to visit Tuhua Island seals during the study period, and occasionally offered seal-swims. The swims were a component of tours that primarily aimed to provide dolphin viewing experiences.

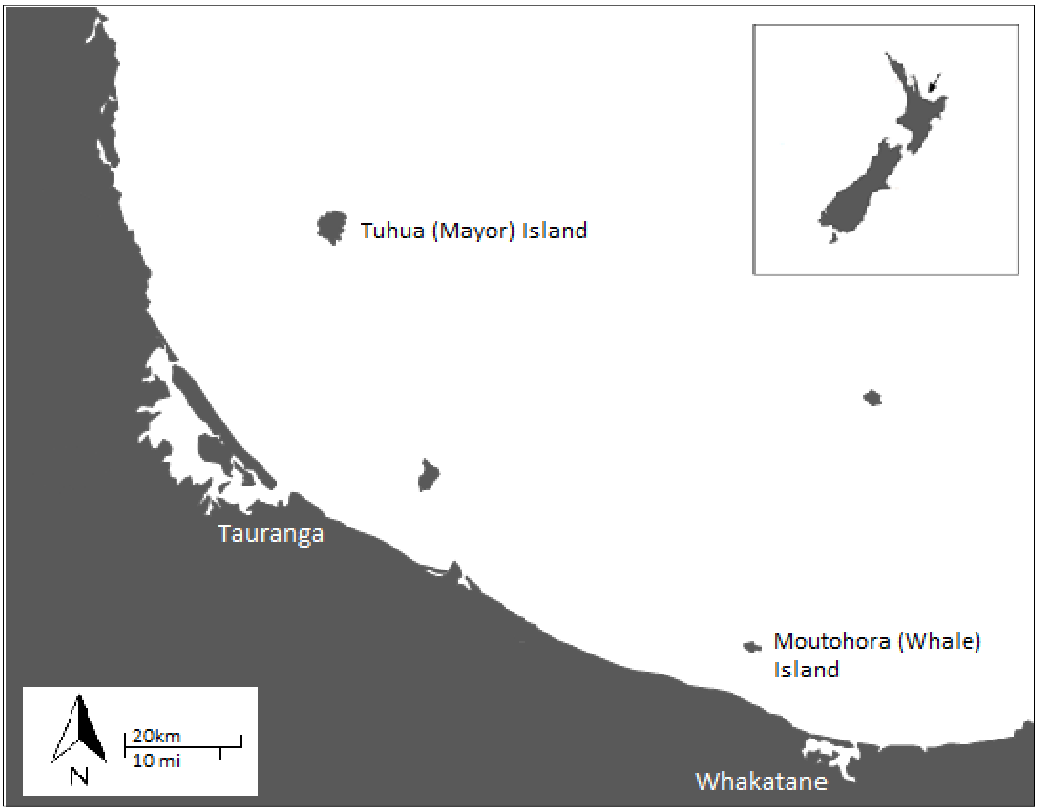

Figure 2.1. Map indicating the location of study sites, Moutohora and Tuhua Islands, in the Bay of Plenty, New Zealand.

2.3.2. Field method

Seal and tourist behaviours were observed from one of two tour vessels (one 10 m length, a single 250 hp motor; and the other 15 m length, a single 550 hp motor), or a Department of Conservation vessel (8 m length, 1 x 270 hp motor). Data were collected prior to, during and after swimming activities over two periods, the breeding season (8 December 2011 to 15 January 2012) and post breeding season (16 January to 14 February 2012). The breeding season was defined as beginning on the day the first pup was born and ending on the day the last pup was born.

Once swimmers entered the water, the behaviour of each seal in the water was recorded at 1-minute intervals. The behaviour classes were based on definitions used by Boren *et al.* (2009) and included ‘ignored/neutral’ (neutral in Boren *et al*. 2009) no apparent change in swim direction, ‘interacted’ actively swam toward and with swimmers, and ‘avoided’ actively swam away and kept out of the way of swimmers. To compare the behaviour of seals across a range of independent variables, the dominant response of seals in the water per minute was used for the analysis. Each seal was classified as being adult male, adult female, sub-adult male, juvenile or pup, as defined by Goldsworthy & Shaughnessy (1994).

During each 1-minute scan, the number of seals in the water was also recorded, the number of swimmers, as well as the distance swimmers were from the seals, the distance of the tour vessel from the seals, and the presence of other vessels within 300 m. Values were collated and analysed as a mean per seal-swim. The time of day and duration of swims were also recorded.

During seal-swims, compliance to seven conditions of the Marine Mammals Protection Regulations and four Permit Conditions was documented (Appendix 1). Instances of breaches were recorded for each seal-swim. Some of the Marine Mammals Protection Regulations and permit conditions were not tested either due to time constraints or because testing certain conditions would affect behavioural sampling time and accuracy.

2.4. STATISTICAL ANALYSIS

Analyses were conducted in the R-statistical environment (version 2.15.0, R Development Core Team, R Foundation for Statistical Computing, Vienna). The impact of ‘number of seals', 'number of swimmers' and 'distance of swimmers' on the interactions displayed by seals was assessed by regression analysis. ANOVA and Student's *t*-tests were applied to assess for significant differences in seal responses during swims and over the study period (based on a statistical tolerance of $p = 0.05$).

2.5. RESULTS

Of 17 seal-swims observed, 16 resulted in interactions with seals. On one occasion, no seals were in the water for the duration of the swim. While relevant to the sustainability of the tours, that occasion was excluded from subsequent analysis as no seal interactions were possible. Of the 16 seal swims, 14 were conducted at Moutohora Island and two at Tuhua Island. There was no significant difference between sites in the percentage of time seals interacted (two-sample *t*-Test: $t = 1.07$, $df = 14$, $p = 0.30$), ignored (two-sample *t*-Test: $t = -1.45$, $df = 14$, $p = 0.17$) or avoided (two-sample *t*-Test: $t = 1.89$, $df = 13$, $p = 0.08$) swimmers. Further analysis focused on Moutohora Island only, as it was a pupping site, and therefore seals were likely to behave differently there and it was the most important site with regard to potential human impacts on seals. Swimming activities at Moutohora Island lasted 29 min. (range = 18 to 55; $n = 14$; $sd = 10$) and averaged seven swimmers (range = 2 to 13; $n = 14$; $sd = 4$). On average, swimmers remained <10 m from seals during an entire encounter on 79% of seal-swims (11 of 14) and ≤ 20 m on 100% of seal-swims. The seals mostly ignored swimmers in the water (54% of the time), often interacted with them (41%) and rarely actively avoided the swimmers (5%) (Figure 2.2).

Figure 2.2. Behaviours displayed by New Zealand fur seals (mean % of time the behaviour was expressed) during 14 seal-swim activities (total 337 min.).

Seal response varied significantly across the duration of seal-swims (one-way ANOVA: $F_{1,335} = 20.68$, $p < 0.001$). The rate of interactions with swimmers peaked at 6 minutes then declined sharply. Interactions were rarely observed after 22 minutes (Figure 2.3). As the rate of interactions decreased, seals tended to ignore, rather than avoid, the swimmers. There was no obvious trend to the rate of avoidance of seals across the duration of a swim.

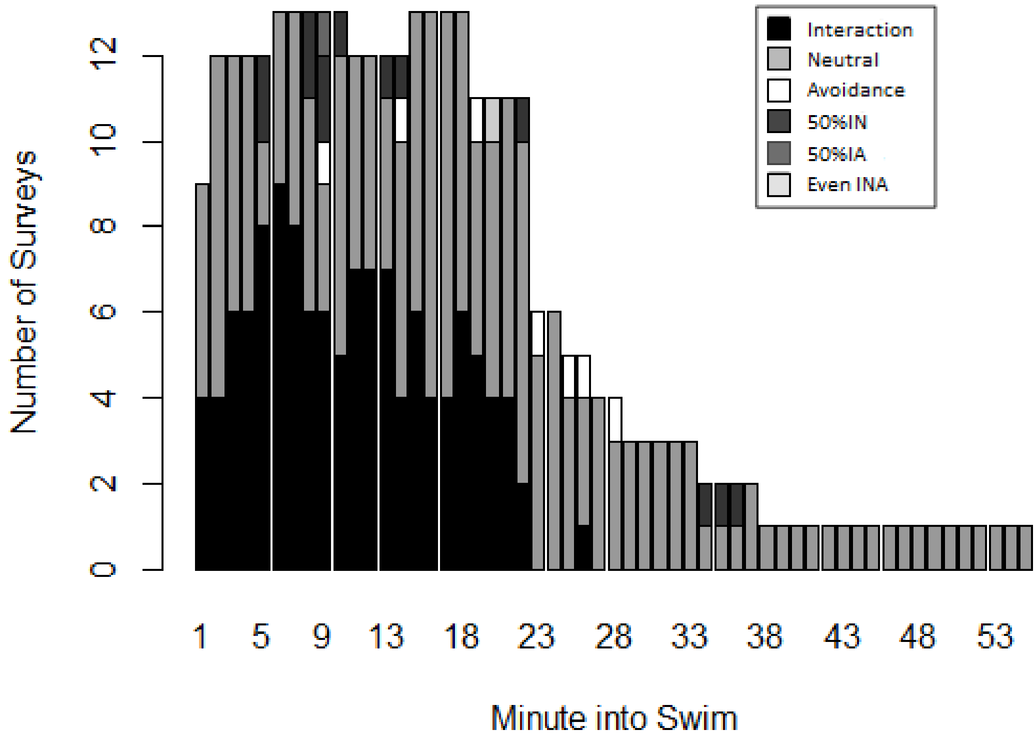

Figure 2.3. New Zealand fur seal response over time during seal-swim activities. IN indicates Interaction/ Neutral and *etc*.

The mean number of seals in the water with swimmers on individual swims ranged from one to nine, the maximum number seals recorded at a single time was 12. The number of seals interacting with swimmers appeared to decrease as the number of seals in the water increased (regression analysis, $F_{1,12} = 7.01$, $p = 0.02$) (Figure 2.4). As this trend may have been skewed by there being a single occasion when the mean number of seals in the water exceeded five, the analysis was repeated excluding that occasion. The decrease in interactions as seal numbers increased from one to four was not significant (regression analysis, $F_{1,11} = 3.19$, $p = 0.10$).

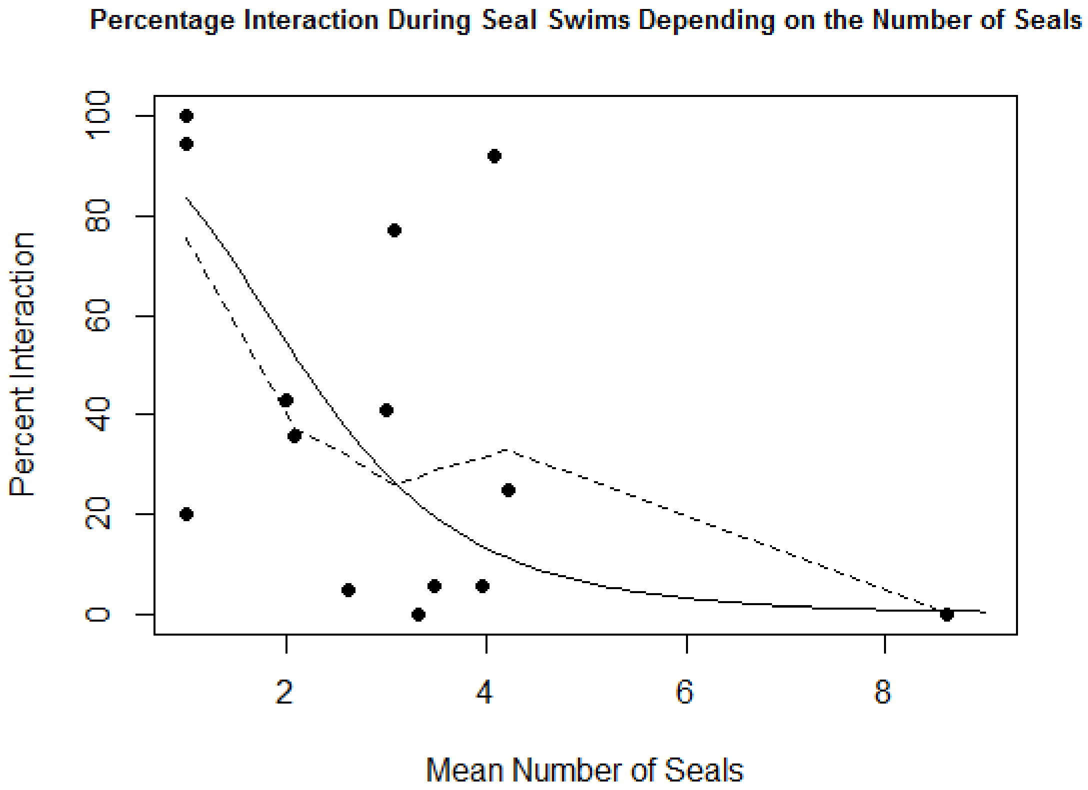

Figure 2.4. Number of seals in the water and percentage interacting with swimmers during 14 seal-swim tours. The solid line indicates the logit model and the dashed line represents the lowess line. The trend was not significant if the occasion with 9 seals was removed from the data set.

Seal interactions with swimmers appeared to decrease each month (Figure 2.5), however this was not statistically significant (one-way ANOVA: $F_{3,10} = 2.69$, $p = 0.10$). There was also no significant difference between months, in the amount of time seals ignored and avoided swimmers (one-way ANOVA: $F_{3,10} = 1.63$, $p = 0.24$; one-way ANOVA: $F_{3,10} = 0.33$, $p = 0.80$; respectively). During the seal breeding season, seals in the water tended to interact more with swimmers than they did during the post-breeding period (two-sample *t*-Test: $t = 2.28$, *df*

= 12, p = 0.04; Figure 2.6). There was no significant difference in the percentage of time seals spent ignoring swimmers (two-sample t-Test: t = -1.98, df = 12, p = 0.07).

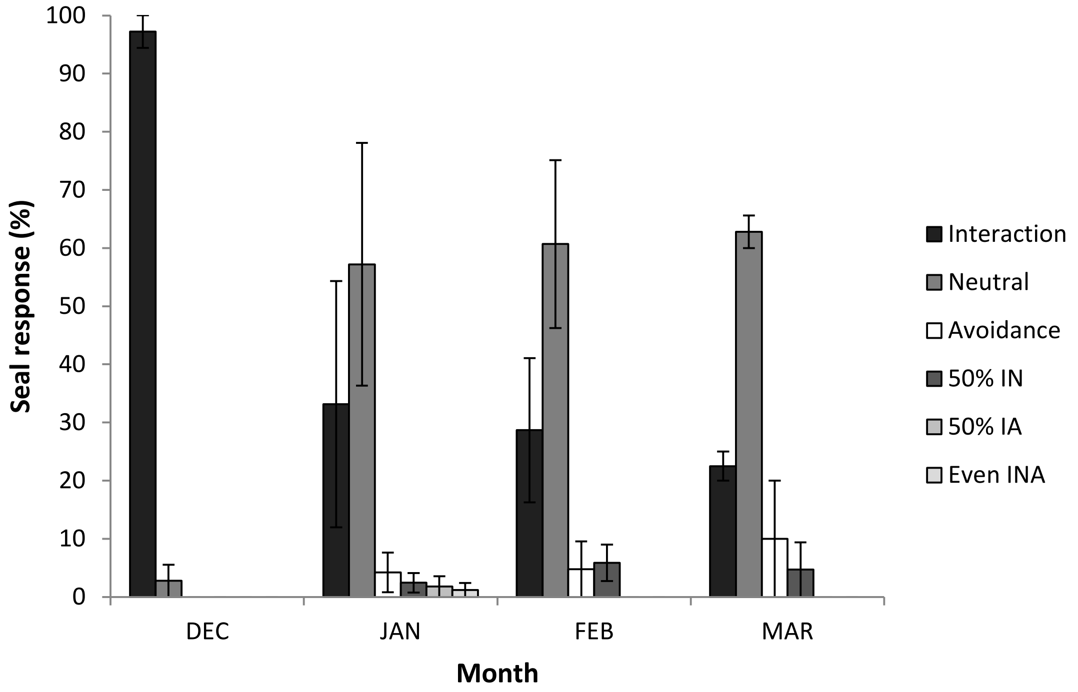

Figure 2.5. Responses of seals (%) during seal-swim activities depending on month, n = 2 in December, 4 in January, 6 in February, and 2 in March. IN indicates Interaction/ Neutral and *etc*.

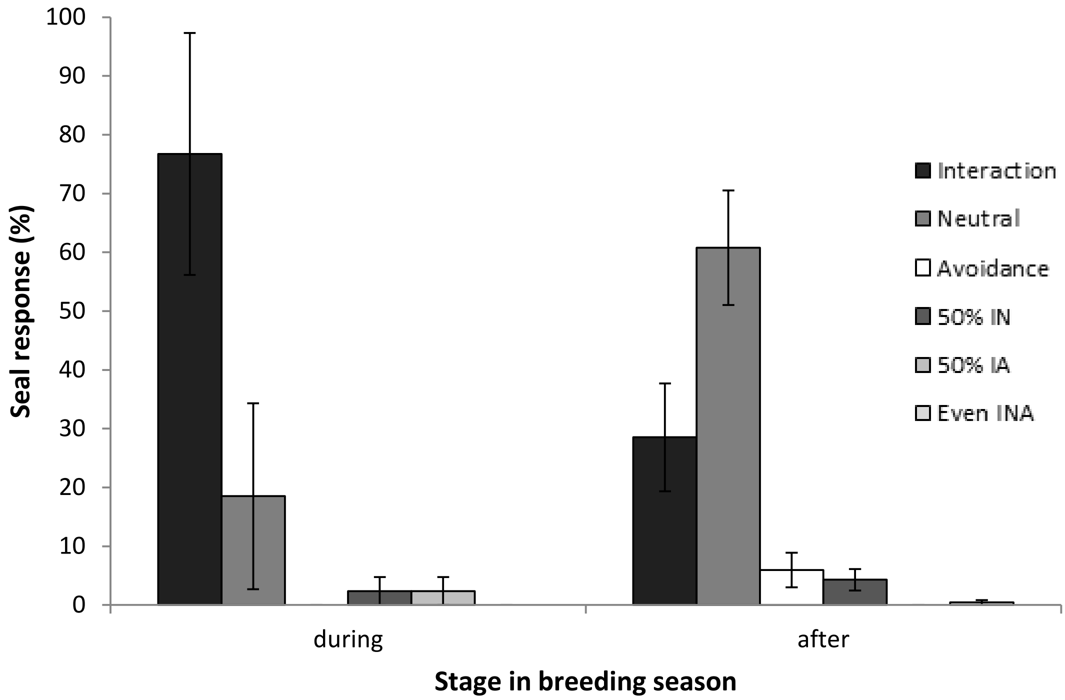

Figure 2.6. Responses of seals (%) during seal-swim activities in relation to stage in the breeding season; *n* = 3 during the breeding period, 11 after the breeding period. IN indicates Interaction/ Neutral and *etc*.

There was no significant difference in the percentage of time that adult males and females spent interacting with swimmers (two-sample *t*-Test: $t = 0.43$, $df = 13$, $p = 0.68$). Combining these data, adults tended to interact less with swimmers than did juveniles (two-sample *t*-Test: $t = -2.63$, $df = 11$, $p = 0.02$) (Figure 2.7).

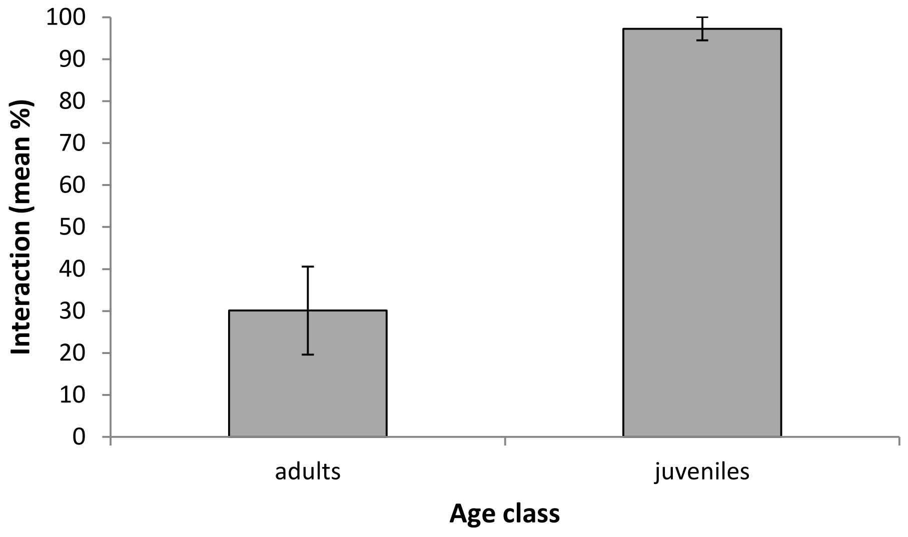

Figure 2.7. Mean percentage of seals that interacted with swimmers, in relation to seal age class; *n* =11 surveys with adults present, 2 with juveniles present, 1 with unknowns present.

The number of swimmers in the water (maximum number per seal-swim) had no significant effect on the percentage of time seals spent interacting (regression analysis, $F_{1,12}$ = 0.06, p = 0.81). Of the two seal-swims in which > 10 swimmers were present, seals did not avoid the swimmers on one and on the other seals avoided swimmers 2.6% of the time. The mean distance of the swimmers from the seals had no significant effect on how frequently seals interacted with swimmers (regression analysis, $F_{1,12}$ = 4.46, p = 0.06).

Whether one or two vessels were present did not influence the time seals spent interacting with swimmers in the water (two-sample *t*-Test: t = 0.73, df = 11, p = 0.48). On the one occasion that the number of vessels present exceeded two (up to 11 vessels including kayaks), seals ignored the swimmers.

Compliance with regulations was monitored at both the study sites and results were combined for the two tour operators (Table 2.1). Of the seven Marine Mammal Protection Regulations examined; there was 100% compliance with six regulations and 94% with one. The non-compliance involved a single 1-minute event when a ‘loud or disturbing noise’ (shouting) was made in the vicinity of the seals. Of the four Marine Mammal Permit Conditions tested, there was 100% compliance with three and 81% with one condition, that swimmers numbers should not exceed 10. On three occasions, more than 10 swimmers (up to 21) were in the water in the vicinity of seals.

Table 2.1. Marine Mammals regulations/permit conditions tested, and the levels compliance for each condition.

Marine Mammals regulation or permit condition	Compliance (%)
Contact shall be abandoned at any stage if a marine mammal shows signs of becoming disturbed or alarmed.	100
No rubbish or food shall be thrown near or around any marine mammal.	100
No sudden or repeated change in the speed or direction of any vessel shall be made.	100
No person shall disturb or harass any marine mammal.	100
Any vessel within 300 m of marine mammals must move the vessel at a constant slow speed no faster than the slowest marine mammal in the vicinity, or at idle or “no wake” speed.	100
No vessel or aircraft shall approach within 300 metres of any group of dolphins or seals if 3 or more vessels are already positioned to allow passengers to view the animals.	100
No person shall make any loud or disturbing noise near dolphins or seals.	94
No more than 10 people the in water with marine mammals.	81
Maximum encounter time with seals can not exceed 90 min.	100
Maximum wet encounters with seals can not exceed 60 min.	100
No touching or handelling of marine mammals.	100

2.6. DISCUSSION

In this study, New Zealand fur seals that were in the water with swimmers spent most of their time (54%) ignoring the swimmers, there was considerable interaction (41% of time) and seals rarely avoided swimmers. Boren *et al.* (2009) documented a similar trend during seal-swim activities in Kaikoura and the Abel Tasman National Park (South Island of New Zealand). Overall, seals in the Bay of Plenty interacted more frequently with swimmers than did seals at the sites studied by Boren *et al*., despite there being many more seals at the South Island sites. Study site differences are a possible explanation for this, as the New Zealand fur seals at the South Island sites have been subject to tourism for a longer period of time and are exposed to a much higher degree of tourism and boat traffic (Boren et al., 2009). It can be assumed that the seals in the Bay of Plenty are habituated to a lesser degree than the seals at Kaikoura and the Abel Tasman National Park.

This study evaluated a range of variables associated with seal-swims to determine which factors could influence seal responses. Interactions with swimmers were initially high, peaking at 6 minutes, then ending at 22 minutes, suggesting the seals are initially curious towards swimmers but lose interest after a period of time. It is also possible that across swim duration, seals become disinterested in the presence of swimmers and shift into ignoring them. This result is similar to a finding by Bejder *et al*. (1999), in which Hector's dolphins (*Cephalorhynchus hectori*) approached tour vessels at the beginning of an encounter but became disinterested as the encounter progressed. Neumann and Orams (2006) discovered that during boat-based common dolphin (*Delphinus delphis*) encounters, initial attraction had a mean duration of 8 minutes, followed by a period of neutral behaviour, after which boat avoidance occurred. Although this study found that seal-swims over 22 minutes did not have any obvious negative effects on the seals, swims over this length are unlikely to evoke high interaction levels in seals towards swimmers.

The two seal-swims with the highest levels of interaction involved only one seal for the majority of the activity. Seals are social animals and exhibit playful behavioural traits, particularly juveniles (Barton et al., 1998, Wilson, 1974). It is proposed that an isolated seal or small group of seals is therefore still likely to interact with swimmers but that larger groups of seals may prefer to interact with each other in the water. As the highest mean seal count observed in this study was nine, and many other sites have an excess of 10 seals in the water at all times, these results do not relate to all seal-swim tourism operations. Visits conducted during this study were not independent as the same seals may have been tested on consecutive or multiple visits. Therefore, results may be related to individual seal personalities. The results suggest that in regards to small recolonising populations of seals such as the population in the Bay of Plenty, swimming with small groups of seals may still result in high levels of interaction and tourist satisfaction.

Seal response during seal-swim activities varied depending on month of the year and the stage in the breeding season. The differences across months relate to the stage in the breeding season, but may also relate to habituation. Habituation is a decrease in response to a repeated neutral stimulus over time (Gabrielsen and Smith, 1995). As month progressed, seals interacted less with swimmers and ignored them more often. The results may indicate that seals lose interest in interacting with swimmers over time, while becoming habituated to the activities and, therefore, ignoring the swimmers more often.

The shift that occurred between December and January was perhaps influenced by the stage of the breeding season. New Zealand fur seals can pup through the period of November to January (Stirling, 1971), and pupping at the Bay of Plenty in 2011-12 occurred between the 8th of December 2011 to the 15th of January 2012. During the breeding season, females give birth and nurse their pups, males actively guard territories and juveniles remain in the water or haul out away from the breeding colony (Boren et al., 2002). Females are more sensitive and susceptible to stress at this stage (Boren et al., 2002) and males are fasting and competing for territories and access to females (Miller, 1974). It can be assumed that the seals in the water during the breeding season were predominantly juveniles, and therefore, that the high levels of interaction observed may be attributed to seal age class.

The above notion is supported by our data, which demonstrated that juvenile New Zealand fur seals interacted with swimmers more than adult seals, although positive juvenile sightings had a much lower *n*-value. Female and juvenile fur seals in particular have been documented to engage more frequently with swimmers than males, due to their inquisitive and interactive nature (Barton et al., 1998). Based on the results of this study, the level of interaction may be influenced by the age class of seals in the water during seal-swims.

The number of swimmers in the water did not affect the frequency of interactions by seals. Similar results have been found elsewhere (Boren et al., 2009, Martinez, 2003). The number of vessels within 300 m of the seal-swim activities also had no significant influence on the percentage of interaction displayed. However, Moutohora Island has low levels of vessel traffic and the mean number of vessels per survey only once exceeded two. Further monitoring would be required if vessel traffic in the area were to increase in the future, as vessel traffic has the potential to influence responses of marine mammals (Papale et al., 2011).

In relation to swimmer distance, interaction displays appeared to be highest when swimmers were closer than 5 m from the seals, however this was not found to be significant. As interaction was defined as, “seals actively swimming towards or amongst the swimmers”, it is not surprising that high levels of interaction were recorded when swimmers were less than 5 m from seals. The more important information to be gained from this data is that in 11 of 14 surveys the mean distance of swimmers from seals was <10 m. This indicates that gaining a close swim encounter with seals may be a priority for tourists.

Compliance to the Marine Mammals Protection Regulations was within acceptable levels across all conditions studied. These levels were taken to be ≥ 80%, which is consistent with compliance studies elsewhere (Allen et al., 2007, Quiros, 2007, Smith et al., 2010). The majority of marine mammal compliance studies are non-compliant (Johnson and Acevedo-Gutierrez, 2007, Scarpaci et al., 2003, Scarpaci et al., 2004, Whitt and Read, 2006), with some exceptions (Allen et al., 2007). The high degree of compliance observed in this study may be a result of the Department of Conservation's large involvement with key industry stakeholders and the presence of a researcher on board. Furthermore, the predictability of sighting fur seals in the region and, therefore, the lack of a need to pursue them, may explain the high levels of compliance observed.

The results of this study indicate no obvious shifts in avoidance responses by New Zealand fur seals during seal-swims. This suggests that the current Marine Mammal Protection Regulations and permit conditions are effective in protecting seals exposed to the low level of tourism activities and boat traffic observed in this study. Recommendations for future management are made based on the behavioural responses of the seals to the variables discussed.

2.6.1. Management implications

Although a low level of avoidance responses were observed during the study, management is still needed to ensure that the levels of responses do not change significantly in the future. This has occurred during swim-with-dolphin activities - over a four year period successful encounters decreased from 48% to 34% and active avoidance increased from 22% to 31% (Constantine, 2001). Such a change could stimulate an established operator to compromise their standards to provide an experience for current tourists, irrespective if this will hasten the demise of their industry.

For effective management of a sustained seal-swim industry to occur in the Bay of Plenty, it must be ensured that increases in the current levels of avoidance responses do not arise with seal population growth and changes in boat traffic. It is suggested that monitoring of seal behavioural responses to swimmers continue, especially at Moutohora Island. In the event that increases in avoidance are observed, the Marine Mammal Protection Regulations relating to seal-swims may need to be re-evaluated and amended.

Overall, the seal-swims observed in this study had minimal effect on seals in the water, and are likely to be sustainable, provided current conditions are not altered in the future. Aside from future monitoring, it is recommended that further research should aim to examine the potential impacts of seal-swims on seals ashore. This study demonstrated that monitoring the impacts of wildlife tourism can be particularly site and time specific. It is recommended that the approaches trialled in this study be adopted to monitor other wildlife tourism activities to ensure their sustainability.

Chapter 3: The effects of controlled boat approaches on the New Zealand fur seal (*Arctophoca australis forsteri)* in the Bay of Plenty, New Zealand.

3.1. ABSTRACT

Animals that are establishing at sites near the edge of a species' range may be more vulnerable to disturbance and more likely to abandon the site than animals at well-established locations within the core of a species' range. Pinnipeds world-wide are changing their ranges and establishing at novel sites. Minimal research is available on the impact that vessel presence may pose on pinnipeds at such sites. This study documented responses of New Zealand fur seals to vessel presence in the Bay of Plenty, New Zealand, where fur seals are now breeding. Seal behaviour at a breeding location was recorded by video in the absence of vessels and recorded from on board a research vessel in the presence. When a vessel was present at the breeding site, there was no change in the percentage of time seals spent resting but they spent significantly less time alert and more time in the water than in the absence of a vessel. In the presence of a vessel, seals spent less time resting and more time alert as months progressed from November to March. The proximity of the vessel to the seals (range 10-60 m) was important; the closer in the vessel, the more vigilant the seals were. Seals spent more time alert in the afternoon than in the morning and were less alert overtime as the boat remained at the site. Pups were the most alert age class, particularly when the vessel was 10-20 m away. Males and pups were more likely to shift behaviour than females and juveniles and seals shifted behaviour more often at closer distances and in the presence of fewer seals. In order to maximise the chance that New Zealand fur seals at small, establishing sites do not abandon the sites, it is recommended that commercial and private vessels do not approach closer than 20 m. The development of a voluntary code of conduct for Moutohora Island may also be beneficial.

3.2. INTRODUCTION

Tourism is one of the world's leading economic sectors (Shackley, 1996), with an estimated one billion tourists travelling in 2012 (World Tourism Organisation, 2012). Wildlife tourism is a branch of the industry that has gained popularity worldwide (Ballantyne et al., 2009, Reynolds and Braithwaite, 2001) and provides people with the opportunity to view animals in their natural habitat (Green and Higginbottom, 2000). Pinnipeds (phocid and otariid seals, and walruses) are important wildlife attractions in many coastal regions around the world (Constantine, 1999). Like any form of wildlife tourism, pinniped-focused tourism can contribute to the conservation of the targeted animals, but can also have negative effects (Higginbottom et al., 2001, Kirkwood et al., 2003, Zeppel, 2008).

Pinnipeds are described as amphibious marine mammals, they forage at sea and regularly haul out on land to socialise, rest, moult and breed. Tourism activities may disturb hauled out pinnipeds and can have short- or long-term effects. Short-term implications of tourism can include moving from land into the sea, as reported for harbour seals (*Phoca vitulina*) disturbed by vessels (Andersen et al., 2011, Jansen et al., 2010). A study on grey seals (*Halichoerus grypus*) found that in the presence of tourism activities, seals were often alert and when approached at close distances, stampeded or "crash dived" into the sea (Curtin et al., 2009). Long-term effects are reported for Hawaiian monk seals (*Monachus schauinslandi*), which abandoned traditional breeding sites for less favourable haul outs, due to tourism pressure, which resulted in low pup survivorship and a population decline (Gerrodette and Gilmartin, 1990). In a recent study, human disturbance (including tourism activities) reduced reproductive rates in the California sea lion (*Zalophus californianus*), potentially reducing long-term population growth (French et al., 2011).

The magnitude of the responses of seals to tourism activities is dependent on a range of factors. Some species are more vulnerable to disturbance than others, for example, when visited at the same location, Australian fur seals (*Arctocephalus pusillus doriferus*) react more strongly to tour boats than New Zealand fur seals (*Arctophoca australis forsteri)* (Shaughnessy et al., 2008). Even seals of the same species may react differently depending on their individual traits, sex, age class and previous level of exposure to tourism activities (Back, 2010, Barton et al., 1998, Orsini et al., 2006). The time of day (Andersen et al., 2011) and stage in the breeding season (Back, 2010, Orsini et al., 2006) are additional factors that modify the behavioural responses of seals to tourism. So too is colony size, with seals in larger colonies responding less to the presence of tourists, (Shaughnessy et al., 2008), possibly due to their perceived individual vulnerability being less when in greater numbers (Childress and Lung, 2003, Roberts, 1996). Seals located closer to the water's edge may be less likely to respond to approaching vessels due to a sense of safety provided by having a quick and direct escape route (Back, 2010). Anthropogenic factors also affect seal response. These include tourist group behaviour and composition (Cassini, 2001, Kovacs and Innes, 1990), distance of the vessel or tourists from seals (Boren et al., 2002, Jansen et al., 2010, Pavez et al., 2011), approach angle (Jansen et al., 2010), and vessel size, speed and noise level (Newsome and Rodger, 2008, Strong and Morris, 2010).

Within New Zealand, pinniped-focused tourism activities include seal-swims (see Chapter 2), and viewing from land or from tour vessels and kayaks (Boren et al., 2002). The New Zealand fur seal is the most commonly found pinniped in New Zealand and the primary target for pinniped-focused tourism in the country. Tourist numbers at New Zealand fur seal sites peak in summer, which coincides with the seals’ breeding season (November to January) (Stirling, 1971).

Recently, New Zealand fur seals have been recovering from past exploitations (Stirling, 1970, Taylor et al., 1995) and are recolonising their former range, including areas on the North Island (Dix, 1993, Shaughnessy and McKeown, 2002). One region of the North Island that has been recolonised is the Bay of Plenty, where pupping was identified at one island, Moutohora Island, in the mid-2000s. Establishing groups of animals such as this may be particularly vulnerable to disturbance as there is an absence of the ‘sense of safety’ that is present in large aggregations (Stevens and Boness, 2003).

Several studies have documented responses of seals to tourism approaches at large, established, colonies (Andersen et al., 2011, Back, 2010, Boren et al., 2002, Holcomb et al., 2009), but few have examined seal responses at small, establishing, sites (Shaughnessy et al., 2008). In this study, controlled vessel approaches were conducted towards New Zealand fur seals at islands in the Bay of Plenty and the seals’ responses were monitored. In addition, seal behaviour was monitored in the absence of vessels using video footage data. Factors that could influence seal response were tested, including time of day, month, seal sex/age class and tourism-based factors. This information can be used to improve management as it provides information on what combination of variables cause disturbance during seal-viewing; variables which can be controlled through management measures. As the New Zealand fur seal continues to recolonise its former range, it is becoming important to develop protocols that mitigate the effect of tourism, allowing these colonies to effectively establish themselves.

3.3. METHODS

3.3.1. Study sites

Data on seal behaviour during controlled approaches were collected from three study sites in the Whakatane region of the Bay of Plenty, New Zealand. These were Moutohora Island, the Rurima Islands and White Island (Figure 3.1).

Moutohora Island

Moutohora Island is located approximately 9 km north of Whakatane. In 1965, the island was declared a wildlife refuge under private ownership and in 1991 it became a Wildlife Management Reserve, administered by the Department of Conservation (DOC). Public landings have been prohibited since 1992 but guided tours on the island are held once a week over summer. In the 1990s, New Zealand fur seals established haul-out sites on Moutohora Island and in the last few years occasional pup births have occurred at a haul-out site in McEwan’s Bay.

Rurima Islands

The Rurima Islands is a group of small islands and rock stacks including Rurima (the largest island), Moutoki and Tokata. They are located 18 km north-west of Whakatane. They are owned by the local Maori and are classified as a wildlife sanctuary with prohibited public access. No evidence of seal breeding on the islands has been recorded.

White Island

White Island is an active marine volcano located 49 km from Whakatane. The Island is privately owned and was declared a private scenic reserve in 1953. Tours onto the volcano run regularly. Seals haul out on the outskirts of the island and at the nearby Volkner Rocks; no evidence of breeding has been recorded.

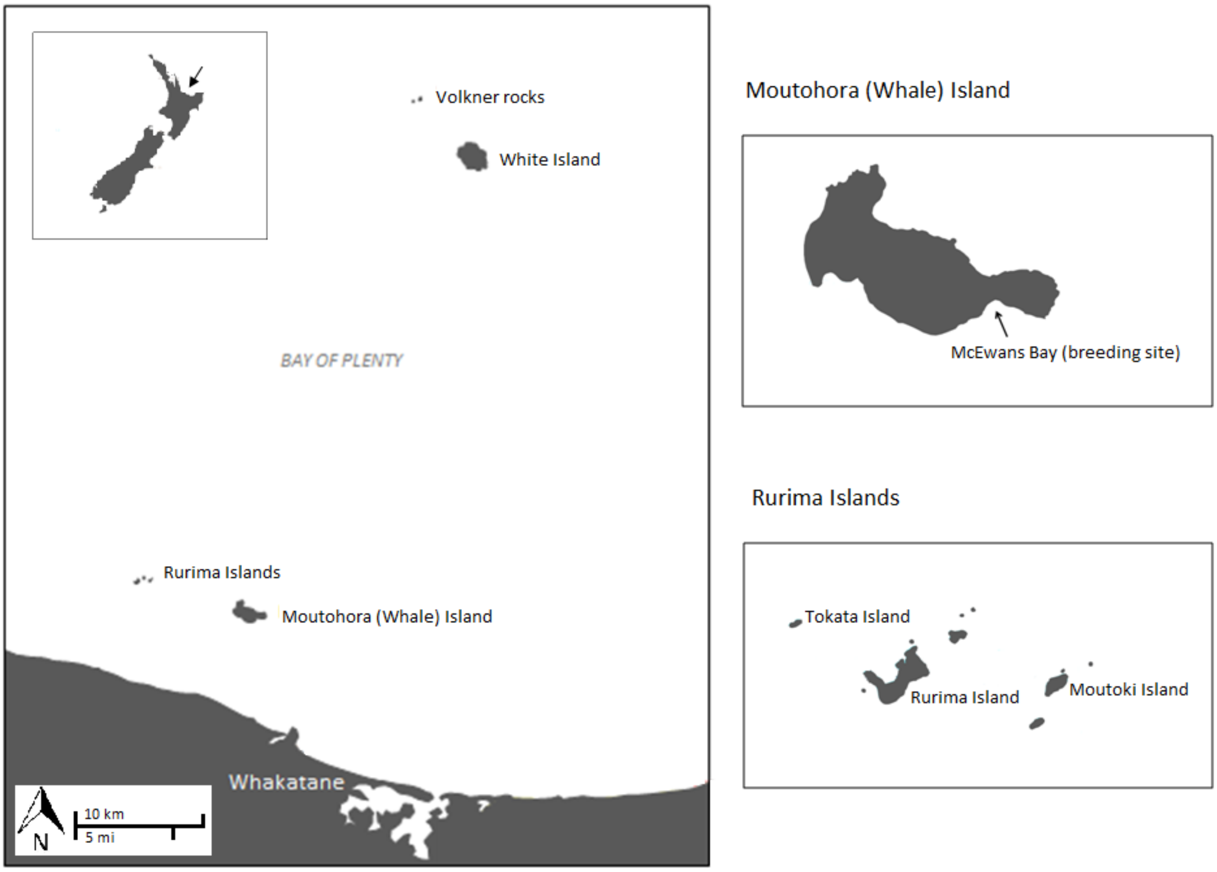

Figure 3.1. Map of the Whakatane region of the Bay of Plenty, New Zealand.

3.3.2. Field method

Method

Controlled approaches towards seals were conducted from on-board a Department of Conservation (DOC) vessel (8 m length, 1 x 270 hp motor) and on one occasion from on-board a chartered tour vessel (10 m length, 1 x 250 hp motor). In this study, a "controlled approach" was a vessel approach towards seals during which many variables could be controlled, including what distance the vessel stoped at, how long it remained stationary at the site and what time it arrived. Moutohora Island was the primary study site but approaches were also conducted at non-breeding islands. During each island visit, the island was circumnavigated to locate seals and each seal or small group of seals was observed at a pre-determined distance for ten minutes, documenting their responses to the vessel. At the McEwan's Bay breeding site, seals were observed for 60 minutes.

McEwan's Bay

Morning and afternoon approaches were conducted toward the breeding group of seals at McEwan's Bay, as seal behaviour can vary depending on time of day. On each approach, the vessel travelled at no wake speed to a randomly selected approach distance: 10-20 m, 20-30 m, 30-40 m, 40-50 m and 50-60 m. A rangefinder (Bushnell 7 x 26 laser rangefinder) was used to ensure the distance was accurate. The boat was then anchored, and the engine turned off. Each visible seal from left to right was given a 'focal-follow' number and its' sex/age class, adult/ sub-adult male (termed male), adult female, juvenile or pup, was noted following the definitions of Goldsworthy and Shaughnessy (1994). Seal identification data was recorded whilst the boat approached the pre-determined distance from the seals.

Once the boat was positioned, behavioural sampling of the seals began using 1-minute scan sampling (Altmann, 1974). In addition, as per group focal follows, if a seal changed behaviour during the minute, this was recorded (Altmann, 1974). An interval timer allowed the exact time of behavioural changes to be noted. It was possible to conduct individual focal-follows as the number of seals visible at one time was low; the total number of seals at the site rarely exceeded ten. Seal behaviour was determined from 11 behavioural categories (see Table 3.1). The variables recorded during surveys at McEwan's Bay included: time and duration of stay, number of seals, number of vessels, distance of seals from vessels, and meteorological information (example data sheet in Appendix 2).

Table 3.1. Definitions of behavioural categories used in this study. Definitions have been adapted from behaviours described by Boren *et al*. (2002), Stirling (1970) and Renouf (1991).

Behavioural category	**Definition**
Rest	Laying down with eyes open or closed.
Alert	General awareness.
Swim	Any form of swim behaviour including active swimming, porpoising, or resting in the water.
Groom	Comfort behaviours including grooming or scratching.
Upright posture	Territorial dominance display in males, possible thermoregulatory/drying posture in females.
Aggressive	Aggressive behaviours including open mouth displays and fights between adult males.
Move	Active movement from one area to another.
Haul-out	Moving from water onto land.
Retreat	Moving from land into water.
Social	Interacting with other seals on land or in the water.
Suckling	Pup-specific behaviour - pup suckling from its mother. Females nursing pups were classified as resting.

True control behaviour of seals in the absence of human disturbance was obtained through the use of a video camera (Panasonic SDR-S71). Day trips onto Moutohora Island allowed a camera to be positioned towards the seals at McEwan’s Bay. The camera was set up approximately 5-10 m above seals (minimum of 10 m from seals). The camera was left filming, and from a further vantage point the researcher recorded any variables that may have influenced the seals, including approaching vessels. The video footage was later analysed manually using the same behavioural sampling method mentioned above. To ensure that only control (in the absence of a vessel) behavioural data was analysed, sections of video footage were excluded from analysis if vessel presence had been recorded at the time of filming.

Non-breeding sites of Moutohora Island, White Island and the Rurima Islands

Moutohora Island, White Island and the Rurima islands were slowly circumnavigated until a seal or group of seals were located. Occasionally, the pre-determined distance for the day could not be achieved due to the tide level and the presence of underwater reefs. On these occasions a more suitable distance category was chosen based on the closest safe distance to that originally prescribed. The behavioural sampling techniques described above were used during each ten minute controlled approach. Aside from the aforementioned variables, co-ordinates and waypoints were recorded at each site.

3.4. STATISTICAL ANALYSIS

Three data sets were used for the analysis of results. Data displaying the percentage of time seals spent in various behaviours per survey were used for comparisons of behavioural budgets in the presence and absence of a vessel (n = 68 surveys in vessel presence, 15 surveys in vessel absence). The data were also used later for analysis of the number of vessels as an influencing factor on seal behaviour. A data set including the behaviour of seals during each 1-minute scan was used for all GLMM analysis and for further analysis of seal response over time (minute into stay) (n = 4084 1-minute scans, divided into 68 surveys). Both of the data sets described above did not include pup behaviour. For all other analysis, including behavioural shift analysis, focal follow data of individual seals in the first 10 minutes of approach were used. Focal follow data included pup behaviour (n= 696 focal follows at all sites, 359 focal follows at McEwan's Bay only).

Generalised linear mixed models (GLMMs) with a binomial distribution were constructed and run in R v2.15.0 (R Development Core Team 2012) with the package lme4 (Bates and Sarkar, 2006). GLMMs were applied to identify which factors influence seal resting and alert behaviours during controlled boat approaches. Data collected for this study was in the form 68 separate 'surveys' (majority 60 minute surveys), divided into 1-minute samples. Models including the random factor 'survey' were better supported than those without and therefore, all subsequent models included this random factor. The influence of the variables time of day, month, distance, number of seals and the interaction between distance and minutes were investigated. The interaction between distance and minutes was considered because the trend observed across time may have differed depending on how close the boat was to the seals.

To determine the most influential variables for seals the drop1 command in R was used to remove the least supported factors in turn until all remaining factors were statistically significant. The models were compared using Akaike's Information Criterion for small sample sizes (AICc), and the model with the lowest AICc was determined to be the best supported model. Due to model selection uncertainty, parameter estimates were calculated after model-averaging (Burnham and Anderson, 2002) using the R package MuMIn (Barton, 2009).

Homogeneity of variance is a key assumption of GLMMs. To test for this, residuals versus fitted values plots were constructed and homogeneity was visually assessed. The even horizontal spread across a range of fitted values and the absence of cone or wave shaped distributions confirmed the homogeneity of variance assumption (Zuur et al., 2009).

The number of behavioural shifts was used as an indicator of seal vigilance/ restlessness. Behavioural shift data were analysed in SPSS (version 20). The square root of the number of behavioural shifts was calculated to produce a better distribution. Forward stepwise logistic regression was used to determine predictor variables affecting whether or not behavioural shifts occurred. These variables were month, time of day, stage in the breeding season, distance, seal sex/age class and the number of seals. Univariate analysis of variance was used to determine which predictor variables affected the number of behavioural shifts displayed by seals.

Analyses of focal follow data were also conducted in SPSS. ANOVA and Student's *t*-tests (based on a statistical tolerance of $p = 0.05$) were applied to assess for significant differences in seal behaviour during controlled approaches depending on a range of variables.

3.5. RESULTS

The mean number of seals per day at Moutohora Island during the period of November 2011 to March 2012 was 22.23 (range = 11-33). The mean number of seals observed at McEwan's Bay per day was 9.48 (range = 4-14). The mean number of seals at other areas of the island was 12.54 (range = 3-24). Mean seal numbers at McEwan's Bay per day in relation to month were 5.25 (range = 4-7) in November, 11.57 (range = 7-13) in December, 11.38 (range = 10-14) in January, 10.15 (range = 8-12) in February and 6.43 (range = 5-8) in March. A minimum of seven pups were born on the Island at McEwan's Bay and another young pup was observed many times at a site further around the island and was presumed to have been born there.

3.5.1. McEwan's Bay breeding site – vessel presence vs. control

At McEwan's Bay, video sampling (n = 15 surveys of varying duration) while based ashore revealed that in the absence of a vessel New Zealand fur seals (excluding pups) spent 65% of their time resting, 16% alert, 6% upright, 9% grooming, 4% in the water and 1% on other activities (Figure 3.2). In the presence of vessels (measured while on-board), the seals spent 61% of their time resting, 8% alert, 8% upright, 5% grooming, 17% in the water and 1% on other activities (n = 68 majority 60 minute surveys). Compared with in the absence of a vessel, when a vessel was present the seals spent the same percentage of time resting (t = 0.49, df = 81, p = 0.63) but significantly less time being alert and more time in the water (t = 2.76, df = 81, p = 0.007 and t = 2.98, df = 81, p = 0.004, respectively).

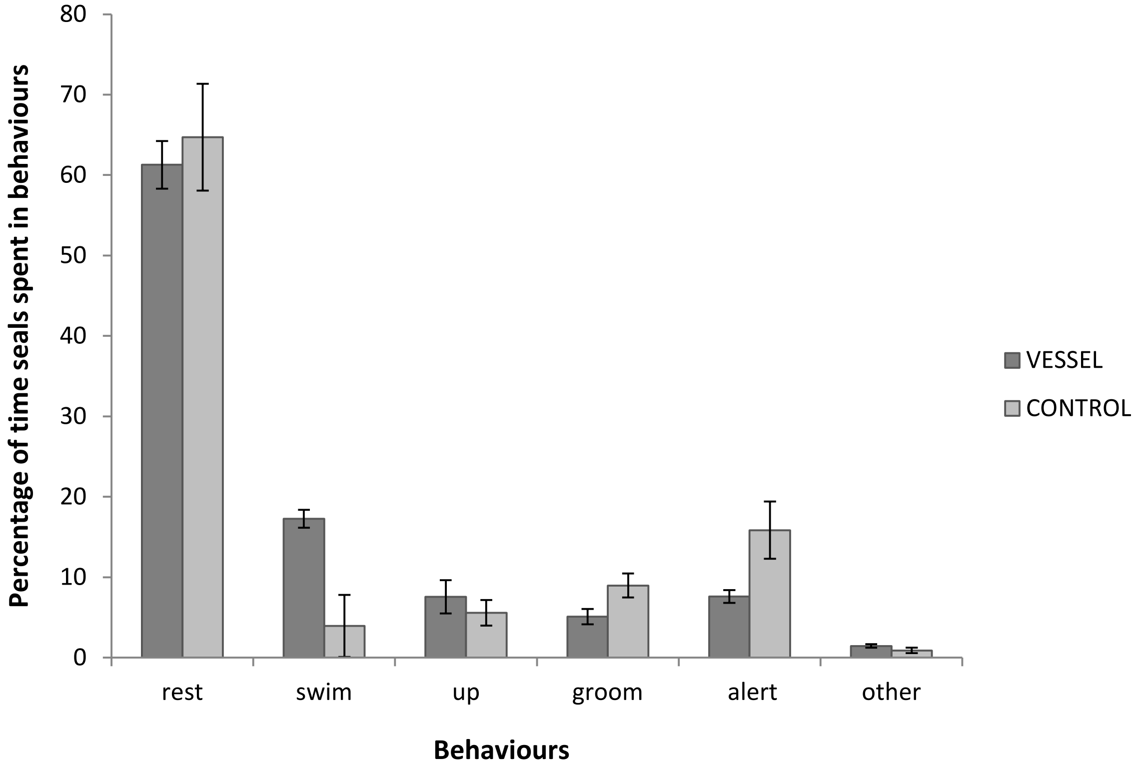

Figure 3.2. The percentage time New Zealand fur seals at McEwan's Bay spent on different behaviours in the presence (*n* = 68 survey periods, total time 4084 min.) and absence (*n* = 15 survey periods, total time 591 min.) of a vessel.

3.5.2. GLMM results for influencing variables on rest behaviour

The most supported GLMM for influences on seal resting behaviour during controlled boat approaches included the explanatory variables: month, distance, time of day and minutes (Table 3.2). This suggests that this combined set of variables best describes the influences on seal resting behaviour during controlled boat approaches. The interaction between distance and minutes and the number of seals at the site did not influence seal rest behaviour. Seals rested less as months progressed from November to March (Figure 3.3 a.). The further the boat was from the seals, the more the seals rested (Figure 3.3 b.). Seals rested slightly more in the morning than in the afternoon (Figure 3.3 c.) and rested slightly less overtime as the boat remained at the site (Figure 3.3 d.).

3.5.3. GLMM results for influencing variables on alert behaviour

The AICc values for the GLMMs relating to alert behaviour were similar and therefore, model-averaging was conducted. The model average included all the explanatory variables: minutes, time of day, month and distance, number of seals and the relationship between minutes and distance. Based on AICc values (Table 3.3), the variables minutes, time of day, month and to a lesser extent, distance, were important influences on alert behaviour. This suggests that this combined set of variables best describes the influences on seal alert behaviour during controlled boat approaches. The interaction between distance and minutes and the number of seals at the site did not influence alert behaviour. Seal alert behaviour increased as month progressed from November to March (Figure 3.4 a.). The further the boat was from the seals, the less alert they were (Figure 3.4 b.). Seals were slightly less alert in the morning than in the afternoon (Figure 3.4 c.) and slightly less alert overtime as the boat remained at the site (Figure 3.4 d.).

Table 3.2. Summary of Generalised Linear Mixed Models comparing the resting behaviour of seals during controlled boat approaches, depending on influencing factors. These factors were: month (November-March); time of day (am, pm); number of seals, time (1-60 mins.), distance between boat and seals onshore (10-20 m, 20-30 m, 30-40 m, 40-50 m & 50-60 m) and the interaction between time and distance. Abbreviations were used in the model description for time of day (tod), number of seals (#seals), time (mins) and the interaction between distance and minutes (distance:mins). All models include a random factor: (1|survey). Shown are model descriptions with AICc, difference in AICc from the best supported model (ΔAICc), deviance, AICc weights (ω) and the number of parameters (k).

Model rank	Description: Seal resting behaviour~	AICc	ΔAICc	Deviance	ω	k
1	mins + tod + month + distance + (1|survey)	3746.898	0.000	3734.876	0.45	6
2	mins + tod + month + distance + distance:mins+ (1|survey)	3748.551	1.653	3734.522	0.20	7
3	mins + tod +month + (1|survey)	3749.245	2.347	3739.230	0.14	5
4	mins + month + distance (1|survey)	3749.693	2.795	3739.678	0.11	5
5	mins + #seals + tod + month + distance + distance:mins+ (1|survey)	3750.423	3.525	3734.385	0.08	8
6	mins + month + (1|survey)	3752.132	5.234	3744.122	0.03	4

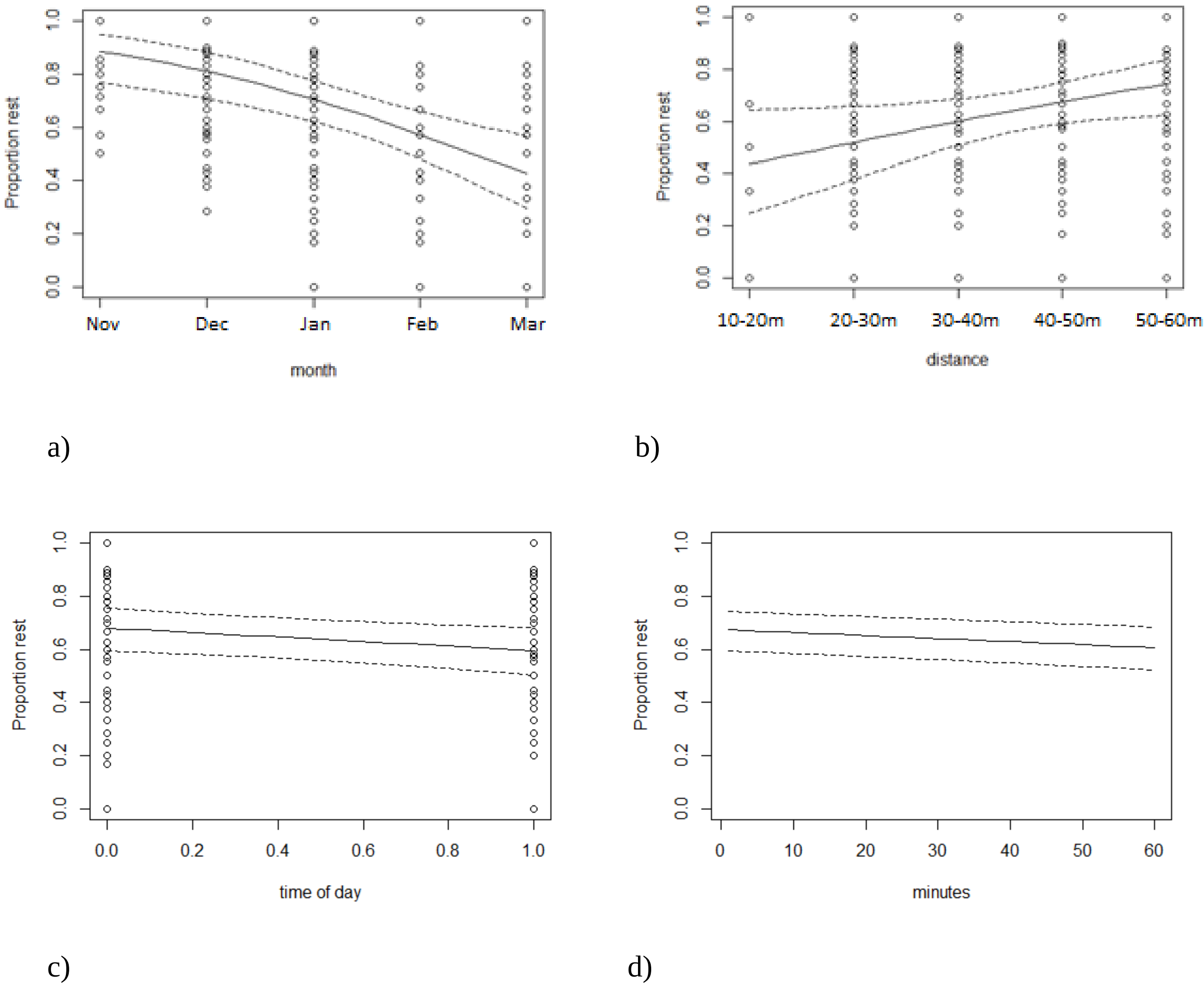

Figure 3.3. GLMM predicted probabilities of resting behaviour in seals for all controlled boat approaches at the breeding site, depending on *a)* month, *b)* distance, *c)* time of day and *d)* minutes. The dotted lines represent 95% confidence intervals. The points on the graph represent the percentage of resting behaviour depending on month.

Table 3.3. Summary of Generalised Linear Mixed Models comparing the alert behaviour of seals during controlled boat approaches, depending on influencing factors. These factors were: month (November-March); time of day (am, pm); number of seals, time (1-60 mins.), distance between boat and seals onshore (10-20 m, 20-30 m, 30-40 m, 40-50 m & 50-60 m) and the interaction between time and distance. Abbreviations were used in the model description for time of day (tod), number of seals (#seals), time (mins) and the interaction between distance and minutes (distance:mins). All models include a random factor: (1|survey). Shown are model descriptions with AICc, difference in AICc from the best supported model (ΔAICc), deviance, AICc weights (ω) and the number of parameters (k).

Model rank	Description: Seal alert behaviour~	AICc	ΔAICc	Deviance	ω	k
1	mins + tod + month + distance + (1|survey)	2993.24	0.00	2981.22	0.34	6
2	mins + tod + month + (1|survey)	2994.48	1.24	2984.46	0.18	5
3	mins + tod + month + distance + distance:mins + (1|survey)	2995.12	1.89	2981.10	0.13	7
4	tod + month + distance + (1|survey)	2995.78	2.55	2985.77	0.10	5
5	mins + tod + (1|survey)	2996.59	3.35	2988.58	0.06	4
6	mins + # seals + tod + month + distance + distance:mins + (1|survey)	2997.04	3.80	2981.00	0.05	8
7	tod + month + (1|survey)	2997.07	3.83	2989.06	0.05	4
8	month + distance + (1|survey)	2997.51	4.27	2989.50	0.04	4
9	# seals + tod + month + distance +(1|survey)	2997.69	4.46	2985.67	0.04	6

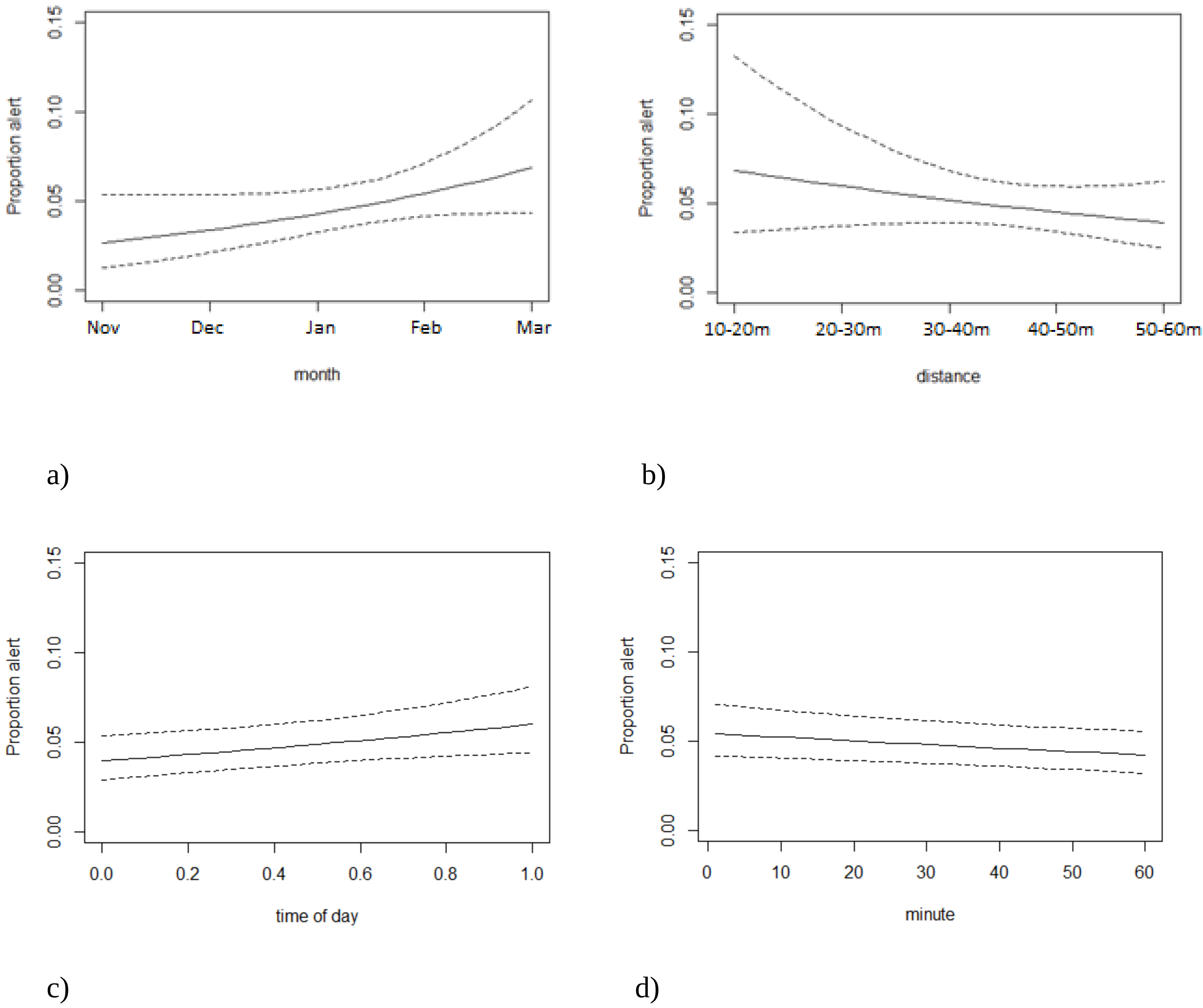

Figure 3.4. GLMM predicted probabilities of alert behaviour in seals for all controlled boat approaches at the breeding site, depending on *a)* month, *b)* distance, *c)* time of day and *d)* minutes. The dotted lines represent 95% confidence intervals. The points on the graph have been removed as the scale of the graph has been adjusted for better visual representation of the trend.

3.5.4. McEwan's Bay breeding site – influence of time & number of vessels

Seal alert and rest behaviour in relation to time was analysed further. During vessel visits, the percentage of time seals spent resting remained constant over time (ANOVA: $F_{59,3777}$ = 0.39, p = 1.00; Figure 3.5), although the time spent alert fluctuated (ANOVA: $F_{59,3777}$ = 1.56, p = 0.004, Figure 3.6). The seals were most alert when the vessel arrived and again approximately 40 minutes after the vessel had arrived.

The maximum number of vessels present per survey did not affect the percentage of time seals spent resting or alert (one-way ANOVA: $F_{4,63}$ = 0.07, p = 0.99) and (one-way ANOVA: $F_{4,63}$ = 0.18, p = 0.95), respectively.

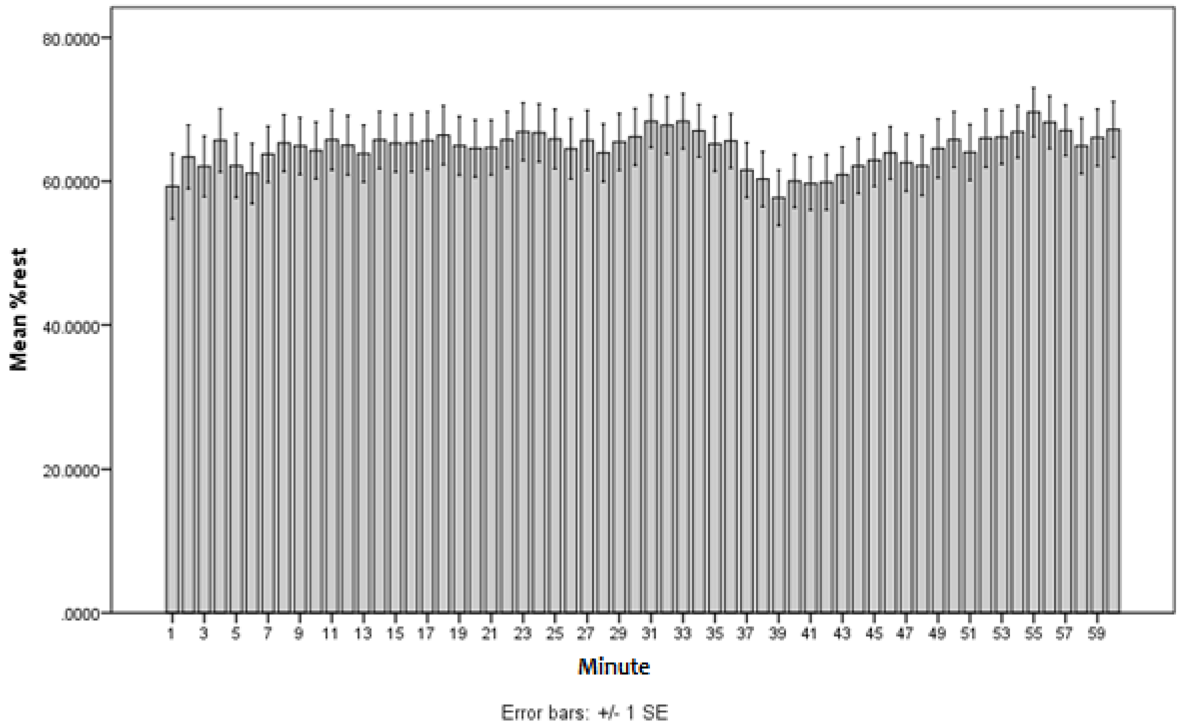

Figure 3.5. Mean percentage of time seals at McEwan's Bay spent resting each minute (over time) during controlled boat approaches, n = 68 surveys.

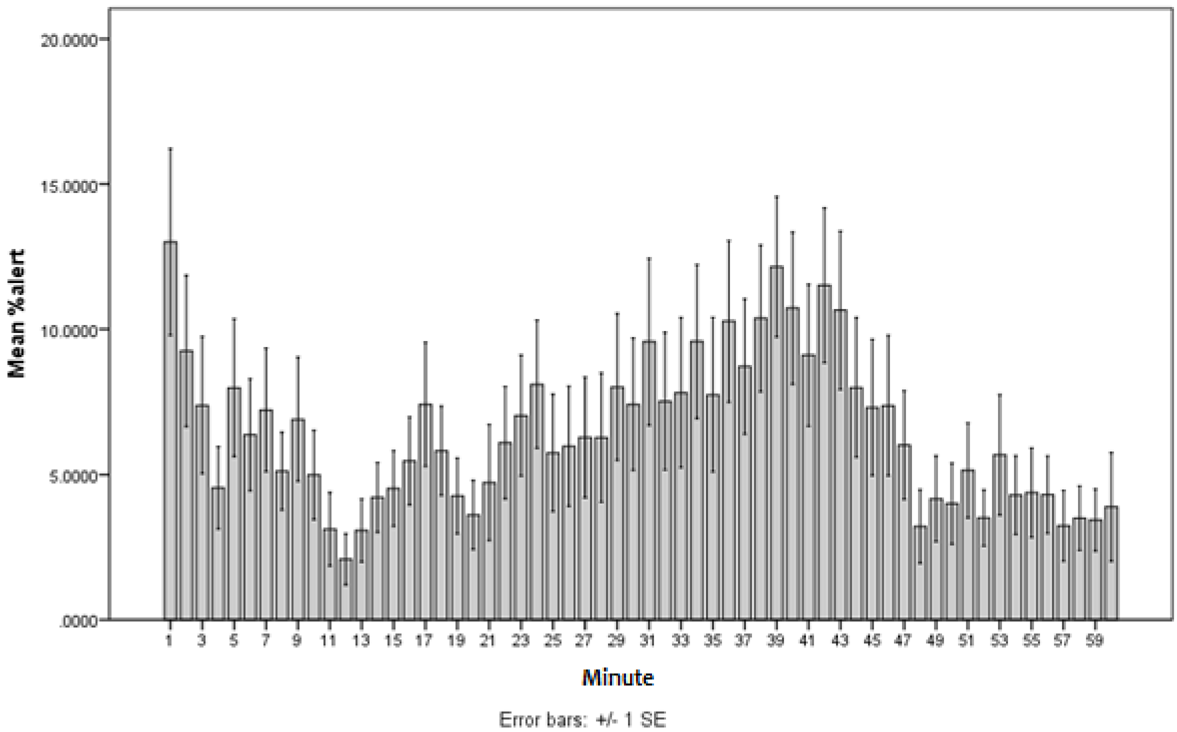

Figure 3.6. Mean percentage of time seals at McEwan's Bay spent alert each minute (over time) during controlled boat approaches, n = 68 surveys.

3.5.5. Site differences

Focal follow data on individual seal response in the first 10 minutes of vessel presence was collected 359 times at McEwan's Bay, 299 times at other areas of Moutohora Island, 29 times at the Rurima Islands and 9 times at White Island. Between locations, there were significant differences in the percentage of time seals spent swimming (one-way ANOVA: $F_{3,692} = 14.11$, $p < 0.001$), grooming (one-way ANOVA: $F_{3,692} = 6.86$, $p < 0.001$), and in the upright position (one-way ANOVA: $F_{3,692} = 5.61$, $p = 0.001$). There was no significant difference, however, in the percentage of time seals spent resting or alert depending on location (one-way ANOVA: $F_{3,692} = 0.78$, $p = 0.51$) and (one-way ANOVA: $F_{3,692} = 1.68$, $p = 0.17$), respectively. When comparing seal behaviour at the McEwan's Bay breeding site with seal behaviour at non-breeding sites of Moutohora Island, there were significant differences in the percentage of time seals spent alert (t-Test: $t = 2.03$, $df = 655.37$, $p = 0.04$), swimming

(t-Test: t = -6.28, df = 486.57, p < 0.001), grooming (t-Test: t = -2.57, df = 460.14, p = 0.01) and upright (t-Test: t = 3.99, df = 504.56, p < 0.001). There was no significant difference in the percentage of time seals spent resting (t-Test: t = 1.38, df = 656, p = 0.17).

3.5.6. Behaviour of seals at McEwan's Bay during the first 10 minutes of a vessel approach

During the first 10 minutes of a vessel's presence at McEwan's Bay, adult males and females rested similarly (t = -0.98, df = 288, p = 0.33) spending approximately 56% and 61% of their time at rest, which was significantly more than the time juveniles (16%) or pups (23%) spent resting (t = 4.49, df =16.31, p < 0.001 and t = 5.36, df = 112.05, p < 0.001, respectively, Figure 3.7 a). Adult males and females also swam for comparable periods (t-Test: t = 0.42, df = 288, p = 0.67), which was less often than juveniles (t-Test: t = -2.29, df = 11.54, p = 0.04), while pups rarely entered the water (Figure 3.7 b). Pups tended to be more alert than the older seals (ANOVA $F_{3,349}$ = 3.94, p = 0.009), which spent similar proportions of time alert (ANOVA $F_{2,299}$ = 1.68, p = 0.19) (Figure 3.7 c).

Focal follow data of seals in the first 10 minutes of vessel approaches were compared based on whether focal individuals came from the McEwan's Bay breeding site or non-breeding sites at Moutohora Island. The percentage of time spent resting decreased each month from November until February, followed by an increase in March. This trend can be seen at both site types (Figure 3.8). An ANOVA revealed that the aforementioned trend was significant at the breeding site (one-way ANOVA: $F_{4,354}$ = 16.08, p < 0.001) but not at the non-breeding sites (one-way ANOVA: $F_{4,294}$ = 1.69, p = 0.15).

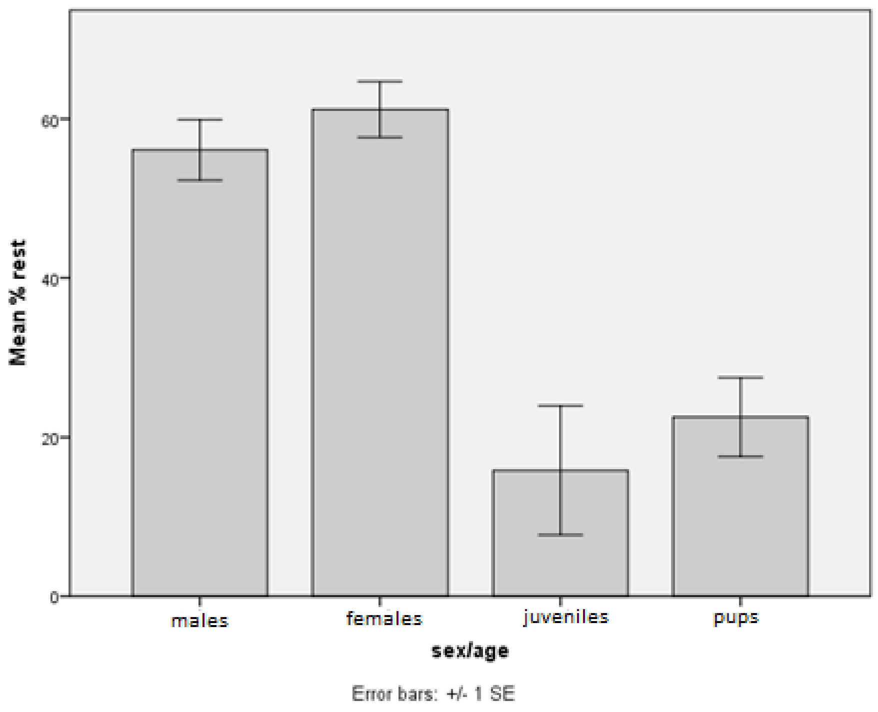

Figure 3.7. a) Mean percentage of time seals at McEwan's Bay spent resting depending on sex/age class.

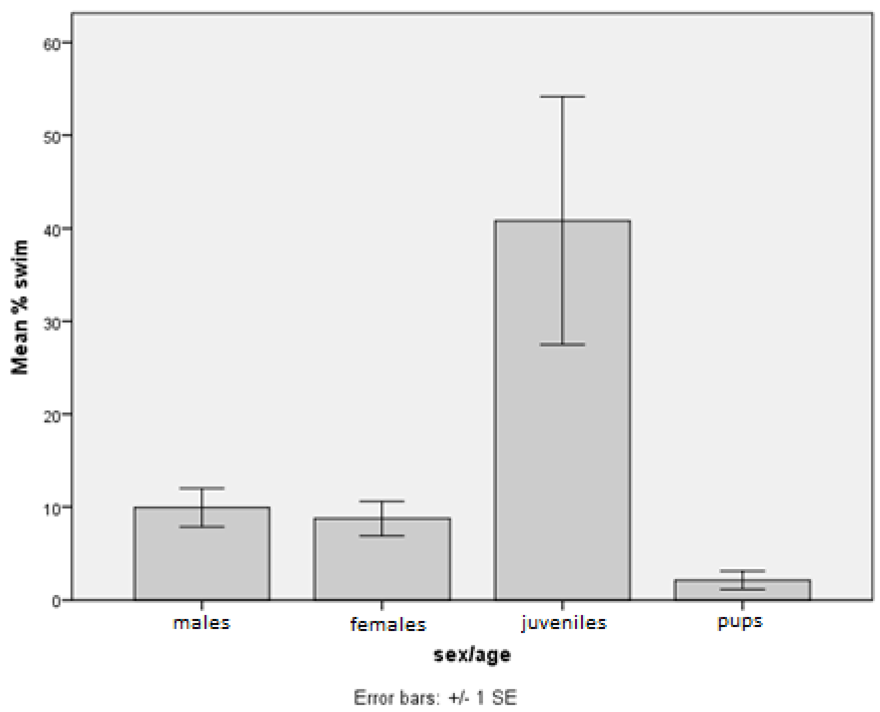

Figure 3.7. b) Mean percentage of time seals spent swimming depending on sex/age class.

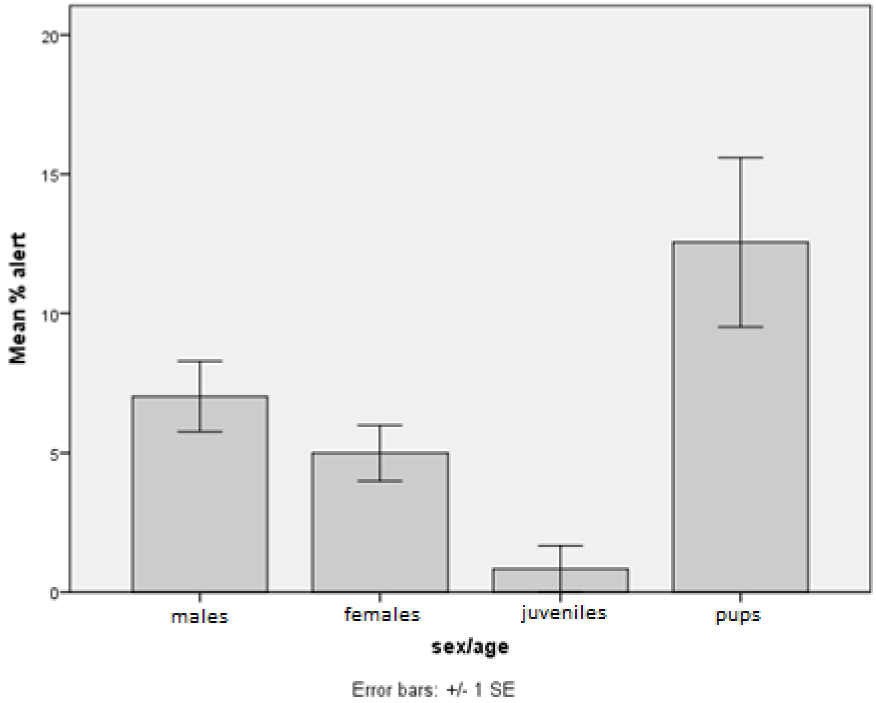

Figure 3.7. c) Mean percentage of time seals spent alert depending on sex and age class. *n* = 138 male, 152 female, 12 juvenile and 51 pup focal follows.

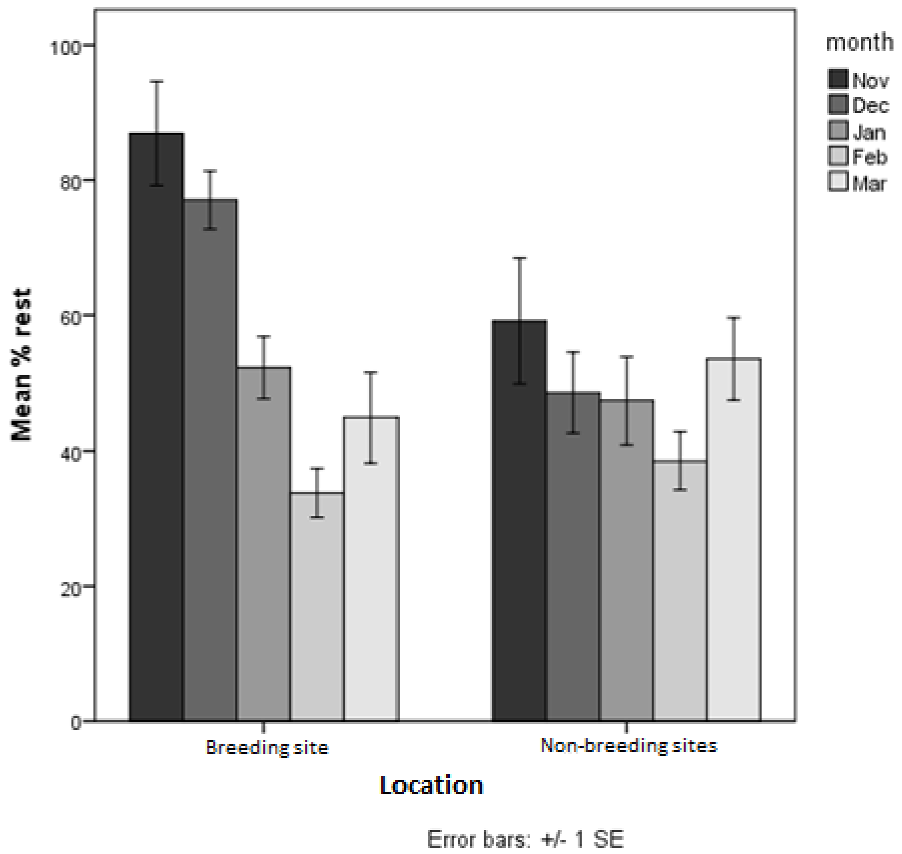

Figure 3.8. Monthly data on mean percentage of time adult New Zealand fur seals spent resting, comparing seals at McEwan's Bay (a pupping site, *n* = 359 focal animals) with those at Moutohora Island (a non-pupping sites, *n* = 299 focal animals).

Seal behaviour at McEwan's Bay varied across month depending on sex/age class. Juvenile rest behaviour was significantly affected by month (one-way ANOVA: $F_{2,9}$ = 44.19, $p <$ 0.001), but alert behaviour was not (one-way ANOVA: $F_{2,9}$ = 0.45, p = 0.65). Pup rest and alert behaviour was not affected by month (one-way ANOVA: $F_{2,48}$ = 0.13, p = 0.86) and (one-way ANOVA: $F_{2,48}$ = 0.77, p = 0.47), respectively. The percentage of time spent resting in both males and females decreased each month until March when it increased slightly (Figure 3.9.a). An ANOVA confirmed that this trend was significant in males (one-way ANOVA: $F_{4,133}$ = 5.53, p < 0.001) and females (one-way ANOVA: $F_{4,147}$ = 9.45, p < 0.001). Male alert behaviour was low in November but consistent across all other months and female alert behaviour increased as months progressed (Figure 3.9. b). The monthly differences in the time spent alert were not significant in males (one-way ANOVA: $F_{4,133}$ = 0.49, p = 0.74) or in females (one-way ANOVA: $F_{4,147}$ = 2.25, p = 0.07).

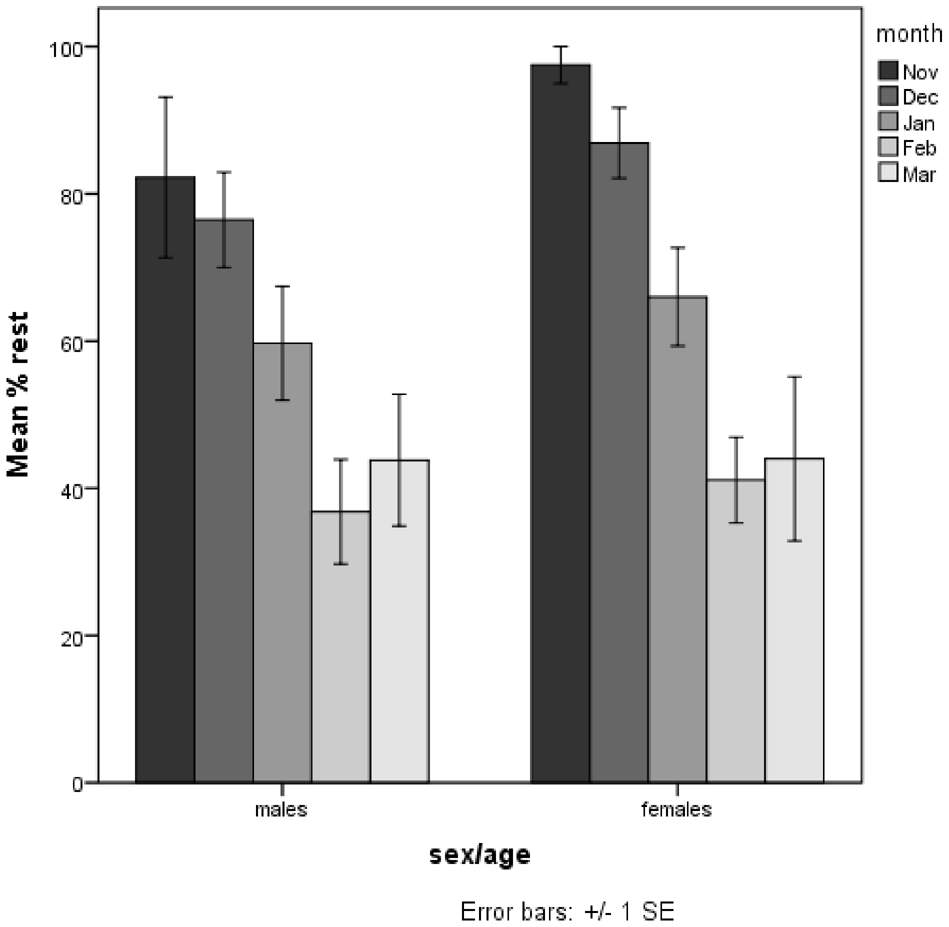

Figure 3.9. a) Mean percentage of time seals at McEwan's Bay spent resting depending on month and sex/age class (males and females only), n = 13 focal follows in November, 73 focal follows in December, 73 focal follows in January, 95 focal follows in February and 36 focal follows in March.

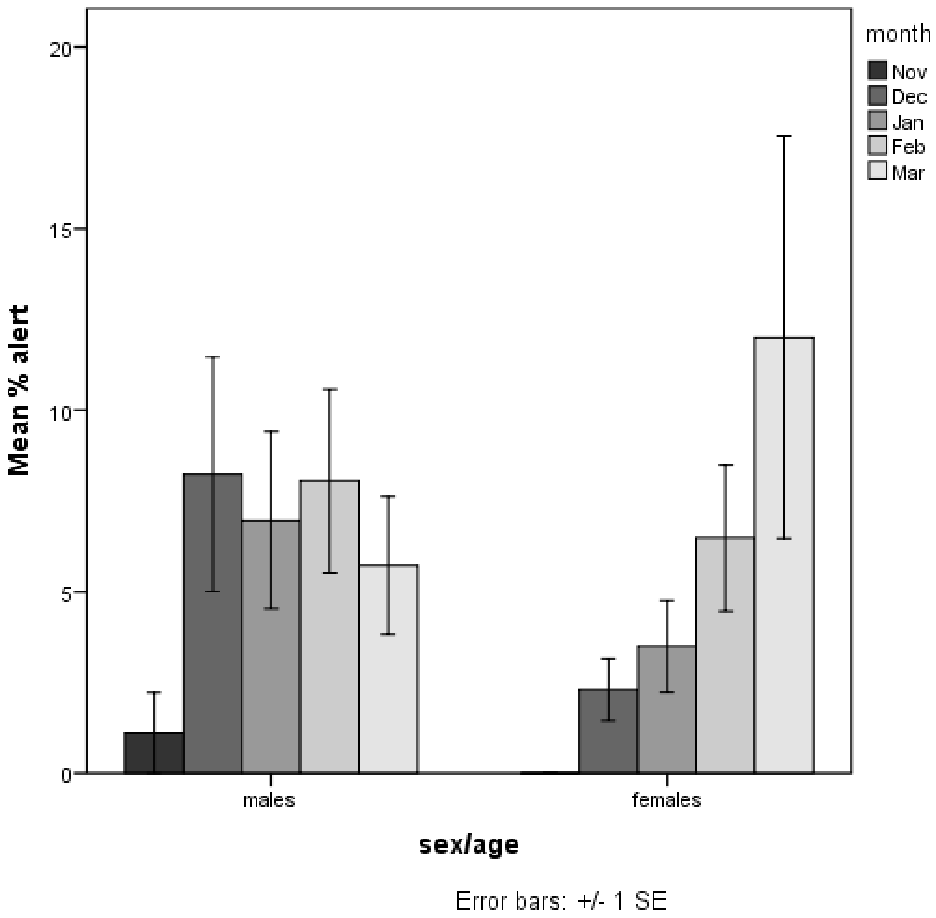

Figure 3.9. b) Mean percentage of time seals at McEwan's Bay spent alert depending on month and sex/age class (males and females only), *n* = 13 focal follows in November, 73 focal follows in December, 73 focal follows in January, 95 focal follows in February and 36 focal follows in March.

Seals responded differently to controlled boat approaches at different distances depending on sex/age class. Pups appeared to be most influenced by vessel distance and at the closest distance (10-20 m), they spent a mean 58% of their time alert (Figure 3.10). An ANOVA confirmed the assumption that pups were significantly more alert when the boat was closer (one-way ANOVA: $F_{4,46} = 7.44$, $p < 0.001$). Distance did not significantly affect alert behaviour in males, females or juveniles (one-way ANOVA: $F_{4,133} = 0.27$, $p = 0.90$), (one-way ANOVA: $F_{4,147} = 1.68$, $p = 0.16$) and (one-way ANOVA: $F_{3,8} = 0.59$, $p = 0.64$), respectively.

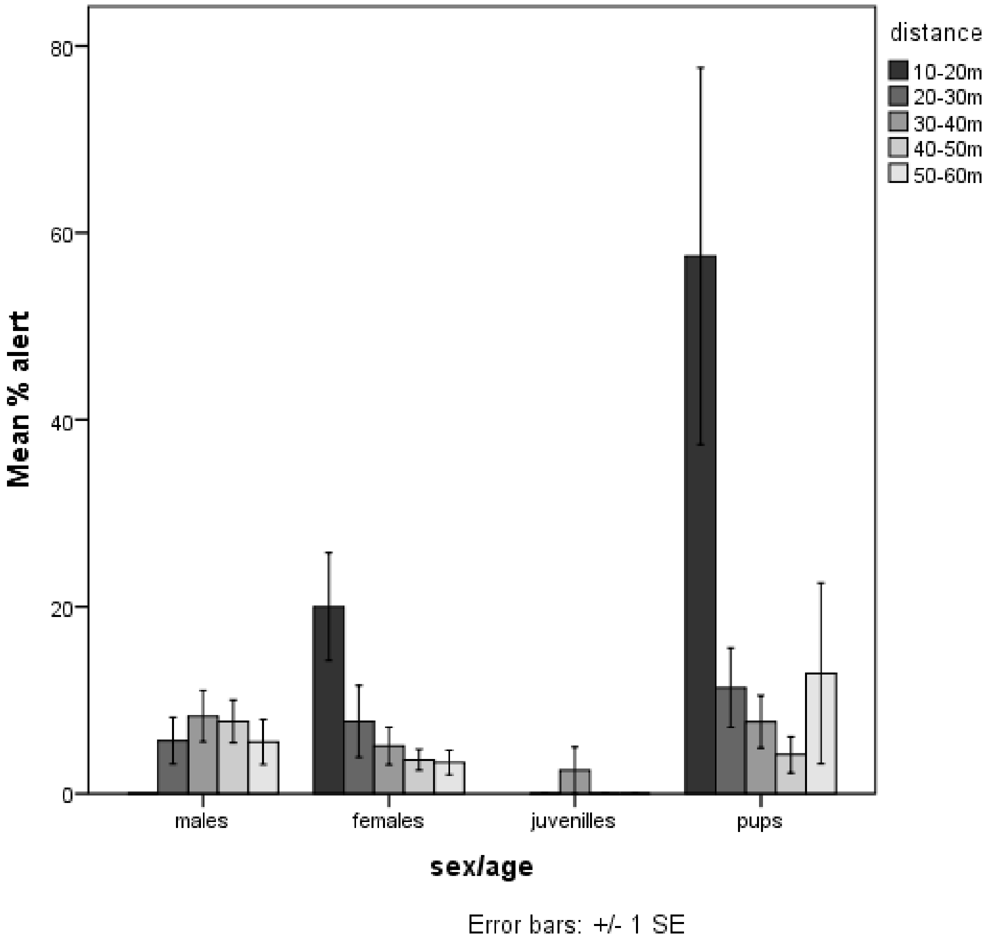

Figure 3.10. Mean percentage of time seals at McEwan's Bay spent alert depending on distance of the vessel and sex/age class, $n = 8$ focal follows at 10-20 m, 62 at 20-30 m, 111 at 30-40 m, 105 at 40-50 m and 67 at 50-60 m.

3.5.7. Influences on behavioural shifts in seals at all sites during the first 10 minutes of a vessel approach

There was no significant difference between sites in the number of times seals shifted behaviour (one-way ANOVA: $F_{3,692} = 0.77$, $p = 0.51$) and therefore, behavioural shift data from all sites were combined. The number of behavioural shifts of each seal in the first 10 minutes of boat approach was calculated from individual focal follow data. Forward stepwise logistic regression was used to determine predictor variables affecting whether or not any behavioural shifts occurred. Whether seals shifted behaviour or not was singularly influenced by their sex and age class ($\chi^2 = 11.50$, $df = 4$, $p = 0.21$) (Figure 3.11). This was confirmed using the backward stepwise and enter methods. Males and pups were more likely to shift behaviour than females and juveniles.

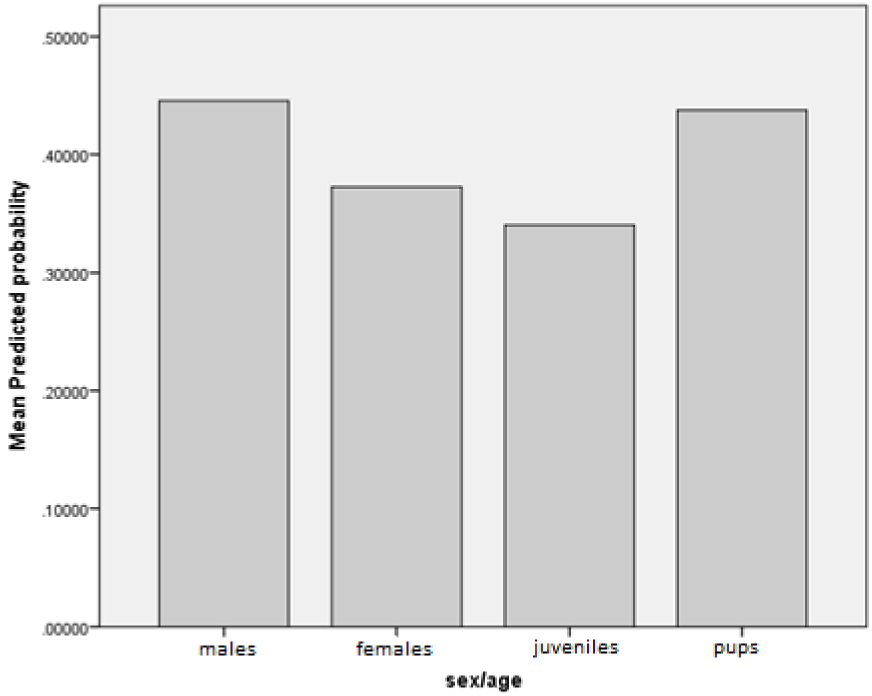

Figure 3.11. Mean predicted probability of seals shifting behaviour one or more times, depending on seal sex/age class, n = 696 focal follows.

Univariate analysis of variance was used to determine which predictor variables affected the number of behavioural shifts displayed by seals. The model for behavioural shifts produced a good fit ($F_{6,269}$ = 3.66, p = 0.002). The important variables in the final model were distance ($F_{5,269}$ = 3.04, p = 0.011) and the number of seals ($F_{1,269}$ = 10.35, p = 0.001). Seals shifted behaviour more often when the boat was closer, particularly 10-20 m (Figure 3.12) and in the presence of fewer seals (Figure 3.13). The 95% confidence intervals for the square root of the number of behavioural shifts was (2.150, 3.136) within 10-20 m, (1.896, 2.299) within 20-30 m, (1.870, 2.229) within 30-40 m, (1.852, 2.194) within 40-50 m, (1.595, 1.982) within 50-60 m and (1.532, 2.020) over 60 m. The co-efficient for the total number of seals is -0.052 (T = -3.22, df= 269, p= 0.001).

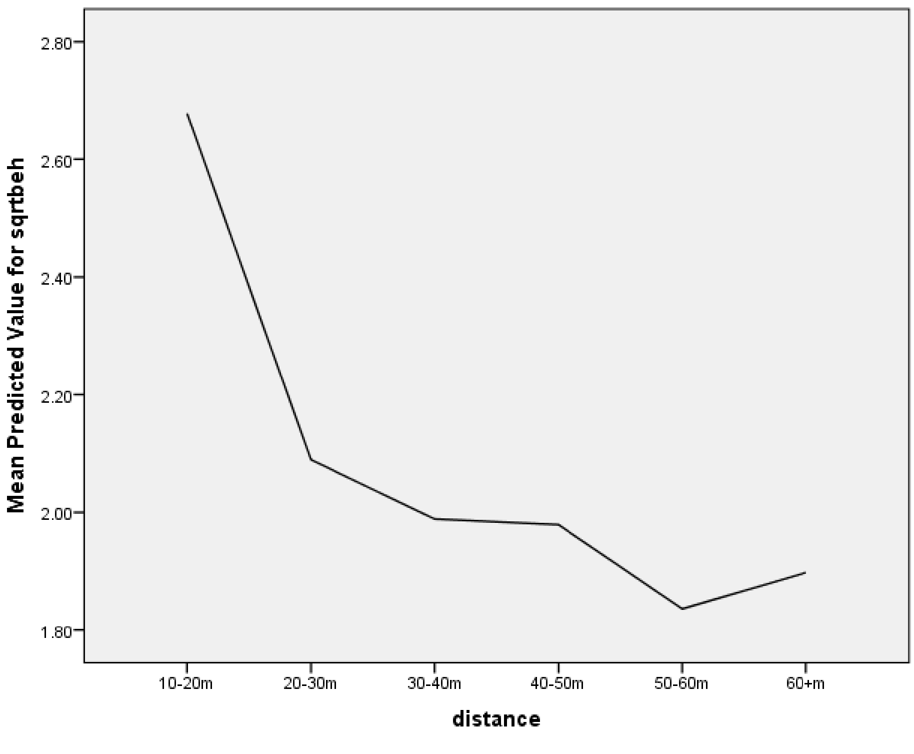

Figure 3.12. Mean predicted values for the square root (number of behavioural shifts), depending on the distance of the boat from the seals, n = 276 focal follows.

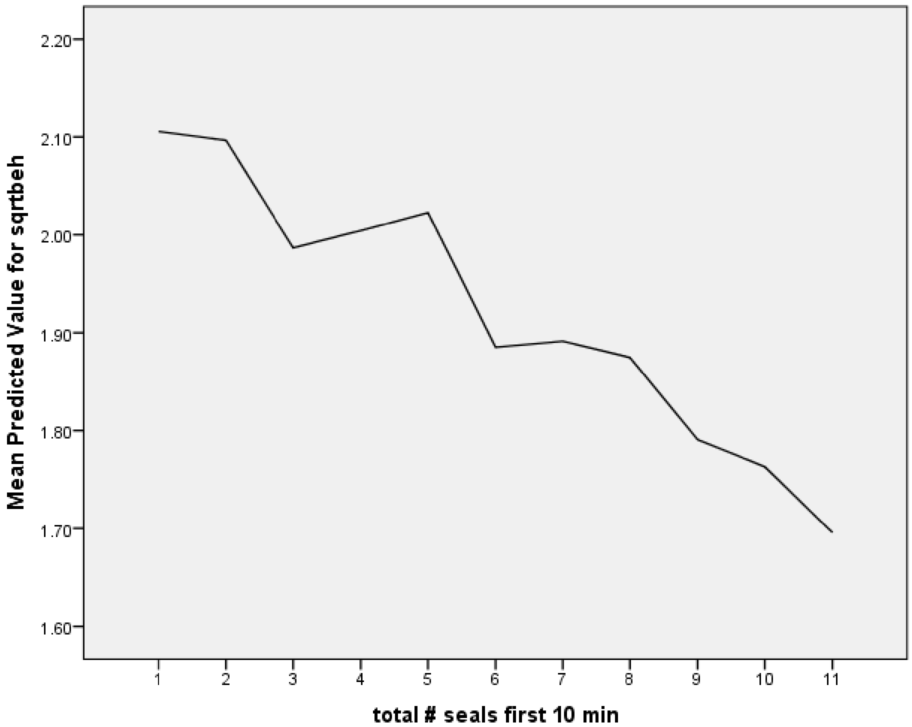

Figure 3.13. Mean predicted values for the square root (number of behavioural shifts), depending on the number of seals present, *n* = 276 focal follows.

3.6. DISCUSSION

3.6.1. Control vs. experiment

A comparison of seal activity budgets at McEwan's Bay in the presence and absence of vessels provided information on the effects of vessel presence on normal seal behaviour. The results suggest that overall, the percentage of time seals rest at McEwan's Bay is not compromised by the presence of a single vessel. Rest behaviour is valued as important for males as they fast for up to three months during the breeding season, during which time they rely on stored energy reserves (Crawley et al., 1977, Stirling, 1971). It is important that adult males spend a considerable amount of time resting to conserve the energy needed to defend their territory (Stirling, 1971). Female rest behaviour is also important– particularly for breeding females – as they need to conserve energy to be able to effectively forage, nurse their pup and maintain their pregnancy. Swimming behaviour was significantly higher in the presence of a boat than in the absence, which may be related to vessel presence but is more likely due to the absence of a wide field of view in the video footage – the observer on the boat could see more than just the cameras field of view. Alert levels in the presence of a vessel were not higher than control levels, which may indicate some degree of habituation to boat presence.

The activity budget of New Zealand fur seals in the Bay of Plenty in the presence of a vessel is similar to control behaviour described by Crawley *et al*. (1977) from observations of the species during the breeding season at the Open Bay Islands (in New Zealand's South Island). Our observations were taken on board a vessel, usually located between 20 to 60 m from the 'colony', whereas Crawley's were taken from a hide-out overlooking the colony (Crawley et al., 1977). It should also be noted that the study by Crawley *et al*. focused on a large colony so there may be differences in behaviour relating to the number of seals present and seal density. The calculations of 61% rest and 8% alert in this study are fairly close to the levels documented by Crawley *et al*. (1977): 74% rest and 14% alert for males and 63% rest and 5% alert for females (there were more females than males at the McEwan's Bay site). It would be assumed that if the boat was having a significant effect on the seal behavioural budget, rest levels would have been significantly lower and alert levels higher than the levels found in our control experiments and described by Crawley *et al.* (1977). As this was not the case, it is likely that the presence of a boat at McEwan's Bay does not negatively affect overall seal activity budgets. However, the effects of biological, seasonal and anthropogenic factors must be taken into account when assessing the effects of the tourism industry.

3.6.2. Sex/age class overall

Individual seal response differed depending on the sex and age class of seals. Of all the sex/age classes, pups were the most alert. It is also possible that the presence of the boat was a factor that increased alert levels in pups, as was found to occur during tourism interactions with harp seal (*Pagophilus groenlandicus*) pups (Kovacs and Innes, 1990). Juveniles were the most likely sex/age class to be observed swimming in this study. A study by Crawley (1977) reported that aside from resting, swimming was the main activity of juvenile New Zealand fur seals and therefore this is unlikely to have occurred as a result of boat presence. This finding is not surprising as unlike the other age classes, juveniles are not tied to sites. Adult males exclude other males and juveniles from their territories by chasing them into the water (Miller, 1975), which also added to the high levels of swimming behaviour observed in juveniles. Curiously, no significant differences in rest, alert or swim behaviour existed between males and females, overall. However, males and females did behave differently depending on other influencing variables, such as month and distance.

3.6.3. Month

The results suggest that at the breeding site, in the presence of a boat, rest behaviour decreases and alert behaviour increases as month progresses from November to January. This trend in behaviour may reflect typical sex specific behaviour during the breeding season, which falls within this period. The breeding season for the Bay of Plenty was determined to be from the 8th of December to the 5th of January based on estimated birth dates of the first and last pup born in the season. During the breeding season females give birth and nurse pups and males compete for territories and access to females (Crawley and Wilson, 1976).

Comparing the behaviour of different seal sex/age classes across months allowed us to determine which classes were contributing to the overall trends. Resting behaviour was highest and alert behaviour lowest for adult males in November. During November, males may have been able to spend a considerable amount of time resting as competition for access to females would not have peaked until pups were born (December to early January). Females go into oestrus approximately 8 days after giving birth (Crawley and Wilson, 1976). Unlike densely populated breeding colonies elsewhere, only a small number of males were present at this breeding site and therefore, threats to territories would have been infrequent prior to the pupping period. The reductions in male seal rest behaviour that occurred following November is most likely representative of increased activity between adult males competing for access to territories and females. Males will defend their territory for up to three months after establishment (Crawley et al., 1977). Similarly, a previous study reported a general decrease in resting behaviour of male New Zealand fur seals between early December and early January and proposed this was related to pupping and oestrus of females (Crawley et al., 1977). The increase in resting behaviour observed in March may relate to the end of male seal tenures and therefore a reduced effort and need to defend territories.

A similar trend for the percentage of time spent resting was found in females. December is the month when most pups were born and therefore it is likely that females spent a large amount of time nursing their newborn pups – during which time females adopt a resting position. Following December female rest behaviour continued to decrease across months. Crawley *et al.* (1977) also reported a decrease in female resting behaviour after the pupping period concluded (Crawley et al., 1977). It is possible that this trend is related to a decrease in parental investment overtime and the female seals' ability to leave the breeding site and spend more time in behaviours such as cooling off as pups mature. The nursing demand on females also increases as pups get older (Sharp et al., 2005). Females need to forage more often or, which may result in them being more active at the colony.

There is a possibility that the roles of different sex/age classes during the breeding season are not the only influence on seal behaviour across months. Comparing focal follow data from the breeding site with the non-breeding site revealed the same trend existed for both site types, however the trend was more distinct and significant at the breeding site. It is likely that weather conditions played some part in the trend. The monthly mean air temperature increased each month and then decreased in March. Although the temperature range was small (21.1 – 23.7 °C), rising radiation and sunlight levels and their effect on substrate temperature may have been a stronger influencing factor. Female New Zealand fur seals have been documented to shift position and retreat to the water as substrate temperatures increase, with most abandoning rest and retreating at substrate temperatures of 26 °C and almost all at temperatures of 40 °C (Gentry, 1973).

3.6.4. Distance

The results suggest that at the breeding site, rest behaviour increases and alert behaviour decreases as the distance between the boat and the seals increases. Other recent studies have documented behavioural changes in seals when boats are positioned at close distances (Boren et al., 2002, Jansen et al., 2010, Strong and Morris, 2010). Levels of alert behaviour for the different sex/age classes were influenced by distance. Female alert behaviour appeared to be more strongly influenced by boat distance than males but pups were the only class to be significantly affected by distance in the first 10 minutes of vessel presence. Adult male and female alert levels remained under 10% for all distance categories, whereas alert behaviour in pups was close to 60% at the 10-20 m category - almost four times higher than control alert levels. This indicates that pups may be more susceptible to disturbance from tourism vessels than adults. Kovacs and Innes (1990) also reported that pups spent significantly more time alert or moving in the presence of tourists, in a study of the impacts of tourism on harp seals. The significantly high level of pup alert behaviour observed in this study most likely occurred because the pups had never seen vessels close-up before (or at all) and were curious, whereas adult seals were possibly already acclimated to boat presence. Acclimation (or habituation) to tourism activities may appear to be positive based on the lack of disturbance observed, however it can have negative consequences if seals do not avoid human activities that may be harmful (Green and Higginbottom, 2001).

3.6.5. Duration of stay

The results of the GLMM suggest that rest behaviour decreases slightly and alert behaviour increases slightly over time, however these are predicted trends and the analysis of the levels of rest and alert behaviour per minute provided an insight into actual patterns in behaviour across time. Alert behaviour was generally highest in the first minute of boat approach, which may have been influenced by the noise of the boat engine and the anchor chain as the anchor was released. In a recent study which exposed Australian fur seals to controlled motor boat noise, seal alert behaviour increased in the presence of boat noise (Tripovich et al., 2012).

After the initial minute, alert behaviour decreased from approximately 13% to only 2% by minute 12. This may indicate that seals recognised the stationary vessel was not a threat and decreased the amount of vigilance displayed, accordingly. After this point, alert behaviour gradually increased until minute 39, when it reached close to initial levels, before gradually decreasing again to levels under 5%. The fact that the boat did not move away (as the tour boat often would) but remained at the site for an hour may explain the fluctuations in the levels of alert behaviour. The behavioural category 'alert' was used for any form of awareness in seals, including awareness of their surroundings or of other seals. Any seals leaving the water and hauling out (on their own accord or due to the presence of the boat) would have caused increased alertness in the group of seals on land. For each minute, the mean percentage of time seals spent alert remained below the 16% control levels found in this study.

3.6.6. Time of day

Time of day was found to have some influence on seal rest and alert behaviour in the presence of a vessel as the most supported GLMM models for both behaviours included the time of day variable. The higher probability of seals resting in the morning than in the afternoon was more likely due to changes in weather conditions or normal diel cycles across the duration of the day than due to boat presence. The cooler temperatures in the morning make it easy for seals to stay cool while resting. Later, when temperature and radiation levels increase, seals are more inclined change position or cool off in the water (Gentry, 1973). Once back on land seals were often observed to spend time alert, moving and grooming before going back to resting. It is unlikely that the presence of the boat caused the reduced rest levels in the afternoon as a study on Australian fur seals showed that seals were more likely to reduce resting behaviour in the presence of a boat in the morning than in the afternoon (Back, 2010).

3.6.7. Number of behavioural shifts

Proportions of alert and rest behaviours were used most often in the analysis because other behaviours - especially instantaneous behaviours - only contributed to a small percentage of overall seal behaviour. If seals do not shift behaviour in the presence of a boat, its presence is unlikely to be affecting the seal. If behavioural shifts do occur, the boat may be influencing seal behaviour or the seal may have been shifting regardless of the presence of the boat. A large number of behavioural shifts however, suggests the boat is likely to be having an effect. For example, the mean predicted value of 7.3 behavioural shifts in the first 10 minutes of boat presence at a 10-20 m distance from the seals, suggested that at close distances the boat influenced seal behaviour.

Males and pups were the most likely sex/age classes to shift behaviour at least once in the first 10 minutes of a boat approach, compared to females and juveniles. It is not surprising that pups often shifted behaviour as unlike other sex/age classes, they engage in play behaviour (McNab and Crawley, 1975). Kovacs and Innes (1990) observed that in the presence of tourists, harp seal pups frequently changed location. It is also possible that the number of behavioural shifts observed in pups in this study is related to boat presence. Males at the breeding site guarded territories and rest behaviour was sometimes interrupted by vigilance, which may explain the higher levels observed in this sex/age class.

The variables affecting the number of behavioural shifts made by seals in the first 10 minutes of approach were distance and the number of seals at the site. The highest numbers of behavioural shifts were recorded when the boat was 10-20 m from the seals. This result indicates that at 10-20 m seals often shifted from one behaviour to another as they became increasingly vigilant or restless. Furthermore, a higher number of behavioural shifts occurred when seals were on their own or in small groups, possibly because single seals are more vulnerable to disturbance. Similarly, Shaughnessy *et al.* (2008) found that fur seal response to tour boats (New Zealand and Australian fur seal) was significantly correlated with colony size. In the wild, animals interrupt behaviours such as foraging and resting to scan their environment for threats (Bednekoff and Lima, 1998). Individuals in larger groups scan less frequently; the ‘group-size effect’ (Elgar, 1989, Lima, 1995). This occurs because of the “dilution effect” which states that larger groups of animals have a higher chance of detecting a threat as there are more animals to scan for threats (Childress and Lung, 2003, Roberts, 1996). Individuals in large groups have a decreased perception of individual risk, making them less vigilant and less vulnerable to disturbance (Childress and Lung, 2003, Roberts, 1996). As animals in larger groups scan for threats less frequently, they can invest more time in other behaviours such as uninterrupted resting and grooming (Treves, 2000).

3.6.8. Management

To comprehensively understand the effects that tourism may impose on targeted species requires documentation of behaviour in correlation with biological, seasonal and operational factors. From an overall perspective, the results of this study indicate that the behaviour of New Zealand fur seals was not negatively influenced by the presence of a single vessel in the Whakatane region of the Bay of Plenty, however several factors were found to influence seal behaviour. Effective management is required to prevent seal responses from changing significantly in the future and to ensure the continued use of Moutohora Island as a breeding site. As observed in this study, some tourism-based factors should be controlled to reduce disturbance.

High levels of alert behaviour were observed in pups 10-20 m from the vessel and the highest number of seal behavioural shifts was observed at the 10-20 m boat distance category. Based on these results, the current permit condition stating that vessels must not approach seals closer than 20 m is suitable and should be maintained. It is recommended that this condition be added to the Marine Mammal Protection Regulations as there are currently no regulations pertaining to distance restrictions for seals. It is also suggested that future monitoring assesses seal population growth and tourism growth in the region. If these were to change in the future, the effect of tourism on the seals and the implications for tourism sustainability may need to be re-evaluated. Future research could also evaluate seal responses to motor boat noise during tourism operations.

Based on the small number of seals on Moutohora Island during the summer months and the finding that smaller groups of seals and isolated seals were more vulnerable to disturbance than larger groups, it is suggested that no additional permits to view seals be granted in the Whakatane region of the Bay of Plenty while the breeding colony is establishing. Should new permits be granted in the future, continued monitoring should be required. It may also be beneficial to the seals to develop a voluntary code of conduct for Moutohora Island. This code could include staggering viewing times when multiple vessels are present at the breeding site (particularly when pups are present) or giving more space to isolated seals located around the island.

Chapter 4: General Discussion

Source: Sunny Gurule 2012

4.1. Introduction

This study focused on both seal-swim and seal-viewing tourism in the Bay of Plenty, New Zealand. The major aim was to evaluate the effects of tourism on establishing groups of New Zealand fur seals and to assess the sustainability of the industry. The effects of viewing seals have been investigated for many species of pinniped and at different locations (Boren et al., 2002, Curtin et al., 2009, Kovacs and Innes, 1990), however only three studies have evaluated the effects of seal-swims on pinnipeds (Boren et al., 2009, Martinez, 2003, Stafford-Bell et al., 2012). Although Boren (2001) evaluated the effects of both viewing and swim-based tourism activities on New Zealand fur seals at established sites in the South Island, this project is the first to study both at small establishing sites in the North Island. Compliance to regulations was also recorded in order to evaluate the effectiveness of the current regulations in protecting seals from disturbance. The majority of pinniped-focused tourism research has focused on impacts at sites with large established colonies (Back, 2010, Boren et al., 2002, Strong and Morris, 2010). As many pinniped species are recolonising former ranges after recovering from historical sealing events, evaluating the influence of tourism at small establishing sites is particularly important.

4.2. The effects of tourism on wildlife

Wildlife tourism is a popular industry and there is a vast array of literature on the effects it has on the wildlife it targets. For example, brown bears (*Ursus arctos*) subjected to controlled tourism in the form of ‘bear viewing’, shifted foraging locations to avoid humans (Rode et al., 2006). Foraging behaviour of common dolphins (*Delphinus sp.*) was also found to be significantly disrupted by human presence in the form of vessel interactions (Stockin et al., 2008). Tourism can affect the body condition and health state of some wildlife, as discovered in a study on one species of lizard (*Podarcis muralis*) (Amo and López, 2006). It can also induce stress and influence body mass, which was found to occur in juvenile hoatzin (*Opisthocomus hoazin*) birds (Müllner et al., 2004). There are some studies which found wildlife tourism to have minimal or no effect on the targeted wildlife. For example, a study by Holcomb *et al.* (2009) reported that California sea lions showed few responses to human disturbance. Tourism was found to have no significant effect on the behaviour or reproductive success of Magnificent (*Fregata magnificens*) or Great (*Fregata minor)* frigate-birds, according to Tindle (1979). Tourism can have a positive effect on targeted wildlife, through education promoting awareness of conservation, socio- economic incentives or direct financial contributions to conservation (Higginbottom et al., 2001). For example, two different studies (one based on Australian sea turtle expeditions and one based on a wetland safari destination in Botswana) found that positive wildlife tourism experiences influenced the willingness of tourists to contribute financially to the conservation of the wildlife (Mladenov et al., 2007, Tisdell and Wilson, 2001). From the varying examples provided, it is evident that the effect tourism has on wildlife varies greatly, is site and species specific, and is dependent on a range of factors.

4.3. The effects of seal-swim tourism on seals

This study found that overall, seals mostly ignored swimmers, and sometimes interacted with them. Seals rarely avoided swimmers. Boren *et al.* (2009) conducted research on seal-swims with New Zealand fur seals at established sites in the South Island and reported very similar results in the levels of interaction, neutral and avoidance responses. It is likely that New Zealand fur seals rarely actively avoid swimmers because in comparison to human snorkelers, the seals have an advantage in relation to speed and manoeuvring ability in the water and therefore may not perceive swimmers to be a threat. A recent study evaluated the effects of seal swims on another otariid species: the Australian fur seal (*Arctocephalus pusillus doriferus*), in Port Phillip Bay, Australia (Stafford-Bell et al., 2012). The research was conducted in 2008 and reported that the presence of swimmers increased the number of seals leaving the water (Stafford-Bell et al., 2012), which was possibly a sign of avoidance.

It is important to investigate the effects of seal-swims as this type of tourism involves extremely close human-seal encounters and has the potential to impact seals or in extreme cases, jeopardise the safety of the tourists involved. Although rare, seal attacks on swimmers have occurred in the past. In 2009, seals (most likely grey seals (*Halichoerus grypus*)) attacked swimmers in Dun Laoghaire, Ireland, biting their legs and reportedly dragging one swimmer underwater (Holly, 2009). Similarly, in Port Phillip Bay, Australia, three swimmers were attacked by Australian fur seals in the same week and one tourist required 17 stitches to a large leg wound inflicted by a seal (Ryan, 2010). This occurred at the site of the tourism-based study by Stafford-Bell *et al*. (2012), mentioned above. As minimal avoidance responses were observed in this study, the risk of attacks on swimmers by New Zealand fur seals in the Bay of Plenty is currently unlikely. However, if avoidance responses were found to increase in the future, the likelihood of an attack may need to be re-evaluated. It should also be noted that seal attacks on swimmers are rare events and based on accounts in Dun Laoghaire and Port Phillip Bay, one particularly aggressive seal is often responsible, rather than a group of seals.

4.4. The factors affecting seal response during seal-swims

Several factors affecting the responses of seals during seal-swims were identified in this study. Time significantly affected seal behaviour, with the highest levels of interaction observed at around six minutes into the swims. The more seals in the water, the less they interacted with swimmers, possibly because seals in groups were more interested in interacting with each other. Seasonal variables such as the month and stage in the breeding season influenced seal response, with the highest levels of interaction occurring during the breeding season rather than after, most likely because the only seals not tied to the sites were juveniles - an age class known to have an interactive and curious nature (Barton et al., 1998). Factors such as the number of swimmers, swimmer distance and the number of vessels did not significantly influence seal behaviour.

Although there is a plethora of literature on the effects of swim-with activities on cetaceans (Bejder et al., 2006, Lundquist et al., 2012, Martinez et al., 2011, Peters et al., 2012, Scarpaci et al., 2000), there is a lack of literature relating to the effects of such activities on pinnipeds (Boren et al., 2009). In regards to factors affecting seal response during swims, Boren *et al*. (2009) looked at both commercial and non-guided seal-swims with New Zealand fur seals, the latter of which resulted in more avoidance responses. Similarly to this study, the number of swimmers did not affect seal response (Boren et al., 2009). A paper on seal-swims with Australian fur seals reported otherwise, stating that the number of swimmers in the water was the main influencing variable on the number of seals leaving the water (Stafford-Bell et al., 2012).

4.5. The effects of seal viewing tourism on seals

A comparison of seal activity budgets in the presence and absence of a vessel revealed that overall seal behaviour is not negatively affected by the presence of a vessel. In saying this, some biological, seasonal and operational factors did affect seal behaviour and the number of behavioural shifts observed in the presence of a boat. Shaughnessy *et al*. (2008) also reported that tour vessels approaching colonies of Australian fur seals and New Zealand fur seals had a minimal effect on the seals. Although the results of this current study are positive in relation to the sustainability of the seals and the tourism industry, some publications report negative effects of boat-based seal viewing on pinnipeds.

A study on the reaction of harbour seals (*Phoca vituline*) to cruise ships in Alaska found that in the presence of vessels, resting seals retreated into the water (Jansen et al., 2010). Andersen *et al.* (2011) and Osinga *et al*. (2012) also reported harbour seals fleeing in the presence of vessels, and Curtin *et al.* (2009) observed grey seals stampeding and “crash-diving” into the sea. A study on the behavioural response of South American sea lions

(*Otaria flavescens*) to tourism disturbance also found that seals retreated from the colony into the sea and further suggested that this behaviour could affect the fitness of individual sea lions (Pavez et al., 2011). At a colony of Australian fur seals naive to boat traffic, many seals fled into the water and reduced suckling bouts occurred (Back, 2010). These disturbances may be species related or may have been influenced by a range of tourism-based factors such as distance of the boat or previous exposure to tourism.

4.6. The factors affecting seal response during seal viewing/vessel presence

In this study, the factors month, distance, minute into vessel presence and time of day influenced seal behaviour in the presence of a vessel. Seals rested less and were more alert as months progressed from November to March. The further the boat was from the seals, the more the seals rested and the less alert they were. Seals rested slightly more and were slightly less alert in the morning compared to the afternoon and both rest and alert behaviour decreased slightly overtime as the boat remained at the site. After analysing focal follow data, the sex and age class of seals was found to influence seal behaviour in the first ten minutes of vessel presence. Adult seals rested more than juveniles and pups, juveniles were the most likely age class to be swimming and pups were the most alert. Different sex/age classes also behaved differently depending on month and distance of the vessel. Seal sex/age class influenced whether or not seals shifted behaviour in the first ten minutes of vessel presence. Males and pups were more likely to shift behaviour than juveniles and females. Furthermore, a higher number of behavioural shifts were observed at closer distances and in the presence of less seals.

Seals may respond differently to tourism depending on site. The field sites for this study were recently colonised by New Zealand fur seals. At one site (Moutohora Island), pup births have occurred since the mid-2000s (R.Tully, research assistant & P. van Dusschoten, tour operator, Whakatane, personal communication 2012). At Moutohora Island, a maximum number of 33 seals were observed during the study period. Less seals were observed at the Rurima Islands, and even less at White Island. This highlights the small numbers of seals present at these sites during the summer months. The numbers of seals are known to increase significantly over winter (R.Tully, research assistant, personal comm. 2012), however pinniped-focused tourism only operates over summer when numbers are low. The Rurima Islands and White Island are not currently visited by pinniped-focused tourism operations, which may have contributed to differences observed between sites.

Several studies have focused on factors influencing seal behavioural responses to tourism activities. The first report to assess the effects of tourism on the New Zealand fur seal was based in the South Island of New Zealand. The research focused on land-based rather than boat-based approaches and found that seal behavioural response was influenced by sex. Females were more likely to flee into the water than males, which often did not move away and rarely retreated into the water (Barton et al., 1998). This report also stated that boats approaching hauled out seals did not cause the 'alert' and 'moving away' responses observed in land based approaches (Barton et al., 1998). One component of a study by Boren *et al.* (2002) focused on the effects of controlled boat-based approaches to seals. Boren *et al.* (2002) identified that seal response varied between different sites during boat approaches and that distance also influenced response: at least 30% of seals were active at the closest distance of 20 m (Boren et al., 2002). Shaughnessy *et al.* (2008) conducted a study on the effects of tour vessels on Australian fur seals and New Zealand fur seals at Montague Island, Australia. Results indicated that resting behaviour generally increased with colony size and decreased as the vessel got closer to the seals (Shaughnessy et al., 2008). The results also revealed that New Zealand fur seals were less disturbed by tour vessels than Australian fur seals (Shaughnessy et al., 2008).

Aside from studies on the effects of boat based seal-viewing on the New Zealand fur seal, many studies have evaluated the effects on other pinniped species. A range of factors influencing seal response to boat approaches have been identified in the literature and are summarised in Table 4.1. Many of the factors relate specifically to a particular pinniped species or site. For example, almost all studies identified distance as an influencing factor but specific distances at which seals responded varied. Approaching harbour seals within 500 m increased the chance of disturbance and approaching as close as 100 m resulted in seals being 25 times more likely to retreat into the water (Jansen et al., 2010). In comparison, New Zealand fur seals observed in this study did not appear to be disturbed at distances of around 20-60 m and even at the closest distance of 10-20 m, no group retreats into the water were observed. Although perhaps suitable for harbour seals, it would be impractical to implement a minimum approach distance of 100 m for New Zealand fur seals. This emphasises the importance of looking at specific species when studying the factors influencing seal response to tourism and the importance of implementing species specific management.

Table 4.1. Summary of literature identifying factors that influence seal response to boat presence.

Study	Boat-based disturbance	Species/location	Factors	Effect
This study	Controlled boat approaches	*New Zealand fur seal (Arctophoca australis fosteri)* *-Bay of Plenty, NZ*	-month -distance -time -time of day -sex/age class -# seals	-Rest ↓, alert ↑ as month progressed -Rest ↑, alert ↓ with increasing distance -Rest ↓, alert ↓ over time -Rest ↑, alert ↓ in am than in pm -Differences. Adult age class rested most, pups most alert, males and pups more likely to shift behaviour - # Behavioural shifts ↓with increasing number of seals
Boren *et al.*(2002)	Controlled boat approaches	*New Zealand fur seal (Arctophoca australis fosteri)* *- Abel Tasman National Park, Kaikoura & Banks peninsula, NZ*	-site -distance	- Site differences - Seals responding ↓ with increasing distance
Shaughnessy *et al.*(2008)	Tour boats	*New Zealand fur seal (Arctophoca australis fosteri) & Australian fur seal (Arctocephalus pusillus doriferus)* *-New South Wales, AUS*	-distance -# seals - species	- Rest ↑, many moving ↓with increasing distance - Rest ↑ with increasing colony size - Rest higher in New Zealand fur seal
Johnson & Acevedo-Gutierrez (2007)	boats & kayaks - tourism & private	*Harbour seal (Phoca vitulina)* *-Washington State, USA*	- boat traffic	- # Disturbances ↑with increasing boat traffic

Jansen *et al*.(2010)	Cruise ships	*Harbour seal (Phoca vitulina)* *-Alaska, USA*	- distance - approach angle	- Disturbance ↓with increasing distance - Direct approach caused more disturbance than passing abeam
Curtin *et al*. (2009)	Tour boats and private boats	*Grey seal (Halichoerus grypus)* *-South Devon, UK*	- distance - vessel type	- Disturbance ↓with increasing distance - Kayaks and private motor boats caused most disturbance
Strong & Morris (2010)	Tour boats and private boats	*Grey seal (Halichoerus grypus)* *-Pembrokeshire, UK*	- distance -boats speed	-Disturbance ↓with increasing distance - Disturbance ↑with increasing speed
Andersen *et al*. (2011)	Tour boats and private boats	*Harbour seal (Phoca vitulina)* *-Kattegat, Denmark*	-distance - breeding season stage -# seals	-Flight initiation when boat at 510-830 m -Weaker and shorter lasting response during breeding season - Alert at further distances with increasing colony size
Pavez *et al*. (2011)	Tour boats	*South American sea lion (Otaria flavescens)* *-North-central Chile*	- distance	- Negative responses ↓ with increasing distance
Tripovich *et al*. (2012)	Controlled boat approaches and controlled noise levels	*Australian fur seal (Arctocephalus pusillus doriferus)* *-Bass Strait, Australia*	-motor boat noise	-Alert ↑, aggressive ↑, rest↓ in response to noise. Seals reacted more strongly to louder sounds
Stafford-Bell *et al*.(2012)	Tour boats and private boats	*Australian fur seal (Arctocephalus pusillus doriferus)* *-Port Phillip Bay, Australia*	-# boats -distance	-Aggressive displays ↑ with increasing number of boats - Number of seals retreating into water ↓ with increasing boat distance
Back (2010)(thesis)	Controlled approaches and	*Australian fur seal (Arctocephalus*	-distance	- Larger ↓ in rest behaviour at closer distances

	tour boats	*pusillus doriferus)* *-Bass Strait, Australia*	-time of day -previous exposure -mother pup pairing -proximity to water	- Larger ↓ in rest, seal attendance and suckling in am than pm - Minimal disturbance to seals frequently exposed to tourism - Unpaired females more likely to flee into water, unpaired pups less likely -Seals close to water's edge less likely to flee into water
Fox (2008) (thesis)	Private boats	*Harbour seal (Phoca vitulina)* *-California, USA*	- distance - boat type - # seals	-Vigilance ↓with increasing distance -Paddle boats caused most disturbance, followed by motor boat and row boat -Vigilance ↓ with increasing # seals

4.7. Long term effects of pinniped tourism

Pinniped-focused tourism has the potential to generate long term effects on pinnipeds, however, there is a lack of literature on the topic. As this study was conducted over one tourism season, no long term implications could be identified. However, it was suggested that habituation may have been occurring due to the exposure of seals to tourism activities over time. This assumption was based on the high levels of alert behaviour observed in pups in the presence of a vessel, compared to adults. Boren *et al*. (2002) identified that habituation was occurring in New Zealand fur seals exposed to a high degree of tourism in New Zealand's South Island. This also occurred in Australian fur seals exposed to tourism for over a century (Back, 2010).

Two studies have identified reduced female attendance to pups and reduced suckling bouts as effects of tourism activities on pinnipeds (Back, 2010, Kovacs and Innes, 1990). These effects have the potential to translate into reduced pup fitness and survival rates, which can have a long term impact on a colony. Furthermore, human disturbance (including tourism activities) reduced reproductive rates in the California sea lion (*Zalophus californianus*) and suggested this would result in a decrease in long term population growth rates (French et al., 2011). The abandonment of important breeding and haul out sites by seals due to mass tourism has also been identified as a long term impact, and in the case of the Hawaiian monk (*Monachus schauinslandi*) seal, contributed to a population decline (Gerrodette and Gilmartin, 1990). The long term degradation of the Mediterranean monk seals' (*Monachus monachus*) habitat through mass tourism-related construction and disturbance has contributed to the decline of the species and is said to threaten its future survival (Johnson and Lavigne, 1999).

4.8. Tourism sustainability and management

Based on the overall low levels of disturbance observed in this study, it was determined that the seal-swim and seal-viewing aspects of pinniped-focused tourism in the Whakatane region of the Bay of Plenty were sustainable in relation to the conservation of the seals. However, for a wildlife tourism venture to be considered sustainable, the protection of the wildlife is not the only requirement. There must be a balance between wildlife conservation, tourist satisfaction and profitability, which sometimes conflict with each other (Reynolds and Braithwaite, 2001). This study did not collect data on tourist satisfaction or profitability, however these aspects should be considered in future studies evaluating the sustainability of wildlife tourism ventures.

Several marine mammal studies have researched tourist satisfaction (Barton et al., 1998, Ponnampalam, 2011, Valentine et al., 2004). One of these was a study that focused on New Zealand fur seal and tourist interactions in Kaikoura (Barton et al., 1998). Most tourists were ‘very satisfied’ or ‘satisfied’ with the tourism ventures and among other things, tourists who got closer to seals were more likely to be very satisfied (Barton et al., 1998). When asked what would enhance the seal encounters, responses included getting closer to seals, touching a seal and the desire for seals to be more active (Barton et al., 1998). It can be seen from these results that tourist satisfaction and wildlife conservation can at times conflict. If tourism operators purely favour the satisfaction of the tourists, the targeted wildlife may become disturbed or harassed and the safety of tourists may be jeopardised. Tourism operations should aim to protect the targeted wildlife and simultaneously ensure that tourists are provided with a safe and satisfying wildlife encounter. The sustainability of the industry, and the profits which it generates, relies on both tourist satisfaction and wildlife conservation.

Pinniped-focused tourism is often species and site specific, which must be taken into account when developing management strategies and regulations. In order to implement effective management, knowledge of the natural behaviour (control behaviour) of the targeted species and how it responds to various aspects of tourism is essential, as discussed above. Knowledge of site characteristics, the level of tourism at these sites and the degree of tourism seals are exposed to are also important considerations. A site and species specific study on the effects of tourism on targeted seals (as applied in this study) should be conducted to effectively develop management which will protect the seals from disturbance. Furthermore, an evaluation of seal responses, coupled with operator compliance can provide information on the effectiveness of current regulations or guidelines (Smith et al., 2010).

Records of compliance were collected during seal-swim trips and were combined for two tour operators in the Bay of Plenty. Compliance levels were acceptable across all conditions studied and were at levels of 100% for almost all conditions. The regulation prescribing 'no loud noises' was broken on one occasion due to 'shouting' but this noise was unintentional and was not made for the purpose of disturbing seals or coaxing them into the water. The permit condition relating to the maximum number of swimmers in the water was broken on three occasions. Although more than 10 swimmers were in the water on these occasions, not all swimmers were close to the seals at the same time – some swimmers remained near the vessel. As high levels of compliance and low levels of avoidance during seal-swims were observed in this study, it can be concluded that the current regulations and permit conditions are effective in protecting the seals in the water and minimising disturbance during seal-swims. Future research could focus on correlating the responses of seals on land with compliance during tourism activities. The wildlife conservation component of the seal-swim tourism industry in the Whakatane region of the Bay of Plenty was considered sustainable based on the results of this study, provided tour operators continue to adhere to the Marine Mammals Protection Regulations and permit conditions.

4.8.1. Factors that may have influenced a sustainable tourism industry

The levels of compliance documented in this study are generally higher than the reports of other marine mammal tourism industries (Johnson and Acevedo-Gutierrez, 2007, Scarpaci et al., 2004, Whitt and Read, 2006). It is important to discuss factors that may have contributed to these satisfactory levels, as this may provide an insight for wildlife managers wanting to develop sustainable marine mammal tourism operations. There are several factors that may have influenced the sustainability of the tourism industry in the Bay of Plenty. These include:

- The involvement of key stakeholders (DOC, tour operators, researchers, members of the local community) in the development of pinniped-focused tourism in the Bay of Plenty. Stakeholders involved with tourism operations often collaborate to achieve a common goal (Bramwell & Lane 2000). For example, regular meetings facilitated by DOC for tour operators are likely to have increased the understanding of regulation requirements. Tour operators relay information on regulations to the tourists, such as “do not touch the seals”, which influences tourists to act appropriately, consequently reducing disturbance.
- The presence of a researcher on-board the tour vessels. DOC endorsed and supported an independent researcher to evaluate the sustainability of the pinniped-focused tourism industry in the Bay of Plenty. The tour operators were also briefed on the importance of the research during a DOC facilitated meeting. This may have influenced tour operators to be more cautious in relation to obeying regulations.
- “Ownership” of the targeted animals. Tour operators and other local members of the community may feel a sense of “ownership” over the seals, particularly if they have been observing the seals since they arrived in the area and have been involved in the development of the tourism industry. This increases the effort of tour operators to protect the seals by complying with regulations and contributing to research. For example, the primary tour operator from this study initiated research on the seals in collaboration with DOC prior to the initiation of this study. This is also an example of a positive working relationship between stakeholders (as mentioned in the first point).
- The species itself. The presence of small establishing groups of New Zealand fur seals are a long term investment for the tour operators. Seals have been identified as ideal candidates for tourism due to their predictable location and the relative ease of placing swimmers in the water with seals. As a result, the opportunity to view and swim with New Zealand fur seals is often offered when dolphins cannot be located during a tour, which ensures tourists are satisfied with their experience. Investment in protecting the seals is therefore important for the longevity of the tourism ventures.

- The simplicity of the regulations. The Marine Mammals Protection Regulations are simple, easy to understand and can be measured. It has been documented that simple rather than complex (involving more than one aspect of tourism) regulations are more likely to be adhered to by marine mammal tourism operators (Scarpaci et al. 2004).

4.8.2. Management suggestions

Management measures were suggested based on the results of this study to minimise the effects of tourism operations on the targeted seals. It should be noted (as mentioned earlier) that management regimes suggested are specific to the Whakatane region of the Bay of Plenty. The level of effort and the number of seals are likely to be different in the Tauranga region and therefore, management suggested in this study may not be suited to the region.

In relation to management of seal-swims in the Bay of Plenty, future monitoring of seal behavioural responses to swimmers was suggested to continue, especially at Moutohora Island. Currently, the permit time restriction (MMPR 1992 permit) for seal swims is 60 minutes. Although interaction was rarely observed after 22 minutes, following this time seals shifted to ignoring swimmers rather than avoiding, indicating longer swims were not negatively affecting seals in the water. The condition relating to the number of swimmers permitted to swim with seals (MMPR 1992 permit) states that the limit is no more than 10 swimmers including guides. As the number of swimmers (which included 2 swims with over 10 swimmers) did not influence the response of seals in the water, the current condition is suitable for the area and does not need to be amended.

In relation to seal-viewing, it was suggested that the minimum approach distance of 20 m is suitable for the Whakatane region and should be maintained. This recommendation was based on high levels of alert behaviour and the highest number of behavioural shifts in pups at the 10-20 m distance category. It was also recommended that the distance restriction be added to the Marine Mammal Protection Regulations as there are currently no regulations pertaining to distance restrictions from seals for the general public. The permits also state that the maximum encounter duration for viewing seals must not exceed 90 minutes. The majority of the surveys in this study were 60 minutes in duration. Resting behaviour appeared to be fairly consistent across time and although alert behaviour did fluctuate, it remained under control levels during each minute. It was not viable to test 90 minute encounters, however it can be assumed that due to time constraints of marine mammal tours, it is unlikely that a tour boat would regularly remain at the same seal site for this length of time.

It was suggested that no additional permits to view seals be granted in the Whakatane region of the Bay of Plenty while the breeding colony is establishing. This precautionary principle was founded based on the small number of seals present on Moutohora Island during the summer months, the finding that smaller groups of seals are more vulnerable to disturbance than larger groups and the fact that the long-term implications of marine mammal tourism are still uncertain. Implementation of a voluntary code of conduct for Moutohora Island was also suggested to minimise the impact of tourism, particularly at the establishing breeding site. This could be developed by tour operators and DOC, based on what they believe to be appropriate management guidelines.

New Zealand fur seal populations are expanding their range and the tourism industry is expanding simultaneously. It is therefore likely that the level of tourism and boat traffic will increase in the future and re-evaluation may be needed if these changes are significant. For example, at the time of the study, guided tours onto Moutohora Island were conducted once a week over the summer period. There is a cliff above the breeding site at McEwan's Bay, where the seals can be closely viewed, however whether tourists have access to this site as part of the tour is unknown. Seals are known to be more disturbed by tourist approaches on land than from vessels (Barton et al., 1998, Boren et al., 2002). If this site is accessible to tourists or becomes accessible in the future, the seals may become disturbed or may be influenced to abandon the breeding site. If vessel traffic or the number of permitted pinniped-focused tourism operators in the Bay of Plenty increases in the future, there is the potential for increased disturbance. In harbour seals (*Phoca vitulina*), increasing boat traffic has been linked to increased disturbance (Johnson and Acevedo-Gutierrez, 2007). Future monitoring of tourism, boat traffic and seal numbers will provide important information for determining whether the effect of tourism on seals in the Bay of Plenty needs to be re-evaluated.

4.9. Limitations of the study

Several factors influenced the amount of data that could be collected during the study period of November 2011 to March 2012. Weather in the Bay of Plenty is very unpredictable, and the only way to access the study islands was through the Whakatane harbour bar, which was sometimes deemed unworkable by the harbour master, due to choppy conditions. Although more data collection at the Rurima Islands and White Island was desirable, these islands were difficult to access. Due to the reefs at the Rurima Islands, these could only be accessed on days with flat-calm sea conditions. Trips to White Island required similar sea conditions and took over an hour to reach by boat. Seals were often scarce at both islands. There are a number of islands in the Tauranga region of the Bay of Plenty which would have provided additional data, however these islands were too far for the DOC vessel to access and therefore this was not possible. Sampling over two seasons would have also added to the results but funding limitations and time constraints prevented this from happening. It would have been desirable to have observed more seal-swims, however factors such as weather, boat space and clashes with days on the DOC vessel influenced the number of opportunities. In order to assess seal-swims at a different site in the Bay of Plenty, one tour vessel in the Tauranga region of the Bay of Plenty was boarded on four occasions. Two seal swims were observed and recorded at Tuhua Island but these had to be eliminated from the analysis due to the small sample size and site differences. On the other two occasions, no seal swims were conducted as the tourism operator primarily targeted cetaceans.

4.10. Conclusion

In conclusion, pinniped-focused tourism in the Bay of Plenty had minimal effects on New Zealand fur seals, based on analysis of seal responses and the presence of a compliant tourism industry. Seals often interacted with swimmers in the water but for the majority of the time seals ignored swimmers. During controlled approaches seals spent most of their time resting. However, some seals did become alert in the presence of the vessel, and levels of alert behaviour were influenced by a range of biological, seasonal and operational factors. This study found that the current regulations appear to be effective in protecting the seals but the minor amendments suggested are required. It should be noted that this study found differences in seal responses to vessels between sites and depending on the number of seals, indicating that the management suggested in this study may not relate to all sites throughout New Zealand. Provided that boat traffic does not increase and tourism conditions do not change significantly in the future, the seal colonies in the Bay of Plenty should remain sustainable.

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APPENDIX 1

Marine Mammals Protection Regulations 1992 – regulations tested

18. (b) contact with any marine mammal shall be abandoned at any stage if it becomes or shows signs of becoming disturbed or alarmed:

(d) no rubbish or food shall be thrown near or around any marine mammal:

(e) no sudden or repeated change in the speed or direction of any vessel or aircraft shall be made except in the case of an emergency:

(i) no person shall disturb or harass any marine mammal:

(l) the master of any vessel less than 300 metres from any marine mammal shall use his or her best endeavours to move the vessel at a constant slow speed no faster than the slowest marine mammal in the vicinity, or at idle or “no wake” speed:

20. (d) no person shall make any loud or disturbing noise near dolphins or seals:

(e) no vessel or aircraft shall approach within 300 metres (1 000 feet) of any pod of dolphins or herd of seals for the purpose of enabling passengers to watch the dolphins or seals, if the number of vessels or aircraft, or both, already positioned to enable passengers to watch that pod or herd is 3 or more:

Marine Mammals Protection Regulations 1992 – permit conditions tested

8 i) no more than 10 persons including guides may be in the water with marine mammals at any time.

12. The maximum interaction time with seals must not exceed 90 minutes per trip.

13. The maximum number of wet encounters with seals must not exceed 8 per trip and cumulatively must not exceed 60 minutes per trip.

17. No touching or handling of marine mammals is permitted by the Permittee, masters, guides, or clients.

APPENDIX 2

Date: 2/2/2012
Site: McEwan's Bay
Distance category: 50-60m

Time	seal 1 sex: M	seal 2 sex: M	seal 3 sex: F	seal 4 sex: J	seal 5 sex:	seal 6 sex:	Additional seals	Distance: boat from seals	Other boats	Co-ords	Notes
8.38	alert	rest	rest	rest	-	-	-	55m	1 rec vessel 50m, 150 from seals	37°51.576S 176°59.134E	Flat calm, no cloud Wind <5 knots N
8.39	Alert (rest 0.20)	rest	rest	Rest (groom 0.30)	-	-	-	57m	1 rec vessel 50m, 150 from seals	As above	As above