

CRC REEF RESEARCH TECHNICAL REPORT

TOWARDS SUSTAINABLE MANAGEMENT OF THE DEVELOPING DWARF MINKE WHALE TOURISM INDUSTRY IN NORTHERN QUEENSLAND

Peter W Arnold, Museum of Tropical Queensland,
Townsville, 4811 & **R. Alastair Birtles**, Tourism Program,
James Cook University, Townsville 4811

A report funded by the CRC Reef Research Centre

The CRC Reef Research Centre was established under the Australian Government's Cooperative Research Centres Program.

The Centre, established in 1993, undertakes an integrated program of applied research and development, training and education, aimed at increasing opportunities for ecologically sustainable development of the Great Barrier Reef and providing an improved scientific basis for Reef management and regulatory decision making.

CRC Reef Research Centre
C/- James Cook University
TOWNSVILLE QLD 4811
Phone: (07) 4781 4976
Fax: (07) 4781 4099
Email: crcreef@jcu.edu.au

? Cooperative Research Centre for Ecologically Sustainable Development of the Great Barrier Reef

National Library of Australia Cataloguing-in-Publication entry

Arnold, P.W. (Peter William), 1949- .

Towards sustainable management of the developing dwarf minke whale tourism industry In northern Queensland

Bibliography.

Includes index.

ISBN 1 876054 22 0

1. Balaenoptera acutorostrata - Queensland, Northern. 2. Whale watching industry - Environmental aspects - Queensland, Northern. 3. Ecotourism - Queensland, Northern. I. Birtles, Alastair, 1950- . II. Cooperative Research Centre for Ecologically Sustainable Development of the Great Barrier Reef (Australia). III. Title. (Series: CRC Reef Research technical report; 27).

599.52409943

This publication should be cited as:

Arnold, P.W. & Birtles, R.A. (1999)

Towards sustainable management of the developing dwarf minke whale tourism industry In northern Queensland

CRC Reef Research Centre

Technical Report No. 27.

Townsville; CRC Reef Research Centre, 30 pp.

This work is copyright. The Copyright Act 1968 permits fair dealing for study, research, news reporting, criticism or review. Selected passages, tables or diagrams may be reproduced for such purposes provided acknowledgement of the source is included. Major extracts of the entire document may not be reproduced by any process without written permission of the Director, CRC Reef Research Centre.

Published by the Cooperative Research Centre for Ecologically Sustainable Development of the Great Barrier Reef ? 1999.

Further copies may be obtained from CRC Reef Research Centre, c/- James Cook University Post Office, Townsville, QLD 4811.

Printed by James Cook University.

TABLE OF CONTENTS

Foreword

| | |
|--|----|
| Executive Summary..... | 1 |
| 1. Introduction..... | 4 |
| 2. Methods..... | 6 |
| 3. Results..... | 10 |
| Encounter statistics..... | 10 |
| Are interactions voluntary?..... | 10 |
| Behaviour..... | 11 |
| 4. Discussion..... | 13 |
| Control of swim-with whales programs..... | 13 |
| Permits..... | 18 |
| Separation of scientific and commercial interests..... | 19 |
| Advertising..... | 20 |
| Need for further information..... | 21 |
| 5. Acknowledgements..... | 23 |
| 6. References..... | 24 |
| Appendix One..... | 28 |

LIST OF TABLES

| | | |
|---------|--|-----|
| Table 1 | Encounters with Dwarf Minke Whales, July 1997..... | 7-8 |
| Table 2 | Search effort on Undersea Explorer during July 6-24, 1997..... | 9 |
| Table 3 | Duration of contacts with dwarf minke whales in the Great Barrier Reef region, by month, from survey data..... | 10 |
| Table 4 | Duration of contacts with Dwarf Minke Whales on Undersea Explorer, 1996-1997..... | 11 |

FOREWORD

Though generally larger than other marine animals, little is known of most cetaceans (whales and dolphins) in the waters of the world. Some species have only recently been described, and the biology and behaviour of others that are relatively common remains poorly known. Of about 80 species described so far in the world, some 43 occur in Australian waters and over 30 within the Great Barrier Reef Marine Park (GBRMP).

Regrettably, to date there have been few studies of cetaceans in GBRMP waters and park managers have relied for information mainly upon analyses of stranded or dead animals and occasional observations of live animals at sea. A notable exception has been the humpback whale (*Megaptera novaeangliae*) and now, through studies by Peter Arnold and Alastair Birtles and co-workers, our knowledge of the dwarf minke whale (*Balaenoptera acutorostrata*) is also increasing.

Surprisingly for a large animal, the dwarf minke whale was not described until 1985 and its taxonomic status remains unresolved. However, the close approach of the minkes to vessels and swimmers in northern Great Barrier Reef waters has provided a unique experience for tourists, a research opportunity for scientists and a challenge for park managers. Such apparently inquisitive behaviour has provided an unparalleled opportunity to document features of the populations, vocalisations and behaviour. Peter Arnold and Alastair Birtles, with marvellous cooperation from certain tourist operators, have been instrumental in initiating the research which is slowly increasing our understanding of the minkes on the Reef. Park managers recognise and appreciate the important contribution of the research to both increasing our knowledge of the dwarf minkes and to developing appropriate management strategies in relation to them.

Arising from the research, Peter and Alastair have proposed a useful code of practice to govern human interactions with the minkes. It is important that the code is followed by vessel operators, swimmers and divers to ensure that people do not adversely affect the whales.

I was privileged to join Peter and Alastair and the team on *Undersea Explorer* for one of their dwarf minke research trips and it is certainly a marvellous experience. I commend all those involved with the research program. The results are proving to be most useful for planning and managing human interactions with the dwarf minke on the Reef and will be incorporated into the Whale and dolphin conservation policy for the Great Barrier Reef Marine Park (see draft at web site: <http://www.gbrmpa.gov.au/information/publications/dwp/>).

Tony Stokes

Manager, Conservation Policy

Conservation, Biodiversity and World Heritage Group

Great Barrier Reef Marine Park Authority

EXECUTIVE SUMMARY

Repeated close encounters with dwarf minke whales *Balaenoptera acutorostrata sensu lato* provide opportunities to:

1. Observe minke whales at low latitude sites, which are potential breeding/nursery areas. Information is extremely limited for any population of minke whale at low latitudes.
2. Observe behaviour and interactions. This information is necessary to interpret reactions to swimmers. No comparable observations have been made on any species of *Balaenoptera*.

Regular interactions of dwarf minke whales with swimmers also form the basis for a fledgling industry on the northern Great Barrier Reef, which requires management.

In this paper, we outline the development and extent of the industry, review Australian legislation and available Codes of Practice, and present initial observations based on the 1996 & 1997 field seasons. Given the unusual, if not unique, attributes of the minke whale-swimmer interactions, existing Codes of Practice are of limited relevance. We propose guidelines, based on our field experience.

This paper was submitted to the Whale-watching Sub-committee of the International Whaling Commission Scientific Committee at its meeting in Oman in April 1998. It was also made available to Environment Australia, which is revising existing federal Whale-watching regulations and to the Great Barrier Reef Marine Park Authority which is developing a Conservation Policy for Cetaceans. Except for minor corrections, this version is as submitted to those agencies in early 1998. We hope that its wider distribution as a CRC document, particularly to charter operators working in the northern Great Barrier Reef, will promote industry feedback. Such input is essential if the guidelines are to be effective as an industry standard.

Main points are:

1. Approaches of dwarf minke whales to boats and swimmers were first documented in the early 1980's.
2. Between 1991 – 1995 there were regular but opportunistic encounters with whales, primarily from live-aboard charter vessels operating along the Ribbon Reefs between Port Douglas and Lizard Island.

3. From 1996, committed whale-watching trips were advertised, offering swim-with-whales programs. The industry is still small, with four boats involved.
4. Observations from *Undersea Explorer* indicated different group sizes between open water encounters (mean=3, n=17) and reef encounters (mean=1.15, n=13).
5. Observations from *Undersea Explorer* documented different encounter times between open water (mean=1.8 hours, n=17) and reef (mean=0.5 hour, n=12).
6. All reef encounters were voluntary, based on approaches of the whales to *Undersea Explorer* while it was anchored.
7. 11/14 open water encounters on *Undersea Explorer*, when the vessel was stopped and drifting, resulted in approaches by the whales.
8. Our observations generally confirm the voluntary nature of approaches and maintenance of contact, as reported by the dive industry operators in 1991-1995.
9. Under present legislation (Whale Protection Act), management is based heavily on adherence to prescribed approach distances. While voluntary approaches by dwarf minke whales can be incorporated within the present guidelines, additional management strategies are necessary, to reduce potential impacts associated with the closer and more direct approaches required by swim-programs (IWC, 1996).
10. We present a Code of Practice which is based on the our field experience, and experience of operators in the industry. These recognise the features peculiar to the swim program with minke whales.
11. A major feature of the Code is that swimmers hold on to a line run from the vessel. This allows maximum control of swimmer behaviour, ensures that approach distances are under the control of the whale, and minimises disturbance to the whales while maximising the potential for extended contact. We recommend that use of lines be mandatory when the vessel is drifting in open water.

12. Three behaviours (speed-up, veering away, deep dives) appear to be associated with disturbance; we recommend that encounters be terminated if there are repeated instances of such behaviour.
13. Present legislation limits approaches of swimmers to whales, in part based on the risk of injury (to whale or swimmer) from close contact. While recognising that whales are large, powerful and wild animals, we note that there have been no signs of aggression in over 130 in-water encounters.
14. We have insufficient information to rule out the use of scuba when in contact with whales, a practice which is regularly used by at least some commercial operators. However, we do not recommend the use of scuba as it presents problems with monitoring swimmer behaviour, causes safety risks in open water and is not necessary for close and prolonged interactions with whales.
15. We endorse existing legislation on ‘no wake speed’ when near whales. Adherence to the guidelines for vessel manoeuvring is especially important when breaking off a prolonged encounter, which usually involves close approaches by the whales to the vessel.
16. We recommend that permits be required for advertised swim-programs.
17. We recommend that such permits be specific to swim-programs, as distinct from general whale-watching permits covering surface-based activities.
18. We agree with previous recommendations to clearly separate permits for scientific research and commercial whale-watching operations. Greater co-ordination is needed among agencies issuing these permits.
19. Given the close encounters associated with swim-programs and the need to allow the whales to control the interaction, we recommend that only one vessel be in contact with a group of whales at any one time.
20. We do not have enough information to advise on time limits for any individual encounter nor the aggregate time for multiple encounters throughout a day.
21. We discuss further issues associated with safety of swimmers, particularly in open water.

1. INTRODUCTION

Whale watching has become a substantial international industry with an estimated 5.4 million participants in 65 countries and overseas territories (Hoyt, 1996). Most recent figures for Australia (Anderson, Forbes & Pirzl, 1996) indicate an annual participation of 600,000 individuals, generating A\$8.9 million.

The main species involved are humpback whales *Megaptera novaengliae* and southern right whales *Eubalaena australis*. In this paper, we report on a fledgling industry based on a third species, the diminutive or dwarf form of minke whale *Balaenoptera acutorostrata sensu lato*.

Dwarf minke whales are one of the smallest of the baleen whales, with a maximum recorded length of 7.8 m (Best, 1985). They are known only from the Southern Hemisphere, with records from South Africa (Best, 1985), Australia (Arnold, Marsh & Heinsohn, 1987; Arnold, 1998), New Zealand (Baker, 1990; Dawson & Slooten, 1990), New Caledonia (Laboute & Magnier, 1979), South America (Zerbini et al., 1996) and the subAntarctic to Antarctic (Kasamatsu et al., 1993).

The taxonomic status of the form is unresolved, but it is generally recognized (IWC, 1991; Bannister et al., 1996) that the 'dwarf' and 'ordinary' southern hemisphere minke whales must be considered separately for management purposes.

In contrast to previous operations, which involve surface observations from vessels or shore, dwarf minke whales have been regularly observed underwater, from live-aboard dive vessels operating in the Cairns section of the Great Barrier Reef Marine Park, Australia during the austral winter months (Arnold, 1998).

Gladstone (Gladstone, 1985; pers. comm.) first documented in-water encounters with dwarf minke whales, based on his experience while conducting research near Lizard Island in the early 1980's. Arnold, Marsh and Heinsohn (1987) listed six diver-whale interactions during the period 1980-1986 in the northern and central Great Barrier Reef region, with an additional record from Marion Reef in the Coral Sea. The six records were submitted as part of a survey concentrating on humpback whales (Simmons & Marsh, 1986); they almost certainly underestimated the frequency of interactions. Observations were made by researchers, private boat owners and commercial operators.

In the early 1990's, references to diver-minke whale interactions began to appear in dive publications (Nissen, 1992; Tonks, 1990, 1991). These prompted a committed survey of sightings by divers

(Arnold, 1998, which listed 156 encounters from 1991-1995 in the Cairns section of the Great Barrier Reef Marine Park alone). Although the survey records also underestimate the number of encounters because not all operators submitted reports of encounters, they do indicate a substantial increase in interactions. Such interactions occurred during regular dive cruises to the outer Barrier Reefs between Port Douglas and Lizard Island. Whales were reported to approach vessels at anchor on reefs. The encounters with whales were considered incidental to reef diving experiences which continued to dictate the destinations visited. Anderson, Forbes and Pirzl (1996), using data to 1994, could still accurately note that "minke whales are observed opportunistically on diving and fishing trips".

In 1996 and 1997, a new phase began with greater coverage of minke whale encounters in sport diver publications and the appearance of specific advertising for whale interactions (Anon. a, b; Aw, 1996; Brown, 1996; Buckingham, 1997). One operation hired a spotter plane to direct its dive vessel to whales. In 1996, the first permit for scientific research was granted to us by Environment Australia.

Presently seven vessels regularly run cruises along the outer reefs during the minke whale season. Four have advertised whale-watching or included reference to minke whales in their publicity during the 1996 and 1997 seasons, while other operators continue to take advantage of incidental approaches by the whales.

Although swim with dolphins programs have been established in several countries and have been documented (e.g. Constantine & Baker, 1996; Weir, 1997), swim-with-whales programs are unusual and there are few recommendations on procedures based on practical experience. Whitehead and Merlen (1988, in Carlson, 1996) have proposed guidelines for cetaceans (including rorquals) near the Galapagos Islands. Although we are aware of swim-with-whale programs involving rorqual whales humpback whales, sei whales *Balaenoptera borealis*) in the North Atlantic, we know of no official guidelines or regulations covering such operations.

In this paper we review the development of the industry and the legislative framework, present preliminary observations on whale behaviour associated with a vessel and swimmers, then discuss management issues. We present a Code of Practice based on our observations over two field seasons (1996, 1997) and information provided by charter operators covering the seasons 1991-1995 (henceforth referred to as the 'survey data').

2. METHODS

Observations were made from *Undersea Explorer*, a 25 m commercial dive charter vessel which advertises whale-watching trips. Details of encounters in the 1996 season are given in Arnold (1998); encounters during the 1997 season are given in Table 1.

Committed watches in 1997 were restricted to the first three trips (July 6-24, 1997). 80.3 hours of committed searches were in open water, over the continental shelf to the west of the outer Great Barrier Reef. Watches while the dive vessel was moored at various dive sites at reefs along the outer Reef totalled 76.7 hours (Table 2).

TABLE 2. Search effort on *Undersea Explorer* during July 6-24, 1997.

| | Open water | Reef |
|--------------------------------|-------------------|-------------|
| Hours of committed search | 80.3 | 76.7 |
| Hours in contact with whales | 31.2 | 6.5 |
| Contact time/search time | 35% | 8.5% |
| Number of encounters | 17 | 12 |
| Mean length of contact (hours) | 1.8 | 0.6 |

Reef observations were made while the vessel was moored at fixed moorings along the Ribbon Reefs.

Searches were routinely made while the vessel was cruising in open water. Except for three cases, the vessel was stopped near to where a whale was sighted and remained drifting, with the engine in neutral, waiting for a whale to approach. If a whale did approach, lines were run from the bow and stern. A crew member and researcher entered the water first to make initial observations and attempt to video the whale underwater for identification. If contact was maintained, passengers were allotted spaces on the bow or stern line (up to 6 per line). In three encounters, one or more swimmers used scuba; the majority of swimmers used mask, snorkel and fins. All encounters depended on approaches to swimmers on the lines by the whale. During the encounter, at least one researcher observed underwater, while one to three observers monitored from the deck of the vessel. Details of location, weather and sea conditions were recorded. Number, position and behaviour of swimmers were noted as influence parameters. Length of contact, number of whales, their estimated depth and distance, approach tracks and behavioural parameters were monitored throughout the encounter both from the surface and underwater. Underwater photography and video recording was used for identification of individual whales, and to document behaviour. This was supplemented by surface photography. Vocalisations were recorded with a four element hydrophone array (10Hz-30kHz). A preliminary characterisation of the vocalisations was given by Gedamke, Costa and Dunstan (1997).

Experiential data were also collected from participants on the trips. Participants on the *Undersea Explorer* minke whale trips during July 1996 and 1997 (n=86) were predominantly certified scuba divers (85%). Just over half (51%) had a qualification above that of basic open water diver. Many were very experienced but 33% had done 50 or less scuba dives. Only one had never snorkelled before the trip. 36% were from outside Australia. Mean age was 34.6 (SD = 12.2, range 10-58) and 55% were male.

3. RESULTS

Encounter statistics

In 1997, there were 17 open water and 13 reef encounters (Table 1). Total contact time in open water was more prolonged, comprising 31.2 hours of the total watch time (80.3 hrs), compared with 6.5 hours contact during the 76.7 hours on watch at reefs (Table 2). Mean contact time was thus also significantly longer in open water (Tables 2, 4).

TABLE 3. Duration of contacts with dwarf minke whales in the Great Barrier Reef region, by month, from survey data.

| Month | Mean duration (hour) | Range of duration (hour) | Number of cases where duration recorded (n=68) | Total numbers of records/month (n=189) |
|-----------|----------------------|--------------------------|--|--|
| May | 0.7 | 0.5-1 | 5 | 12 |
| June | 1.5 | 0.1-6.5 | 22 | 71 |
| July | 1.2 | 0.1-5.5 | 35 | 80 |
| August | 0.75 | 0.5-1 | 4 | 22 |
| September | - | 0.5, 3.5 | 2 | 4 |

Group size differed between reef and open water. 12/13 reef encounters were with a single animal, for a mean group size of 1.15. In open water, only 8/17 encounters involved a single animal; mean group size was 3 (range 1-10; the latter a minimum figure).

Are interactions voluntary?

The 13 contacts at reef sites during 1997 were while the vessel was moored, so clearly required voluntary approaches by the whales. Such approaches constituted 89.8% of cases reported in the survey data (Arnold, 1998).

In 14/17 open water encounters during 1997, the vessel was stopped after a whale was sighted (usually 100-300 metres from the vessel). In 11/14 cases, this resulted in approaches by the whales.

In 1997, we had three cases in which the whales were first noted close to the vessel while it was still at cruising speed. In one case two groups of 3 and 2 animals were surfing towards the boat when first seen; in another case the whale was first seen about 30 metres from the boat, maintaining a parallel course. In the third case, a whale approached as we were steaming towards a reef. The whale

maintained contact, circling the boat while it was cruising at 8.5 knots and crossing the bow eight times in a 13 minute period. In the survey data, nine cases were reported of whales following a boat, either while it was travelling between reefs or moving from one dive location to another on the same reef. In two cases, these approaches were while the vessel was cruising at speed (up to 12 knots) and the whales either surfed or porpoised behind the boat. In another case from 1997, the whale maintained contact with the travelling vessel for 45 minutes.

Maintenance of the encounter also was voluntary. This is evident from the prolonged mean encounter times in the survey data (e.g. mean of 1.2 hours for July, with a range of 0.1-5.5 hours: Table 3) and confirmed by us, at least for open water encounters, on *Undersea Explorer* (Table 4). Although our mean contact time of 1.8 hours in open water will be biased by a single contact of 10.7 hours, in 8 open water encounters, the contact time exceeded one hour. Our reef contact times were shorter than those reported in the survey data (Table 3), a discrepancy we can not explain. It is possible that only close or prolonged contacts were recorded in the survey data. Behaviour of the whales around reefs may be more variable; in 1996 we had no reef encounters during two weeks of observation (Arnold, 1998).

TABLE 4. Duration of contacts with Dwarf Minke Whales on *Undersea Explorer*, 1996 - 1997. Note that data from July 1997 are presented separately for all sightings, those in open water and those on reefs.

| Month/Year | Mean Duration (hour) | Range of duration (hour) | Number of cases where duration recorded | Remarks |
|------------|----------------------|--------------------------|---|---|
| July 1996 | 1.3 | 0.1-3.2 | 11 | All sightings (in open water only) |
| July 1997 | 1.3 | 0.02-10.7 | 29 | All sightings (reef and open water sightings) |
| July 1997 | 0.5 | 0.02-4.3 | 12 | Reef sightings only |
| July 1997 | 1.8 | 0.02-10.7 | 17 | Open water sightings only |

Behaviour

Whales in open water consistently approached from upwind. In 77.4% of the hourly weather recordings (n=146), sea state was estimated as Beaufort 4 or 5. Whales used the waves to surf towards the boat, passing swimmers who were holding on to lines streaming upwind of the drifting vessel.

A wide range of behaviour has been documented (Birtles & Arnold, in prep), including headrise ('spyhopping'), exaggerated back flexure, explosive bubble cloud production, prolonged surface swimming (with and without apparent respiration), breaching, lateral swims, horizontal and vertical

barrel rolls, prolonged belly up swims, jaw gape (exposing baleen plates), throat expansion, wide exposure of eye, porpoising or surfing behind a vessel, close approaches to swimmers from behind, change of level in the water (either a deep dive away from swimmers or a movement upwards towards swimmers at the surface), apparent hovering or maintaining position close to swimmers, 'give way' behaviour between whales. Three appear to be particularly associated with disturbance. Veering is a rapid change in direction away from a vessel or swimmer. Speed-up occurs when the whale increases the amplitude of its caudal peduncle to provide extra power. The most common reaction was for the whale to complete several power strokes, increasing the distance between it and the source of disturbance, before gliding and remaining in the general area. Veering could also involve speed-up of the whale. The third reaction, usually only visible underwater, was for the whale to dive more deeply rather than maintain a level near the surface, where the swimmers were hanging from ropes. 8/9 of the veers recorded in 1996 and 1997 were associated with a direct approach by a swimmer to the whale, although direct approaches did not always elicit a veer or other avoidance response.

In contrast to the apparent avoidance behaviour just noted, we have regularly observed cases in which the whales either slowed down or appeared to stop completely and maintained a position near swimmers (sometimes less than 5 metres away). Given that the vessel was usually being blown by 15-25 knot winds, dragging the lines and swimmers with it, this apparent hovering required a deliberate action of the whale to maintain position with the swimmers. Behaviour studies in progress will quantify such behaviours and place them in context with relation to the behaviour of swimmers.

Despite over 130 records of in-water encounters with minke whales (from survey data and our direct observations), we are unaware of any signs of aggression. In 1997, one swimmer on *Undersea Explorer* reported that he was nudged from behind by one of the whales. Some swimmers have even touched a whale (e.g. Aw, 1996), which elicited an avoidance response but no aggression. One interaction described in the survey involved a small animal (estimated length 3 metres) which made close approaches to swimmers. However it subsequently sped away from divers so quickly that all swimmers left the water.

Dwarf minke whales are highly manoeuvrable around vessels and swimmers; in this respect they resemble dolphins more than other baleen whales (pers. obs). Accidental contact with the swimmers by dwarf minke whales would seem unlikely, except perhaps for calves, which may be less controlled in their swimming. However, the behaviour of the whales must be monitored at all times and caution in approach exercised if the whales are highly active (e.g. exhibiting high rolls, back arches, breaching).

There is a general feeling that bubbles disturb whales and thus use of scuba is generally not recommended in swim-with-whale operations (e.g. Whitehead & Merlen, 1988, in Carlson, 1996; Environment Australia, 1998). Twelve cases of in-water encounters in the survey data involved scuba divers, with one case in which a whale repeatedly approached a group of six divers at 20 metres depth, then passing by divers hanging at a decompression stop under the dive boat. This is likely to be an underestimate of frequency as it was not always clear from the reports whether swimmers were on snorkel or scuba. In the 1997 season at least 10 of the 25 in-water encounters on two commercial dive vessels reported to us were with scuba divers. Direct observations on *Undersea Explorer* in 1997 and examination of video of other encounters show that dwarf minke whales may approach scuba divers as closely as they approach snorkellers, without exhibiting signs of disturbance. There is a need for more observations on use of scuba, which we intend to make in the 1998 field season. However, observations to date suggest that, as long as direct approaches to the whale are not made, scuba may not elicit the adverse reactions in dwarf minke whales that have been noted for some other species of cetaceans.

We have only limited information on respiration rates, given the difficulty of recording this with groups of whales. Combining 1996 and 1997 data for open water, dive times were highly variable, ranging from 0.5-11.6 minutes (n=39). Dive times during reef encounters were equally variable (0.5-11 minutes; n=17). Variation in the ratio of surface interval to dive time can not be used as a measurement parameter, because the dwarf minke whales we observed consistently took only one breath between dives.

4. DISCUSSION

Control of swim-with whales programs

The Scientific Committee of the International Whaling Commission, in discussing whale-watching, pointed out that swim-programs required close and more direct approaches than other forms of whale-watching, and recommended that a precautionary approach be taken to their management. In many countries (e.g. United States, New Zealand, South Africa), swim-with-whale programs are banned outright (Carlson, 1996). Recent (December 1997) legislation in Queensland prohibits swimmers from entering the water within 300 metres of a whale or, if already in the water, from approaching closer than 300 metres to the whale (Qld Government, 1997). Closer approaches may be allowed if under a commercial whale-watching program permitted under the Marine Parks Act 1982.

Although sightings of dwarf minke whales occur in Queensland, they are most frequently beyond the 3 nautical mile limit of state waters. This area is under the control of the Great Barrier Reef Marine Park Authority which, jointly with the Queensland Department of Environment, grants permission for all commercial whale-watching covering the dwarf minke whale industry. Guidelines for behaviour under these permits are based on the Commonwealth of Australia Whale Protection Act 1980.

Under this Act, it is illegal to 'interfere' with a cetacean (whale, dolphin or porpoise). 'Interference' includes 'harass, chase, herd, tag, mark or brand' (Commonwealth of Australia, 1993). For the purposes of administration of the Act, the Environment Australia Biodiversity Group has defined as interference approaches closer than set out under the Whale-watching Guidelines of 1989. These are 1000' (300 m) in an aircraft, 100 m in a vessel and 30 m by a swimmer (Tucker, 1989).

The approach distances just quoted 'refer to active approaches on the part of people, and so stipulate how far a person/vessel is allowed to move towards a cetacean before having to stand off and wait. If a cetacean wants to interact it will remain with the vessel/swimmer which can drift passively with the cetacean keeping pace. This situation is not in conflict with the guidelines as the cetacean is being allowed to determine whether it wishes to interact' (Environment Australia, 1998b, p. 4).

The observations that we have made strongly suggest that approaches and maintenance of contact, both in open water and on reefs, are made by the whales and thus are voluntary. We are unaware of any operation in which a dive vessel directly approaches or chases minke whales. Even when a vessel is directed toward a group of whales by a spotter plane, as was the case with one operator in 1996, the final approach to the vessel and swimmers in the water was by the whales themselves.

It could be argued that present federal regulations cover in-water encounters, since approaches by swimmers to closer than 30 m of a whale would be deemed 'interference' under the Whale Protection Act. However, we feel there needs to be further guidance about behaviour under such circumstances, which we present in the attached Code of Practice (Appendix 1). Interactions resulting from voluntary approaches still need to be managed to reduce potential impacts on the whales. Such interactions have occurred regularly in the past and will continue, if not increase. In the absence of a regulatory mechanism, they need to be managed by self-regulation within the industry.

It is apparent from the data collected by O'Neill and Birtles (in prep) that the procedures and legislation need to be clearly outlined to the passengers, as well as the likely behaviour of the animals themselves. They then realise the reasons for the procedures and that there is a clearly laid out plan of action which has the best chance of producing a good encounter. Pre-encounter briefings also need to prepare the swimmers for the strength of feelings that some will have when in close contact with

whales, in order to prevent potentially harassing behaviour such as swimming toward a whale or attempting to touch it. Clear communication and adequate pre-encounter briefings are vitally important aspects of the procedure.

From experiential data (O'Neill and Birtles, in prep) we can also demonstrate that minimising adverse reactions of the whales enhances the experience for swimmers through more prolonged contact times and closer interactions. Use of such experiential data has already proved valuable in managing whale shark-swimmer interactions in Western Australia (Birtles et al., 1996; Davis et al., 1997).

Our Code has been developed based primarily on open water encounters following directed searches for whales. These are potentially more 'invasive' than opportunistic encounters and require a generally accepted procedure. We believe, however, that the recommendations set out in our guidelines can be more widely applied to many of the reef associated, incidental or opportunistic encounters as well.

The principles behind the Code are those recently proposed to the ANZECC task force on recreational observation of marine mammals (Stevens, pers comm) and implicit in recommendations of the Whale-watching Working Group of the International Whaling Commission Scientific Committee (1998):

- (1) initiation and maintenance of encounters is at all times to be under the control of the whales
- (2) all attempts should be made to minimise disturbance to the whales, as demonstrated by overt changes in behaviour

The suggestions for manoeuvring of the vessel are based on Australian Whale Watching Guidelines, a code developed for watching minke whales in Scotland by the Hebridean Whale & Dolphin Trust/ Sea Life Surveys (in Carlson, 1996) and our own experience on *Undersea Explorer*. In-water behaviour is based mainly on our own experience and information relayed to us in the survey.

In open water, we consider that ropes must be used. This allows the tightest control of swimmers and ensures a predictable location of the vessel and swimmers to which the whales can habituate. Our own studies of whale-swimmer interactions are still under analysis and we have no indication of habituation, however evidence for short term habituation by rorqual whales has been presented by Watkins (1986).

There is also an important safety issue. During the minke whale season, seas can be moderate to rough (Beaufort 4-5) and winds can regularly reach 15-20 knots. Rapid drift of the boat is normal and,

without ropes, it would be very easy for swimmers to become widely separated from the vessel. Some of the swimmers may have limited experience in open water and there is a potentially dangerous situation to both swimmer and whales if a dive tender has to be despatched to recover someone who has drifted off.

Since encounters with swimmers may entail very close (to less than 5 metres) interactions with the whales, we believe that only one vessel should be engaged with a group of whales. In 1997, we were approached at speed to well within 100 metres by a second vessel while we were swimming with whales. This approach was from upwind of us, and thus in the area from which the whales approached our vessel. We feel that such approaches by a second vessel unduly constrain the swimming pattern of the whales and thus violate the general principle that the whales dictate the nature of the encounter. Weir (1997) also recommended that only a single vessel be in contact during swims with bottlenose dolphins in Victoria. Present regulations on the number and positioning of vessels in contact with a whale differ between state and federal waters and none have been designed to consider the particular circumstances of swim-with-whales programs. The Queensland Government (1997) regulations restricting approaches within 300 metres only if there are “three or more boats already closer than 300 metres”, are probably influenced by the much more crowded Hervey Bay situation where humpbacks are being observed by a much larger fleet of commercial operators. They would be inappropriate for managing in-water minke whale encounters.

In some guidelines, there is a limit placed on length of a single encounter or even the total time that a single whale would be in contact with boats in any one day. We do not have enough information to comment on such a restriction, although we are collecting data to allow individual recognition of whales to allow us to identify such occurrences and the whales' reactions to prolonged encounters.

On *Undersea Explorer* there is a time limit that each passenger is on the rope. This avoids having too many people in the water at the beginning of the encounter and has been generally accepted by passengers when they are aware of the extended length of most contacts and are thus reassured that there is a reasonable opportunity for encounters. More information is needed, however, before general recommendations can be made. The time spent on the line is dependent on a number of factors, including the total number of passengers on the vessel and differences in the attenuation of interest between passengers. In the 1998 season, we plan to examine this in relation to factors such as weather, sea state, underwater visibility, water temperature and motivation/expectations of the passengers.

In the case of approaches by whales to vessels at anchor on a reef, we do not consider the use of ropes mandatory. For instance, humpback whales on the Silver Banks in the Caribbean are observed by

small groups of snorkellers who maintain their position close to the vessel (D. Seifert, pers. comm.). In the absence of lines, there must be such a procedure in place to control the number and behaviour of swimmers, and there must be a constant monitoring of the whales' behaviour for signs of potential disturbance (e.g. repeated cases of veers, speed-ups, deep dives).

We need more information on the reaction of whales to scuba, but information to date suggests that scuba is already regularly used in such encounters and that at least some whales appear to be undisturbed by the bubbles. Our major reservations about the use of scuba is the difficulty in controlling behaviour of the divers and monitoring for any signs of disturbance to the whales. One possibility, which has been used by cruise operators on the GBR, is to have the scuba divers hang from a bar under the boat which is routinely in place for a safety decompression stop.

There are also safety issues in using scuba in open water. In rough seas, unless the diver is tethered by a rope, it would be very easy to become widely separated from the vessel. There is the further problem with maintaining depth; in one case reported to us, divers photographing whales ended up in 40 metres of water.

It is extremely difficult to completely control divers if whales approach unexpectedly during a routine reef dive. In such cases, it is essential to emphasize in pre-dive briefings the rule 'No swimming directly at the whale'. It is also important in such briefings, to indicate that compliance with the procedures offers the best chances of a prolonged encounter.

We recommend that photographs be taken with natural light. We have seen one case on video in which a flash was used in dim light with no apparent reaction by the whale. However, given the anatomical adaptations to low light demonstrated in the retina of cetaceans (Dral, 1977), we consider that flash photography should be avoided.

Given that encounters in 1997 were often terminated by the observers rather than the whales, it is important that the appropriate 'break-off' procedures are strictly adhered to. Under the Whale Watching Guidelines, boats are to maintain a 'no wake' speed in the vicinity of whales. This is especially important when a contact with whales has been running for several hours and the animals may be used to swimming across the bow at close (few metres to tens of metres) range. When breaking off encounter 15.1 on July 15, 1997, we noted two minke whales surfing down the waves toward the bow of the boat as we started to motor away. Both animals veered away sharply about 30 metres upwind of the boat as they apparently realised that the vessel was moving. A close watch of the position of the whales is necessary as the vessel motors slowly away from the contact site.

Permits

Several characteristics of this fledgling industry must be recognised. First is that the swim-with-whales encounters have been occurring, at least in an opportunistic fashion, since the early 1990's. Banning such activities would be impractical, given the apparently voluntary nature of approaches by the whales, and the likelihood that they will continue. A ban would be strongly resisted by the dive industry. Opposition to the possibility of such legislation has already been expressed in the dive literature (Halstead, 1996).

Secondly, the industry consists of two groups of operators: those that take advantage of incidental encounters and those that therefore more actively seeking whales advertise their trips as a whale-watching experience.

Thirdly, the encounters mostly occur from a limited number of live-aboard dive boats which have cruises of 3 - 6 days duration with a limited number of passengers (less than 30) per cruise. Day operators opportunistically take advantage of approaches by whales but sightings do not occur predictably on a daily basis and thus such operators currently are unlikely to be in the position to advertise committed whale watching trips.

We suggest that specific permissions be required for all operations which advertise swim-with-whale programs. These should be distinct from surface-based whale-watching permits and species specific (in line with the recommendations for Tier 2 management protocols in Commonwealth Draft National Guidelines for Cetacean Conservation (Environment Australia, 1998)). Committed whale-watching trips inevitably involve close contact with the animals and whale-watching operators are under greater pressure to deliver the advertised experience than those simply taking advantage of opportunistic encounters. A condition of the permit should be to provide data on all sightings of whales (date, time, number of whales, whether in-water encounter, number of swimmers, number of whales, length of encounter), as well as an indication of the cruise path. Such statistics are generally recorded by operators anyway and should impose a relatively small additional cost in time. There should be a high level of interpretation about dwarf minke whales as part of the briefing. An educational program on whales would enhance the value of the whale-watching experience (Hoyt, 1996) as well as moderate unrealistic expectations on the part of passengers about approach distances (Forestell & Kaufman, 1996). Part of the education program would be to explain the reasons for the guidelines and to show that following such procedures is not restrictive but actually enhances the chances of a good interaction with the whales. Provision of information has been identified as an important component in passenger satisfaction on other whale-watching enterprises (Neil, Orams & Baglioni, 1996). Such operators must have in place a procedure for controlling behaviour of the swimmers and for

monitoring the behaviour of whales for any signs of disturbance. This is particularly important when scuba gear is used.

We feel that it would be too cumbersome to require detailed permits for all operators who have only incidental or opportunistic encounters with minke whales, but such operators should be strongly encouraged to keep records of encounters and make the data available to management authorities. If interactions are not controlled through permits, it is particularly important that there be a high acceptance of a Code of Practice, ensuring maximum compliance with recommended guidelines. We feel that there is a considerable feeling of good-will in the industry towards the proper management of minke whale swim programs, as evidenced by the widespread co-operation of industry in providing information to us.

There is already an organisation of the live-aboard dive vessel operators (Cod Hole and Ribbon Reef Operators Association) to allow self regulation of activities. By restricting the encounters by permit to current operators who have been interacting with minke whales it would be possible to maintain local control and promote a sense of stewardship over the whales and the swim-with-whales program. If the permit is issued for several years, then it allows longer term planning by operators (Burger, 1996). A permit system would also allow, for the first time, the collection of accurate data on participation rates in the industry, both in terms of vessels and passenger numbers.

We strongly agree with the Draft National Guideline for Cetacean Observation (Environment Australia, 1998a: p. 7) that no new swim operations should occur until further research has been undertaken on the baseline features of the population, potential impacts and mitigation measures. Such a cap on the number of permits has been applied in Hervey Bay and was recommended in the plan for the Whitsunday Management Area. It would be an appropriate application of the Precautionary Principle to put in place such a cap earlier rather than later, in the development of the industry.

Separation of scientific and commercial interests

Hoyt (1996) estimated the cost benefits flowing from the provision of ship time to researchers by commercial whale-watching operations; in the north-eastern United States this amounted to an annual sum of U.S.\$875,000. Provision of such ship time to on-board naturalists/researchers for up to 20 field seasons, has increased knowledge on cetaceans, resulting in refereed publications (e.g. Clapham, 1996; Barlow & Clapham, 1997). In Scotland, a committed study of minke whales (Gill & Fairbairn, 1995) was supported by a commercial operation specialising in nature-based tourism, although in that

case the Hebridean Whale & Dolphin Trust was eventually established to maintain such work separately from the commercial aspects of the company.

Against such benefits, is the perception that relaxation of whale-watching regulations under a scientific permit may give undue commercial advantage to an operator on whose vessel such studies are conducted. At worst, it could be considered as a "back-door" way to approach whales closer than allowed by the Whale Protection Act.

Although current knowledge is adequate to make management decisions on some issues, for others we have little or no information. Clearly, the best way to get such information is to document activities on a commercial vessel.

In order to resolve conflicts of interest we have two suggestions. First, we endorse Corkeron's (1996) recommendation that applications for a scientific permit should be subject to peer assessment and their evaluation should include consideration of the resulting publications within refereed journals (or, in the short term, the likelihood of such publications).

Secondly, the vessel on which such studies are conducted needs a commercial whale-watching permit to allow activities of paying passengers within the strictures of the Whale Protection Act and a generally accepted Code of Practice. At present, research/education permits are administered by one agency while commercial permits are administered by various federal or state agencies. Greater integration of the permit procedures is necessary.

Advertising

Stunning close-up photographs and videos of humpback whales are now common in the general media. Whale watching operators, viewing humpback whales, have identified the unrealistic expectations of their passengers, based on such extensive and spectacular coverage, as a problem (Colgan, Prasser and Jeffery, 1996). Operators in the fledgling dwarf minke whale industry do not yet have this impediment, but will bring a similar constraint upon themselves if their advertising promotes unrealistic expectations in terms of closeness of encounters, clarity of water, etc.

Hoyt (1996) recommended a diversification in whale-watching cruises so they become advertised as marine nature tours, of which whales are only one of the experiences. Since dwarf minke whale-watching trips were developed by operators running dive-cruises to the outer reefs, this diversity of experiences already exists. One of us (RAB) has been documenting this in a CRC Reef Research program with Peter Valentine, based on over 500 questionnaires collected from participants on dive

trips during 1996 and 1997. It is important to know the expectations of the passengers and to ensure that the advertising clearly indicates the experience offered. Otherwise, there may be conflicts of interest among the passengers who have booked on the trip. Those who were expecting to dive on reefs may begrudge the time spent looking for whales, while those interested in the whales may become upset if they feel an encounter with whales was prematurely terminated because the vessel needed to move to the next reef dive site. In 1997, one operator clearly advertised a 'minke whale only' trip, directed at underwater photographers. It remains to be seen whether such 'niche' marketing is economically viable. It is likely that the majority of operators will continue with a mixed reef diving/swim-with-whales program and their advertising must clearly reflect that.

Committed dwarf minke whale-watching trips may need to search for whales in open water, rather than wait for encounters while anchored on a reef. One constraint is the generally windy conditions and moderate to rough seas prevalent during the minke whale season. Advertising for such trips needs to alert passengers to these conditions, to prepare them for such experiences.

Need for further information

The Scientific Committee of the International Whaling Commission (1998) set as overall objectives that whale-watching not cause a significant adverse change in population dynamics or impede normal habitat use and activities such as feeding and socialising. In the present case it is difficult to apply such recommendations due to the lack of information on the target species.

There is no information on abundance or demographic parameters for any population of dwarf minke whale; indeed we cannot even delimit what a population is for this form. Whereas the conservation status of 'ordinary' southern hemisphere minke whale was considered 'Secure' within a recent Action Plan for Australian cetaceans (Bannister et al., 1996), no category was assigned to the dwarf form 'because of insufficient information'.

It is unlikely that such information will be available in the foreseeable future. Unlike humpback whales, dwarf minke whales do not pass a single location with sufficient reliability to allow censuses to be conducted (e.g. Bryden et al., 1990; Paterson et al., 1994). Based on our experience in 1996 and 1997, as well as reports from 1991-1995, there may be considerable year to year variation in sites where whales are seen. This spatial and temporal heterogeneity introduces severe biases in population estimates based on observations in a limited part of the dwarf minke whale's range (see Hammond et al., (1990) for a comparable example on blue whales).

There are two additional constraints on making population estimates in the present project. Commercial whale-watching operators, such as *Undersea Explorer*, try to maximize the contact time

with whales, hence population estimates based on sight/unit effort data from such platforms will be highly biased (Gordon, Fairbairns, Hilby, Lovell & Papastravou, 1994). Moreover, the voluntary approaches of dwarf minke whales within our study area to whale-watching vessels operating at cruising speed represents a particularly well-developed form of 'ship-seeking' behaviour and could result in significant overestimates of population size. However, interactions are not restricted to a few 'friendly' whales. In 1997, we had 30 encounters with over 60 whales; so far we have only one confirmed re-sighting.

We need information on what the whales are doing in the area. Other forms of minke whales show segregation by gender and age class. From underwater observations in 1997, we know one group contained both male and female whales. Individual groups also contained animals differing widely in size. However we need more extensive and more reliable information on the lengths and sex of animals subject to whale-watching.

Neither the survey data nor our still incomplete analysis of photographs and video provide clear evidence of long term (weeks to months) residency of individual dwarf minke whales at particular sites on the northern Great Barrier Reef. More extensive data are needed, however, before this possibility is rejected.

We do not know if dwarf minke whales feed in the northern GBR. There are no reports of the conspicuous lunge-feeding behaviour of other forms of minke whales (e.g. Gaskin, 1982). Despite extensive underwater observation over two years, we have never seen whales evacuate faeces; this suggests limited feeding.

The majority of sightings are of an individual or a pair, however groups of four to five animals are not rare. The close proximity of animals (within tens of metres of one another) contrasts with sight records of the other forms (e.g. Edds & MacFarlane, 1987) which indicate animals scattered over a wide area. Studies by Dr D. Costa and Mr J. Gedamke on *Undersea Explorer* in 1997 clearly showed that in at least some circumstances, groups of dwarf minke whales are highly vocal. More work needs to be done on the situations in which vocalisations occur and their frequency in order to assess the potential for acoustic contact between widely separated groups of whales.

With more sighting effort, reports of cow-calf pairs are increasing. It is important to know whether there are substantial numbers of cow-calf pairs, since this would mean that the northern Great Barrier Reef is a significant location for what is a particularly sensitive stage of the life cycle.

We need better knowledge of dwarf minke whale behaviour, to assess the effects of human actions. We agree with Corkeron (1996) that there is a need to establish the significance (if any) of short-term reactions such as veers and speed-ups and to investigate any links to long-term effects. However, using the precautionary approach, we should assume, until we have better evidence, that such short term aversive reactions may be detrimental and try to minimise them. It is important to consider that what may be relatively benign as a single incident may become important if repeated regularly in most encounters that the whales have with swimmers. If such short term reactions can be managed properly, then the chances of long-term effects should also be minimised.

5. ACKNOWLEDGEMENTS

We thank John Rumney and Andy Dunstan of *Undersea Explorer* for the tremendous opportunity they gave us to make direct observations on minke whales and for the wonderful logistical and financial support from *Undersea Explorer*. We especially thank the entire crew. We are particularly grateful to the passengers on the whale watching trips for their help and co-operation during interactions. Jason Gedamke (University of California, Santa Cruz) and Fleur O'Neill (James Cook University) allowed us to refer to their work in progress and we also thank the latter for her superlative assistance in field and laboratory. We thank our volunteer Barbara Lukoschek for her help, Matt Curnock for assistance with data analysis, Max Churchward (formerly of Mike Ball Dive Expeditions) and Ian Stapleton (Nimrod) who shared their experience with minke whales and Douglas Siefert (Tiny Bubbles Expeditions, Inc.) for providing great company and information on operations in the North Atlantic. Tim Stevens (formerly Queensland Dept Environment) and Rebecca Pirzl (Environment Australia) kindly provided information on whale watching legislation at state and federal level. Observations were made under Scientific Permits P1996/043 and P1997/049 from the Environment Australia Biodiversity Group.

6. REFERENCES

- Anderson, G.R.V., Forbes, M. and Pirzl, R. 1996. A national overview of the development of whale watching in Australia. In *Encounters with whales. 1995 Proceedings.* eds K. Colgan, S. Prasser and A. Jeffery. Australian Nature Conservation Agency, Canberra, pp. 5-16.
- Anon, a. 1997. Live your dreams. Dive with the whales. *Dive Log Australia* March, 1997: 104 (advertisement only).
- Anon, b. 1997. Minke whales. *Dive Log Australia* August, 1997: 44 (advertisement only).
- Arnold, P. 1998. Occurrence of dwarf minke whales (*Balaenoptera acutorostrata*) on the northern Great Barrier Reef. *Report of the International Whaling Commission* 47: 419-424
- Arnold, P., Marsh, H. and Heinsohn, G. 1987. The occurrence of two forms of minke whales in east Australian waters with a description of external characters and skeleton of the diminutive or dwarf form. *Scientific Reports of the Whales Research Institute, Tokyo* 38: 1-46.
- Aw, M. 1996. Meeting with minkes. *Scuba Diver* March-April, 1996: 40-43
- Baker, A. 1990. *Whales and dolphins of Australia and New Zealand. An identification guide, revised edition.* Allen and Unwin Australia Pty Ltd, Sydney.
- Bannister, J., Kemper, C. and Warnecke, R. 1996. *Australian Cetacean Action Plan.* Australian Nature Conservation Agency, Canberra.vii+242 pp.
- Barlow, J. and Clapham, P.J. 1997. A new birth-interval approach to estimating demographic parameters of humpback whales. *Ecology* 78 (2): 535-546.
- Best, P. 1985. External characters of southern minke whales and the existence of a diminutive form. *Scientific Reports of the Whales Research Institute, Tokyo* 36: 1-33.
- Birtles, A., Cuthill, M., Valentine, P. and Davis, D. 1996. Incorporating research on visitor experiences into ecologically sustainable management of whale shark tourism. In *Proceedings of the Ecotourism Association of Australia National Conference, Alice Springs.* eds H. Richins, J. Richardson, A. Crabtree, S. Bryce, P. Larcombe and P. Ridd.
- Brown, A. 1996. Mike Ball uses spotter planes for mink (sic) whale season. *Dive Log Australia* August, 1996: 20.
- Bryden, M., Kirkwood, G. and Slade, R. 1990. Humpback whales, Area V. An increase in numbers off Australia's east coast. In *Antarctic ecosystems, ecological change and conservation.* eds K. Kerry and G. Hempel. Springer-Verlag Press, Berlin, pp. 271-277.
- Buckingham, L. 1997. Tale of the whale - a diver's perspective. *Dive Log Australia* July, 1997: 48.
- Burger, A. 1996. Whale watching and regional tourism. In *Encounters with whales. 1995 Proceedings.* eds K. Colgan, S. Prasser and A. Jeffery. Australian Nature Conservation Agency, Canberra, pp. 93-96.

- Carlson, C. 1996. A review of the whale watching guidelines and regulations around the world. SC/48/0 25, unpublished document submitted to Scientific Committee, 48th International Whaling Commission meeting.
- Clapham, P.J. 1996. The social and reproductive biology of humpback whales: an ecological perspective. *Mammalian Reviews* 26 (1): 27-49.
- Colgan, K., Prasser, S. and Jeffery, A. (eds). 1996. *Encounters with whales. 1995 Proceedings*. Australian Nature Conservation Agency, Canberra.
- Commonwealth of Australia, 1993. *Whale Protection Act 1980*.ii+20 pp.
- Constantine, R. and Baker, C.S. 1996. Monitoring the commercial swim-with-dolphin operations in the Bay of Islands, New Zealand. *Department of Conservation Project 'Impact of marine mammal watching'* Investigation number 1993.
- Corkeron, P. 1996. Research priorities for whale watching in Australia. In *Encounters with whales. 1995 Proceedings*. eds K. Colgan, S. Prasser and A. Jeffery. Australian Nature Conservation Agency, Canberra, pp. 123-136.
- Davis, D., Banks, S., Birtles, A., Valentine, P. and Cuthill, M. 1997. Whale sharks in Ningaloo Marine Park: managing tourism in an Australian marine protected area. *Tourism Management* 18 (5): 259-271.
- Dawson, S.M. and Slooten, E. 1990. Stranding of a dwarf minke whale at Banks Peninsula, New Zealand. *New Zealand Natural Sciences* 17: 89-93.
- Dral, A.D.G. 1977. On the retinal anatomy of Cetacea (mainly *Tursiops truncatus*). In *Functional anatomy of marine mammals*, ed. R.J. Harrison, Academic Press, London, pp. 81-134.
- Edds, P.L. and MacFarlane, J.A. 1987. Occurrence and general behaviour of balaenopterid cetaceans summering in the St Lawrence Estuary, Canada. *Canadian Journal of Zoology* 65: 1363-1376.
- Environment Australia, a. 1998. *Draft national guidelines for cetacean observation*. unpubl. document, 7 pp.
- Environment Australia, b. 1998. *Supporting document for draft national guidelines for cetacean observation*. unpubl. document, 16 pp.
- Forestell, P. and Kaufman. 1996. Whale watching in Hawaii as a model for development of the industry worldwide. In *Encounters with whales. 1995 Proceedings*. eds K. Colgan, S. Prasser and A. Jeffery. Australian Nature Conservation Agency, Canberra, pp. 53-65.
- Gaskin, D.E. 1982. *The ecology of whales and dolphins*. Heinemann Educational Books, Inc., London.
- Gedamke, J., Costa, D.P. and Dunstan, A. 1997. New vocalisation definitely linked to the minke whale. *J. Acoust Soc. America* 102 (pt 5,2): 3121-3122 (abstract only).
- Gill, A. and Fairbairns, R.S. 1995. Photo-identification of the minke whale *Balaenoptera acutorostrata* off the Isle of Mull, Scotland. In *Whales, seals, fish and man*. eds A. Blix, L. Wallace and O. Ulltang. Elsevier Science B.V., , pp. 129-132.

- Gladstone, W. 1985. Meeting minke whales. *Geo* 6: 80-81.
- Gordon, J., Fairbairns, R., Hilby, L., Lovell, P. and Papastravou, V. 1994. Collecting scientific data on whale watching projects: opportunities and problems. edited version of paper to European Cetacean Society Conference, 1994, 2pp. (available <http://gnew.gn.apc.org/hwdt/dataprob.html>)
- Halstead, B. 1996. 'Full ahead. Turn left at the first pole'. *Dive Log Australia* August, 1996: 50-52.
- Hammond, P., Sears, R. and Berube, M. 1990. A note on problems in estimating the number of blue whales in the Gulf of St Lawrence from photo-identification data. In *Individual recognition of cetaceans: use of photo-identification and other techniques to estimate population parameters*. eds P. Hammond, S. Mizroch and G. Donovan. International Whaling Commission, Cambridge, pp. 141-142.
- Hoyt, E. 1996. Whale watching: a global overview of the industry's rapid growth and some implications and suggestions for Australia. In *Encounters with whales. 1995 Proceedings*. eds K. Colgan, S. Prasser and A. Jeffery. Australian Nature Conservation Agency, Canberra, pp. 31-36.
- IFAW, Tethys Research Institute and European Conservation. 1995. *Report of the workshop on the scientific aspects of managing whale watching, Montecastello di Vibio, Italy*.
- International Whaling Commission. 1991. Report of the scientific committee. pp. 51-82. *Report of the International Whaling Commission* 41, Cambridge.
- International Whaling Commission. 1998. Report of the Whale-watching Working Group. Pp 250-256. *Report of the International Whaling Commission* 47, Cambridge (also available on internet).
- Kasamatsu, F., Yamamoto, Y., Zenitani, R., Ishikawa, H., Ishibashi, T., Sato, H., Takashima, K. and Tanifuji, S. 1993. Report of the 1990/1991 southern minke whale research cruise under scientific permit in area V. *Report of the International Whaling Commission* 43: 505-522.
- Laboute, P. and Magnier, Y. 1979. *Underwater guide to New Caledonia*. Les editions du pacifique, Papeete, Tahiti.
- Neil, D., Orams, M. and Baglioni, A. 1996. Effect of previous whale watching experience on participant's knowledge of, and response to, whales and whale watching. In *Encounters with whales. 1995 Proceedings*. eds K. Colgan, S. Prasser and A. Jeffery. Australian Nature Conservation Agency, Canberra, pp. 182-188.
- Nissen, M. 1992. Creatures great and small. *Sportdiving in Australia and the South Pacific* 32: 30-32.
- Orams, M.B. 1997. Historical accounts of human-dolphin interaction and recent developments in wild dolphin based tourism in Australasia. *Tourism Management* 18 (5): 317-326.
- Paterson, R., Paterson, P. and Cato, D. 1994. The status of humpback whales, *Megaptera novaengliae*, in east Australian waters. *Biological Conservation* 70: 135-142.
- Queensland Government, 1997. *Nature Conservation (Whales and Dolphins) Conservation Plan*. 16pp.
- Simmons, M. and Marsh, H. 1986. Sightings of humpback whales in Great Barrier Reef waters. *Scientific Reports of the Whales Research Institute, Tokyo* 37: 31-46.

- Tonks, D. 1990. Close encounters. *Sportdiving in Australia and the South Pacific* 19: 72-74.
- Tonks, D. 1991. Encounters with minke whales and other big things. *Dive Log Australia* October, 1991: 25.
- Tucker, M. 1989. *Whales and whale watching in Australia*. Australian National Parks and Wildlife Service, Canberra.
- Watkins, W. 1986. Whale reactions to human activities in Cape Cod waters. *Marine Mammal Science* 2: 251-262.
- Weir, J., Dunn, W., Bell, A. and Chatfield, B. 1997. An investigation into the impact of 'dolphin-swim ecotours' in southern Port Phillip Bay. unpublished manuscript, Dolphin Research Project Inc, Hampton, Victoria, Australia.
- Zerbini, A., Secchi, E., Siciliano, S. and Simoes-Lopes, P. 1996. The dwarf form of the minke whale, *Balaenoptera acutorostrata* Lacepede, 1804, in Brazil. *Report of the International Whaling Commission* 46: 333-340.

APPENDIX ONE

CODE OF PRACTICE FOR DWARF MINKE WHALE-DIVER INTERACTIONS

Some of the protocols which we have been following are clearly mandatory for any cetacean tourism activity and would thus fit under the Commonwealth's proposed base level (tier one) of regulation (Environment Australia a, 1998). Others are more specific to the proposed tier two level of regulation (addressing regional and species specific issues). Finally, some relate more specifically to the situation aboard *Undersea Explorer*.

These guidelines were developed to manage diver-whale interactions conducted under our scientific permit, which allowed approaches to 10 metres from whales. This is in contrast to the 30 m limit recommended under the current Whale Watching Guidelines. This is of particular importance when placing swimmers in the water and is an issue that must be resolved in more generally applicable minke whale industry guidelines. The current guidelines acknowledge that 'they apply primarily to large species of whales' and that 'small cetaceans may come close to vessels and ride the bow wave, boat operators may find that in these cases it is not possible to fully adhere to some of the guidelines'. While this is meant to refer to dolphins, some of the behaviours of dwarf minke whales can produce a similar situation.

Pre-swim brief.

- ?? Outline activities permitted under Whale Protection Act and Whale Watching Guidelines
- ?? If operating under permit, explain any special conditions of the permit
- ?? Clearly explain to passengers the procedures for whale-diver interactions (this will vary according to whether open water or reef encounter)
- ?? Prepare participants adequately for the strength of their feelings during a close encounter and the need to resist the urge to swim towards whales and/or to touch them
- ?? Make clear to participants they **should never swim directly at a whale** by ensuring that participants understand this behaviour will result in the whales leaving or maintaining a greater separation from divers. Adherence to the Code of Practice is likely to result in closer passes and more prolonged encounters.
- ?? Stronger emphasis of the above is necessary for reef encounters when use of lines is not feasible.
- ?? Provide roster of first people to enter water if whales are spotted (from previously arranged selection of names from the passenger list).
- ?? Prepare participants for weather/sea conditions that may require hard physical effort, especially with camera equipment.

Open water procedures

- ?? When whales are spotted at a distance of between 100-300 m, motor slowly towards point of last surfacing; do not circle or make rapid changes in heading
- ?? If whale has not re-surfaced, continue towards direction of last sighting, put engine in neutral and drift; if whale surfaces within 100 m while the vessel is still steaming, continue on course (unless vessel is headed directly at whale) for 10-15 seconds before putting engine in neutral and drifting.
- ?? If whales do not approach vessel, continue on; do not chase whales
- ?? If whales approach, run out lines from bow and stern which can stream upwind of vessel. Use of lines should be mandatory in open water, both for better control of swimmers and for safety of both swimmers and whales
- ?? One crew member should enter water to assess conditions (e.g. strength of current)
- ?? If deemed safe, passengers and researchers enter water and take up positions on the lines; the crew member may be replaced by researcher or video camera operator
- ?? One crew member is stationed at the duckboard (exit/entry point) to assist snorkellers in and out of the water and to oversee safety of passengers on the line
- ?? Inflatable tender is to be in the water but only to be used in emergencies
- ?? The most experienced personnel take position at end of each line; this allows maximum data and video recording
- ?? The whales' behaviour should be monitored by an independent observer at all times; activities of swimmers which result in repeated veers, speed-ups or deep diving by the whales should lead to termination of the interactions
- ?? Recommended maximum per line is six, but fewer swimmers are preferred in order to allow individuals to be well-spaced along the line, without interfering with one another
- ?? Entry into the water and movement on and between lines should be done quietly using slow, calm movements wherever possible
- ?? Swimmers should remain on the line at all times, unless exiting water or changing position between bow and stern line. If they leave the line they **should never swim directly at a whale**
- ?? Passengers change over at 15 minute intervals; we recommend that swimmers avoid the area **between** the bow and stern lines as whales may unexpectedly surface in that area. They therefore move up the bow line and swim to the stern close to the hull of the boat
- ?? We recommend use of mask, fins and snorkel for high quality encounters (i.e. scuba is not required and therefore not recommended)
- ?? There should be no touching or physical contact with the whale

- ?? Swimmers should avoid rapid movements, e.g. maintaining contact with the line but lunging forward with a camera
- ?? Photography should be with natural light only; i.e. no flash photography
- ?? There should be no food scraps of any sort placed in the water during interactions
- ?? Sullage tanks should be sealed while interactions continue (for sake of humans and whales)
- ?? There should be no attempts to feed the whales
- ?? No motorised sledges are to be used
- ?? If sharks are sighted, the more experienced personnel at the end of the lines assess whether to terminate the encounter and, if so, whether snorkellers can safely swim back to the boat or require to be picked up
- ?? Only one whale-watching vessel should be in contact with a group of whales
- ?? Special care needs to be taken when breaking off a contact. It is essential that the vessel initially maintain no wake speed and the positions of the whales are carefully monitored, especially if they are still crossing the bow. The vessel speeds up only when well clear of the whales
- ?? **Variation in procedures for reef situations**
- ?? If the vessel is approached by a whale while moored on the reef, we recommend use of lines if this is feasible. If lines can not be used (e.g. because of inappropriate direction or strength of current), an equivalent procedure for controlling number and position of swimmers is essential.
- ?? Particularly clear pre-dive briefings, careful in-water monitoring and supervision will be required to manage divers in the absence of lines
- ?? Numbers of swimmers should be kept small (although we do not have sufficient information to give a specific number) and should remain in the same position close to the vessel so that the whales can become familiar with the positions of vessel and swimmers
- ?? The whales' behaviour should be monitored at all times; activities of swimmers which result in repeated veers, speed-ups or deep diving by the whales should lead to termination of the interactions
- ?? If divers are using scuba when the whales approach (e.g. for a reef dive), the dive continues as usual, including a safety stop on return to the vessel. However, divers **should never swim directly at a whale.**
- ?? Such incidental approaches by minke whales during reef dives are likely to produce high levels of excitement and/ or interest from divers. It is therefore vital that they are well briefed **before** entering the water about procedures to be followed in the event of an interaction occurring.
- ?? If scuba is used to observe/photograph whales, then an independent observer on snorkel should monitor behaviour of the whales in relation to the scuba divers (Further research on the effects of scuba on minke whales is required before any additional recommendations are made).