



Australian Government

Department of the Environment, Water, Heritage and the Arts

Marine and Tropical Sciences Research Facility Preliminary Report, June 2007

Program 8: Sustainable Use and Management of Marine Resources of the Great Barrier Reef

Extension Project for:
MTSRF Program 4 Species of conservation concern
And complementary to:
MTSRF Project 1.8.6 (a) and (c)¹

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1. Project Title

Condition and trends of dwarf minke whale populations in the Great Barrier Reef World Heritage Area (GBRWHA).

2. Project Objectives

1. To assess the distribution, abundance, movements and demography of dwarf minke whales in the northern Great Barrier Reef (GBR); and
2. To develop a risk assessment model and biological indicators for sustainable management.

Note: Funding from the Marine and Tropical Sciences Research Facility (MTSRF) was not allocated to these tasks, however co-investment from the Great Barrier Reef Marine Park Authority (GBRMPA) to the value of \$15,000 was provided over financial year 2006/2007 (only) for the specific task of analysing and reporting on archival passenger questionnaire data collected over 2002-2005, to identify potential trends in swim-with-dwarf minke whale tourism interactions and the management of these interactions over this period.

¹ See also Project 4.8.6 JCU Birtles, A. (2007) June Milestone Report.

3. Progress towards Milestones

Milestones with specific funding have been met (archival passenger questionnaire data entry and preliminary analyses; reported herein). Project Objectives 1 and 2 are being partially addressed through three James Cook University PhD studies (2006-2009) by A. Mangott, S. Sobotzick (supervised by Dr Alastair Birtles and Professor Helene Marsh) and M. Curnock (supervised by Birtles and Professor Peter Valentine), however additional MTSRF funding and/or co-investment is required.

Project activities since commencement of funding in 2007:

- Appointment of Research Officer (M. Curnock) on 19 February 2007 for three months (until 20 May 2007) to conduct data entry and analyses;
- Data entry of archival passenger questionnaires completed (n=2,373); and
- Trend analyses of passenger questionnaire data ongoing (preliminary results reported below).

Note that complementary activities towards this project's overarching objectives are in progress under MTSRF Program 8 (Project 4.8.6 Objective a), which will identify the social and economic values of dwarf minke whales (among other iconic marine species) as part of a Quadruple-Bottom-Line evaluation of the sustainability of swim-with-dwarf minke whales tourism in the GBRWHA.

The Minke Whale Project (MWP) research team (led by Birtles) is also conducting an ongoing research program (2003-2009; funded by the GBRMPA: Dwarf Minke Whale Tourism Monitoring Programme) to collect, analyse and report on Whale Sighting Sheets collected by the tourism industry, which provides an indication of the scale of minke whale sightings and interactions in the Cairns/Cooktown Management Area of the Marine Park. PhD projects (by A. Mangott, S. Sobotzick and M. Curnock), due to be completed by the end of 2008 to early 2009 will additionally contribute to the evaluation of the sustainability of this industry, including the development and evaluation of a range of Sustainability Indicators.

It is important to note that additional funding is required for an expanded Whale Sightings Network, DNA analyses and VHF/Satellite tracking studies, which are necessary to evaluate the condition and trends of the GBRWHA dwarf minke whale population.

Specific project outputs since commencement of funding in 2007:

1. Presentation of preliminary results of passenger questionnaires (among other MWP research results) to GBRMPA staff for the GBRMPA Seminar Series, 8 May 2007 (*The Minke Whale Project: science for the sustainable management of swim-with-dwarf minke whales tourism in the GBRMP*).
2. Presentation of preliminary results of passenger questionnaires to staff from GBRMPA, QPWS and Department of the Environment and Heritage, and tourism industry representatives at the 2007 Pre-Season Dwarf Minke Whale Tourism Monitoring Workshop, 25 May 2007.
3. Preliminary report to the RRRC and the GBRMPA on analyses of passenger questionnaires (2002-2005) and identification of any trends associated with swim-with-dwarf minke whales tourism activities (this report).

Additional milestones for financial year 2007/2008:

1. Draft manuscript for peer-reviewed publication based on trend analysis of archival passenger questionnaire data (end July 2007).

3.1 Report on passenger questionnaires (MWQ 2002-2005)

3.1.1 Methods

Questionnaire design

Questions in the single-page (double-sided) survey were designed to elicit passengers' perceptions and experiences from their interactions with dwarf minke whales. A key objective of the questionnaire was to enable passengers to identify incidents of particular concern to the sustainable management of in-water interactions with the whales, based on findings by Valentine and others (2004) and Birtles and others (2002a) from analyses of 955 passenger surveys collected from swim-with-whales participants over 1999-2001. Passenger satisfaction, expectations of the experience and evaluation of the quality of interpretive material received on trips were additional key foci of the survey instrument. A slightly modified version of the questionnaire was used on the three swim-with-minke whales permitted day-boats, beginning in 2004.

An agreement of confidentiality of data from this survey was undertaken with each participating operator, ensuring that no operators or individuals will be identifiable from the results.

Sampling on vessels

Questionnaires were collected from a total of eleven vessels, including: *Aristocat IV*, *Diversity*, *Floreat*, *Nimrod Explorer*, *Poseidon III*, *Quicksmart*, *Spirit of Freedom*, *Super Sport*, *Taka II*, *Taka* and *Undersea Explorer*. Details of these vessels are presented in Table 1 below. All vessels, with the exception of *Spirit of Freedom*, held a GBRMPA permit for swimming-with-dwarf minke whales activities from 2003 onwards (year of issue). The vessels *Aristocat IV*, *Poseidon III* and *Quicksmart* are Port Douglas-based day trip vessels, with passenger capacities ranging from 45-90, visiting sites in the Agincourt-St Crispins Reef Complexes, and were not sampled prior to 2004. The remaining vessels are live-aboard dive vessels, running itineraries between three and six days, further north in the Ribbon Reefs, with generally fewer passengers (capacities ranging from twelve to thirty persons).

A total of 185 trips (by eleven different vessels) were sampled between May and August over the four-year period 2002-2005. Questionnaires were distributed and collected by vessel crew and/or researchers (when present onboard) towards the end of each trip on which minke whales were encountered. Questionnaire completion by passengers was entirely voluntary. A sample of 2,373 passenger questionnaires was collected over the four-year period 2002-2005. The sample sizes per year and per vessel are shown below (Tables 2 and 3 respectively).

Response rate

Calculation of the exact response rate was not possible due to some vessels not providing details of the number of passengers carried on specific trips that were sampled. The maximum possible number of passengers on each trip (based on the passenger capacity for each vessel) has therefore been used to calculate the *minimum* overall response rate (see Table 4 below). For the 185 trips that were sampled, a maximum of 4,980 passengers could have been carried by the vessels. From these 185 trips, 2,373 completed questionnaires were returned. The minimum overall response rate is therefore 2,373/4,980, or 47.7%. As sampling of day boats began only in 2004, the response rates for live-aboard dive vessels and day vessels are also shown separately (Table 4).

Table 1: Details of vessels on which MWQs were collected, 2002-2005.

Vessel name (Operator / company name)	Length	Cruising speed	Passenger capacity	Description of itinerary	Years sampled			
					2002	2003	2004	2005
<i>Nimrod Explorer</i> (Explorer Ventures Australia)	21m	9kn	18	3, 4 and 6 day live-aboard trips to Ribbon Reefs and Osprey Reef. Departs Cairns and Cooktown.	✓	✓	✓	✓
<i>Super Sport</i> (Mike Ball Dive Expeditions)	27m	14kn	26	Three-day live-aboard trips to Ribbon Reefs. Departs Cairns and Lizard Island.	✓	✓	✓	✓
<i>Undersea Explorer</i> (Undersea Explorer)	25m	8kn	21	Research vessel. Six-day trips to Ribbon Reefs. Departs Port Douglas.	✓	✓	✓	✓
<i>Taka II</i> (Taka Dive)	22m	9kn	26	3 and 4 day trips to Ribbon Reefs and Osprey Reef. Departs Cairns.	✓	✓	✓	
<i>Taka</i> [new vessel replaced Taka II in 2005] (Taka Dive)	30m	11kn	30	3 and 4 day trips to Ribbon Reefs and Osprey Reef. Departs Cairns.				✓
<i>Diversity</i> (Sable Lake Pty Ltd)	20m	14kn	12	3 and 4 day trips to Ribbon Reefs and Osprey Reef. Departs Cairns.		✓	✓	
<i>Floreat</i> (Floreat Reef Charter)	21m	8kn	13	No set itineraries. Available for charter.			✓	✓
<i>Quicksmart*</i> (Quicksilver Dive)	24m	25kn	80	Day trips from Port Douglas to Agincourt Reefs.			✓	✓
<i>Poseidon III*</i> (Poseidon Cruises)	24m	25kn	90	Day trips from Port Douglas to Agincourt Reefs.			✓	✓
<i>Aristocat IV*</i> (Aristocat Reef Cruises)	17m	20+kn	45	Day trips from Port Douglas to Agincourt Reefs.				✓
<i>Spirit of Freedom</i> (TUSA Dive)	37m	12kn	26	3 and 4 day live-aboard trips to Ribbon Reefs and Osprey Reef. Departs Cairns and Lizard Island.				✓

* Indicates day vessels; remaining vessels are live-aboards.

Table 2: MWQ sample sizes per year, 2002-2005 (n=2373).

Year	n	Proportion of total sample (%)
2002	432	18.2
2003	403	17.0
2004	689	29.0
2005	849	35.8
TOTAL	2373	100

Table 3: MWQ sample sizes per vessel, 2002-2005 (n=2373).

Vessel*	n	Proportion of total sample (%)
A	557	23.5
B	523	22.0
C	444	18.7
D	289	12.2
E	261	11.0
F	88	3.7
G	74	3.1
H	49	2.1
I	41	1.7
J	25	1.1
K	22	0.9
Total	2373	100

* Vessel names removed in accordance with confidentiality agreement.

Table 4: MWQ minimum response rate by year, 2002-2005 (n=2373).

Year	No. of vessels sampled	Total no. of trips sampled	Maximum number of passengers on these trips (N)	Sample size (n)	Minimum response rate (n/N)
2002 Live-aboard vessels only	4	32	728	432	59.3%
2003 Live-aboard vessels only	5	38	774	403	52.1%
2004	6 Live-aboard vessels	47 (Live-aboards)	1023 (Live-aboards)	584 (Live-aboards)	57.1% (Live-aboards)
	2 Day boats	3 (Day boats)	260 (Day boats)	105 (Day boats)	40.4% (Day boats)
2005	6 Live-aboard vessels	52 (Live-aboards)	1225 (Live-aboards)	578 (Live-aboards)	47.2% (Live-aboards)
	3 Day boats	13 (Day boats)	970 (Day boats)	271 (Day boats)	27.9% (Day boats)
TOTAL Live-aboard vessels	8 different vessels	169	3750	1997	53.3%
TOTAL Day boats	3 different vessels	16	1230	376	30.6%
TOTAL OVERALL	11 different vessels	185	4980	2373	47.7%

3.1.2 Results

The following results represent preliminary analyses of the 2002-2005 survey data with limited interpretation, including some comparisons of trends using additional data collected over 1999-2001 (previously reported by Valentine *et al.* 2004 and Birtles *et al.* 2002a). Further in-depth analyses are continuing through mid-2007 for subsequent peer-reviewed publication.

Sample demographics

Of the total sample (2002-2005), 51.5% were male. The mean age of respondents was 34.4 years, ranging from 7 to 83. Respondents originated from 54 countries. The largest proportion of respondents came from Australia (27%), the United States (25%), the United Kingdom (12%) and Japan (12%) (Figure 1). Fifty-seven percent of respondents were first-time visitors to the Great Barrier Reef.

Respondent SCUBA experience and qualifications

The majority of respondents were certified SCUBA divers (representing 86% of the total sample including day vessel and live-aboard passengers). From the live-aboard sample, 96% were certified SCUBA divers. From the day vessels, only thirty percent held SCUBA certification. The mean number of years of SCUBA diving experience for the total sample

was 7.0 (median four years; range 0-48 years' experience). The median total number of dives performed by respondents in their life was fifty (ranging from 0 to 20,000 dives).

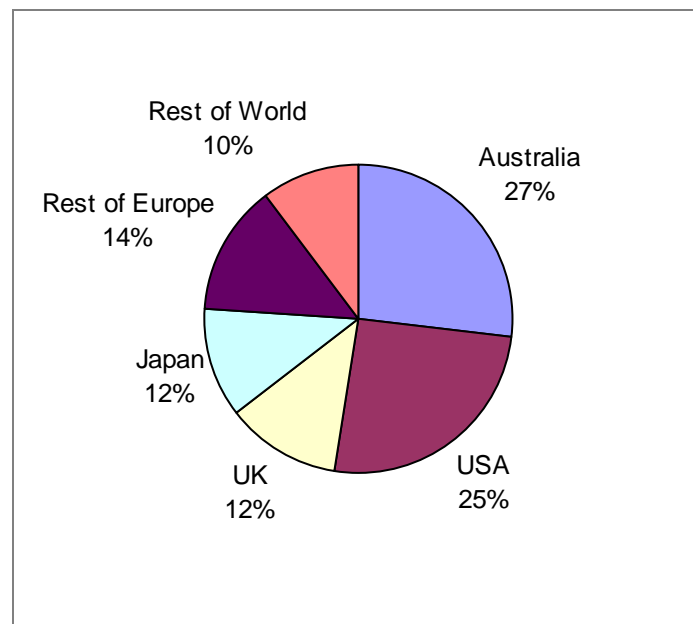


Figure 1: Respondents' country of origin (major groups; n=2,373).

Purpose of respondents' trip to Far North Queensland

Live-aboard respondents were asked, "Was your visit to Far North Queensland primarily to see minke whales?" Over the four year period 2002-2005, 34.8% of the live-aboard sample answered 'Yes' to this question. The day-boat passenger questionnaire asked the alternative questions, "Had you ever heard about minke whales on the Great Barrier Reef before this trip?" and "Did you expect to see any minke whales on this trip today?" Seventy-five day-boat respondents (twenty percent of this sample) indicated that they had heard about minke whales on the Reef prior to their trip, and 39 of these (ten percent of the day-boat sample) indicated that they had expected to see minke whales on their trip. Of these 39 respondents, 27 were from Australia and 22 had visited the Great Barrier Reef before this trip.

A comparison of the proportion of live-aboard respondents who had visited Far North Queensland primarily to see minke whales over the seven-year period, from 1999 to 2005 (incorporating results published by Valentine *et al.* 2004) is shown in Figure 2. These results show a high proportion each year of live-aboard dive vessel passengers (ranging from 21.5% in 1999 to as high as 39.7% in 2001 and 38% in 2005) who traveled to the region primarily to see minke whales.

Passengers' experiences with minke whales

Of the total sample (2002-2005; n=2,373), 92.1% of respondents indicated that they had swum with minke whales on snorkel (84.6% of respondents) and/or SCUBA (35.8% of respondents) during their trip.

Respondents were asked, "How would you rate your overall satisfaction with your minke whale experience?" and were provided with a ten-point semantic differential scale (ranging from 1 = 'very poor' to 10 = 'excellent') in order to respond. The mean rating overall for the total sample (2002-2005; n=2,373) was 9.16 (median = 10). A comparison *between years* for the live-aboard passengers only (2002-2005; eight vessels, n=1,997) revealed a significant

difference (Kruskal Wallis non-parametric test; $p=0.000$; Table 6), with the mean ratings per year varying from 8.99 at the lowest (in 2002) to 9.40 at the highest (in 2003; see Table 5). A comparison *between four live-aboard dive operators* that were sampled in each of the four years from 2002-2005; $n=1,901$) also revealed a significant difference between operations for the mean satisfaction rating of passengers (Kruskal Wallis test; $p=0.001$; Table 8), with mean ratings varying between operations from 8.99 (lowest) to 9.42 (highest; Table 7).

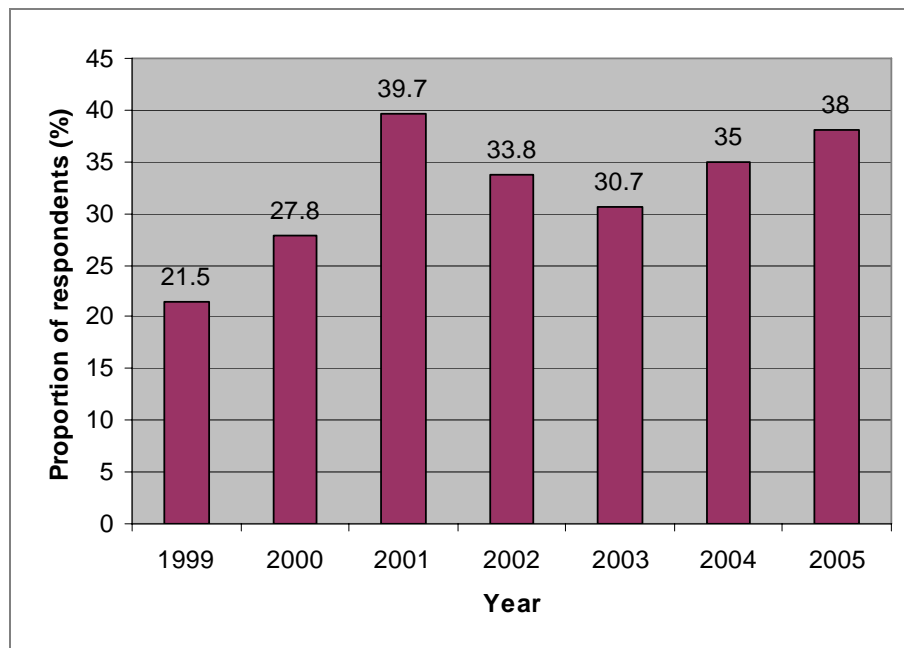


Figure 2: Year-by-year comparison of the proportion of live-aboard respondents who visited Far North Queensland primarily to see minke whales, 1999-2005 ($n=2,952$).

Respondents were asked, “Overall, how well did your minke whale experience(s) meet your expectations?” and were provided a five-point categorised response option (ranging from 1 = ‘well below my expectations’ to 5 = ‘well above my expectations’) in order to respond. The mean rating overall for the total sample (2002-2005; $n=2,373$) was 4.26 (median = 5). A comparison *between years* for live-aboard passengers (2002-2005; eight vessels, $n=1,997$) revealed a significant difference (Kruskal Wallis test; $p=.000$; Table 6). Mean ratings for this variable between years for live-aboard respondents varied from 4.14 (at lowest in 2002) to 4.42 (at highest in 2003; Table 5). A comparison *between the four live-aboard dive operators* (as per above) again revealed a significant difference between between operations for this variable (Kruskal Wallis test; $p=.001$; Table 8), with mean ratings varying between operations from 4.14 (lowest) to 4.39 (highest; Table 7).

Passengers' perception of management of minke whale encounters

Respondents were asked, "Overall, how well do you feel your minke whale encounter(s) were managed by your boat crew?" A ten-point rating scale was provided (ranging from 1 = 'very poorly' to 10 = 'very well') with space for respondents to provide reasons for their selection on the scale. The mean rating overall for the total sample (2002-2005; n=2,373) was 9.46 (median = 10). A comparison between years for all live-aboard passengers only (2002-2005; n=1,997) revealed a significant difference (Kruskal Wallis test; p=0.000; Table 6), however the mean rating for this variable each year was consistently high, varying from 9.29 (at lowest in 2002) to 9.56 (at highest in 2005; Table 5). A comparison between the four live-aboard dive operators again revealed a significant difference between between operations for their mean ratings (Kruskal Wallis test; p=0.000; Table 8), however the mean ratings for each vessel were all relatively high, ranging from 9.20 (lowest) to 9.71 (highest; Table 7).

Table 5: Comparison of live-aboard respondents' mean ratings *between years* for (a) overall satisfaction with their minke whale experience, (b) how well their minke whale experience met their expectations, and (c) how well they felt their minke whale encounters were managed by their boat crew (2002-2005; eight vessels, n=1,997).

	2002	2003	2004	2005	Overall (2002-2005)
Mean rating of satisfaction (1-10; 1 = 'very poor' to 10 = 'excellent')	8.99	9.40	9.12	9.31	9.20
Mean rating of how well respondents' minke whale experience met their expectations (1-5; 1 = 'well below my expectations' to 5 = 'well above my expectations')	4.14	4.42	4.17	4.28	4.24
Mean rating of how well respondents felt their minke whale encounters were managed by their boat crew (1-10; 1 = 'very poorly' to 10 = 'very well')	9.29	9.55	9.46	9.56	9.47

Table 6: Kruskal Wallis test results comparing live-aboard passengers' mean ratings *between years* (2002-2005) of (a) overall satisfaction with their minke whale experience, (b) how well their minke whale experience met their expectations, and (c) how well they felt their minke whale encounters were managed by their boat crew (eight vessels, n=1,997).

Kruskal Wallis test (grouping by year; 2002-2005)	(a) Satisfaction rating	(b) Expectation rating	(c) Management rating
Chi-Square	21.943	20.658	22.776
df	3	3	3
Asymp. Sig.	.000	.000	.000

Table 7: Comparison of passengers' mean ratings *between four live-aboard dive operations* of (a) overall satisfaction with their minke whale experience, (b) how well their minke whale experience met their expectations, and (c) how well they felt their minke whale encounters were managed by their boat crew (2002-2005; n=1,901).

	Operator*			
	A	B	C	D
Mean rating of satisfaction (1-10; 1 = 'very poor' to 10 = 'excellent')	9.42	9.18	9.15	8.99
Mean rating of how well respondents' minke whale experience met their expectations (1-5; 1 = 'well below my expectations' to 5 = 'well above my expectations')	4.39	4.25	4.17	4.14
Mean rating of how well respondents felt their minke whale encounters were managed by their boat crew (1-10; 1 = 'very poorly' to 10 = 'very well')	9.71	9.48	9.39	9.20

* Operators de-identified in accordance with confidentiality agreement.

Table 8: Kruskal Wallis test results comparing passengers' mean ratings *between four live-aboard dive operations* (2002-2005; n=1,901) of (a) overall satisfaction with their minke whale experience, (b) how well their minke whale experience met their expectations, and (c) how well they felt their minke whale encounters were managed by their boat crew.

Kruskal Wallis test (grouping by dive operation)	(a) Satisfaction rating	(b) Expectation rating	(c) Management rating
Chi-Square	17.235	15.494	51.142
df	3	3	3
Asymp. Sig.	.001	.001	.000

Passenger perceptions of impacts on minke whales

Respondents were asked, “Do you feel any concern that this kind of whale-watching (swimming with minkes) might result in some negative impacts on the whales?” A total of 13.9% of the sample responded ‘Yes’ in answer to this question.

Particular incidents that negatively impacted passengers’ minke whale experiences were elicited via a list of potential impacts derived from findings by Birtles *et al.* (2002a) and Valentine *et al.* (2004). The proportion of respondents who indicated that such incidents had negatively on their experience is presented below (Table 9).

Table 9: Proportion of respondents indicating particular incidents that had negatively impacted on their minke whale experience (2002-2005; n=2,373).

Incident	Proportion of respondents (%)
Seas too rough	15.0
Bad visibility	14.6
Encounters with whales too short	11.1
Not enough whales	11.0
Whales not coming close enough	9.2
Rope was too crowded	7.5
Splashing/kicking by other passengers	7.1
Too many divers/snorkellers in the water	4.7
Other divers chasing/following whale(s)	2.8
Whale(s) being scared away	1.8
Potentially dangerous marine animals (sharks/sea snakes)	1.6
Nervousness about being in the water with whale(s)	1.6
Bubbles from SCUBA disturbing the whale(s)	1.2
Divers taking flash photos	0.8
Food scraps in water	0.3
Being scared by the whale(s) behavior	0.2

Passenger preparedness for interactions with minke whales

Respondents were asked, “Do you feel you were adequately prepared for your encounter(s) with minke whales?” Of the total sample (2002-2005; n=2,373), 9.7% indicated that they did not feel adequately prepared. This proportion of passengers varied between years (Figure 3; representing four live-aboard operations sampled continuously from 1999-2005; n=2,829) and between operators (Figure 4).

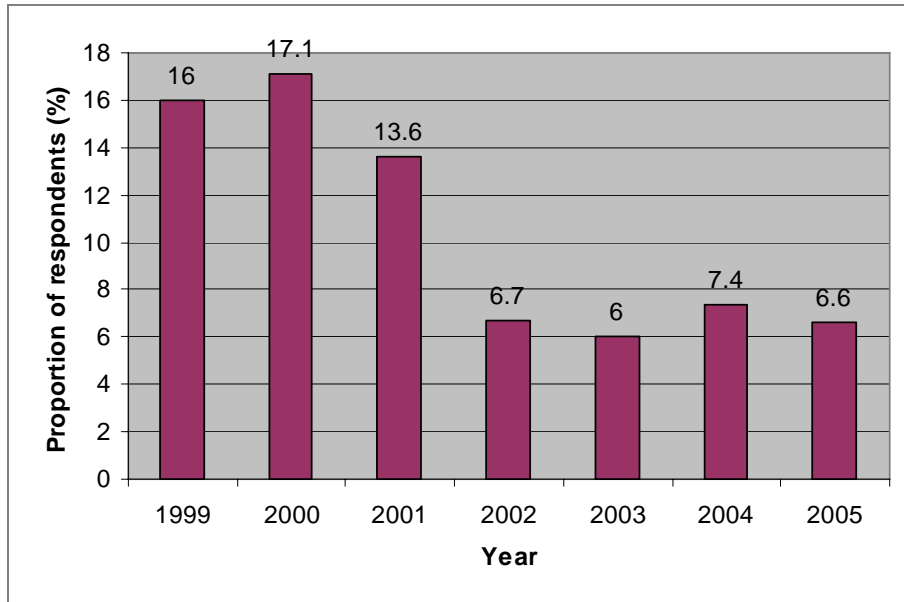


Figure 3: Comparison between (seven) years of the proportion of respondents on *four live-aboard dive operations* who felt they were not adequately prepared for their encounter with minke whales (1999-2005; n=2,829).

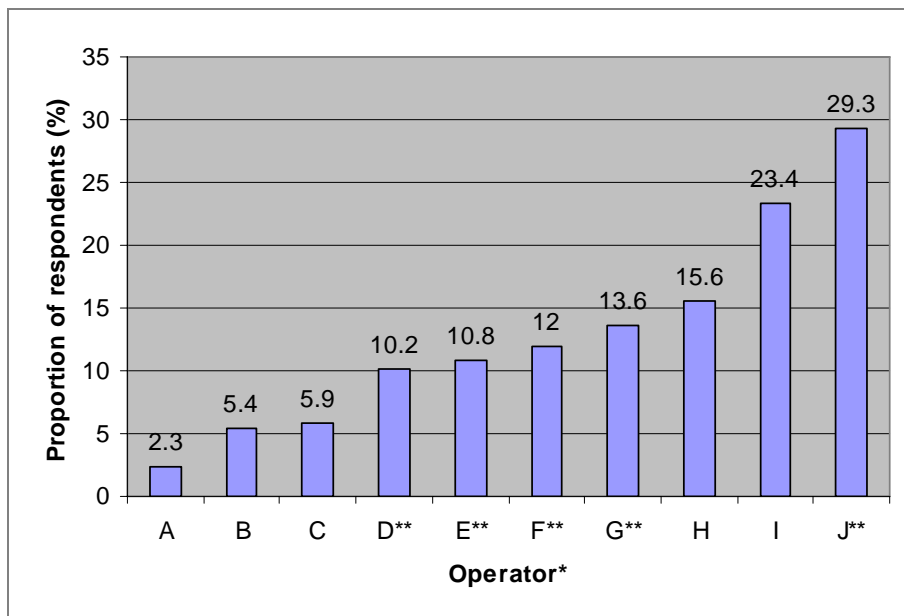


Figure 4: Comparison between operators of the proportion of respondents who felt they were not adequately prepared for their encounter with minke whales (2002-2005; n=2,373). * Operators de-identified in accordance with confidentiality agreement. ** Represents operators with low sample sizes (n<100).

Interpretation about minke whales

Respondents were asked “Overall, how would you rate the quality of the information you received about minke whales?” and were provided a ten-point rating scale (ranging from 1 = ‘very poor’ to 10 = ‘excellent’) in order to respond. The mean rating for the total sample (2002-2005; n=2,373) was 8.62 (median = 9). A comparison of the mean ratings between operators (for the five operators with samples n>100) revealed a significant difference (Kruskal Wallis test; p=0.000; Table 10). The mean ratings for these five vessels are presented below (Figure 5).

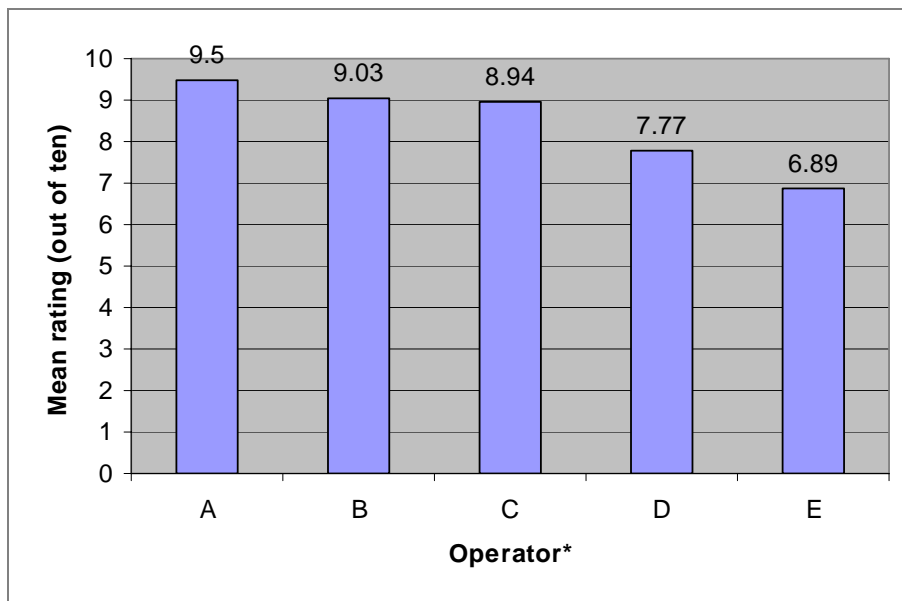


Figure 5: Comparison between five operators of passengers’ mean rating of the quality of information they received about minke whales (2002-2005; n=2,162). * Operators de-identified in accordance with confidentiality agreement.

Table 10: Kruskal Wallis test results comparing passengers’ mean ratings of the quality of information they received about minke whales, *between five dive operations* (2002-2005; n=2,162).

Kruskal Wallis test (grouping by dive operation)	Rating of quality of information about minke whales
Chi-Square	384.017
df	4
Asymp. Sig.	.000

Respondents indicated, from a list of possible sources, what information about minke whales they had access to whilst on-board or prior to their trip. The proportion of respondents from the total sample (2002-2005; n=2,373) that indicated they had access to these sources of information is presented below (Table 11).

Table 11: Proportion of respondents that had access to specific sources of information about minke whales (n=2,373).

Source of information	Proportion of respondents who indicated they had access to this information (%)
Pre-dive briefing	65.0
Specific pre-minke encounter briefing	64.2
Pre-trip briefing by staff	56.3
Informal discussions (with staff or other passengers)	52.4
Pre-trip information (e.g. magazines, internet or books)	38.7
"Mystery of the Minkes" documentary film (limited availability prior to 2003)	37.7
Reference books provided on boat	36.1
"Swimming with dwarf minke whales" colour posters (2005 only)	34.2
Presentation / talks by Minke Whale Project researcher (introduced to MWQ in 2005 only)	26.7
Minke Whale Information Package (white folder)	26.3
Minke Whale Identification Guide Booklet (from 2003-2005)	22.2
CRC Reef Current State of Knowledge Brochure May 2002	22.1
Minke Whale Project Reports and Publications	12.6
Tourism industry advertising material	9.5
Minke Whale Identification Guide CD-ROM (from 2003-2005)	8.0
Minke Whale Project website (http://www.reef.crc.org.au)	5.6

The best sources of information about minke whales, indicated by respondents are shown below (Table 12).

Table 12: Proportion of respondents indicating particular sources of information as the best source of information about minke whales (2005 results only presented to compare full range of interpretive materials/sources; n=849).

Source of information	Proportion of respondents who indicated that this was the best source of information about minke whales (%)
Vessel crew	29.6
Minke whale researchers (when present)	22.4
"Mystery of the Minkes" documentary film	14.5
Briefings (combined)	11.6
Informal discussions (with staff or other passengers)	2.9
CRC Reef Current State of Knowledge Brochure May 2002	4.2
Other sources (combined)	14.8

3.1.3 Discussion

The results above are presented with limited interpretation due to ongoing analyses throughout mid 2007. However, these results show several key trends and patterns in this now-extensive longitudinal data set which will assist the development and refinement of social and managerial Sustainability Indicators using passenger-generated monitoring data. Some such potential Sustainability Indicators were identified at a 2002 Workshop (entitled "Management of Swim-With-Dwarf Minke Whale Activities in the Northern Great Barrier Reef") involving five of the now nine permitted GBR swim-with-minke whales tourism operators, tourism industry and accreditation representatives, State and Commonwealth government management agency staff, and Minke Whale Project researchers. Proposed indicators included (from Birtles *et al.* 2002):

- The occurrence of a pre-dive briefing of passengers given by crew (as 'good briefings' were recognised by passengers as the most important element of a well-managed encounter; Birtles *et al.* 2002a); and
- Feedback from passengers that they felt adequately prepared for their encounter(s) with the whales.

Additional social/managerial indicators for evaluating the effectiveness of management strategies are also likely to include visitor satisfaction, perceptions of management effectiveness, awareness of potential ecological impacts, education and learning, attitudes and behaviours. Further in-depth analyses of this questionnaire data set through 2007 will assist in the refinement of research tools for monitoring the sustainability of this unique marine wildlife tourism industry from 2008 onwards.

4. References

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Valentine, P.S., Birtles, R.A., Curnock, M., Arnold, P.W. and Dunstan, A. (2004). Getting closer to whales - passenger expectations and experiences, and the management of swim with dwarf minke whale interactions in the Great Barrier Reef. *Tourism Management* 25: 647–655. Available online: <http://www.sciencedirect.com/science/journal/02615177>