

Status and distribution of humpback whales (*Megaptera novaeangliae*) in northern Luzon, Philippines

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ABSTRACT

Since the verification of the occurrence of humpback whales in the Babuyan Islands, Philippines in 1999, studies have been carried out on their status and distribution. Boat-based surveys of the waters around the islands were conducted from 2000-03. In 2003, a survey was also conducted off the eastern coast of Northern Sierra Madre. Once the whales were sighted, the location, group composition and behaviour were noted, fluke photo-identifications taken, sloughed skin and biopsy samples collected and songs recorded. A total of 367 humpback whale sightings were documented in four seasons around the Babuyan Islands. However, a cow-calf pair sighting off the coast of Northern Sierra Madre indicates that this breeding area may extend farther south. A total of 69 individuals have been photo-identified from 1999-2003. Re-sightings across years are as follows: one individual was sighted for three consecutive years (2001-03); two individuals for two consecutive years (2001-02 and 2002-03); while three individuals were sighted in two different years (1999 and 2002; 2001 and 2003). Twelve of the 40 individuals photo-identified in the Philippines from 1999-2002 were matched to humpback whales identified in Ogasawara and Okinawa, Japan, including one whale that moved between these regions in one season. These matches indicate that the Philippine humpback whales are part of this greater western Pacific population. A subjective comparison between humpback whale songs recorded in the Philippines and Hawaii in 2002 indicated marked similarities. A total of nine distinctive themes were identified; seven of these were common to songs from both regions. The similarity in songs suggests humpback whales in the Philippines mix to some degree, at least acoustically, with the whales in Hawaii and the rest of the Pacific basin.

KEYWORDS: HUMPBACK WHALE; MOVEMENTS; BREEDING GROUNDS; PHOTO-ID; SURVEY-VESSEL; VOCALISATION; BIOPSY SAMPLING; CONSERVATION; WHALING

INTRODUCTION

North Pacific humpback whales (*Megaptera novaeangliae*) are known to assemble in three regions during winter for breeding: (1) in the eastern North Pacific along the coast of Mexico and central America, and near the offshore Revillagigedo Islands; (2) in the central North Pacific around the main Hawaiian islands; and (3) in the western North Pacific around the Ogasawara and Ryukyu Islands in southern Japan (Nishiwaki, 1959; Perry *et al.*, 1999; Rice, 1978). In the western North Pacific, the historical winter range of humpback whales included the waters south of the Ryukyu Islands around Taiwan and Hainan and south of the Ogasawara archipelago in the Mariana and Marshall Islands (Darling and Mori, 1993; Nishiwaki, 1959; 1960; 1962; Tomilin, 1957). The Hainan region has not been surveyed for humpback whales in recent times. Investigations off Taiwan and Saipan (Northern Marianas) in the early 1990s indicated that humpback whales had not obviously re-inhabited these southern parts of the range at that time (Darling and Mori, 1993). However, records of humpback whales killed in Taiwan (from 1920 to 1967) indicated that this region was recently, and may still be, used by this species (Darling and Mori, 1993; Tomilin, 1957; Yu, 2002). Several sightings from 1994 to 2003 off Taiwan indicate humpback whales are currently present to some degree (J.Y. Wang, pers. comm.). Further, a confirmed humpback whale sighting off Saipan in 1991 led to the suggestion that the winter range of the population could be expanding or may, at least occasionally, extend into this region (Darling and Mori, 1993). This latter assessment seemed to be confirmed by further surveys conducted in the Marianas Islands in 1995 and 1996, which produced no humpback whale sightings, but noted a cow-calf pair recorded on video in the region in March 1994 (Yamaguchi *et al.*, 2002).

Northern Luzon, Philippines is approximately 325km south of Taiwan, China, the closest location with any current or historical reference to humpback whales. Humpback whales have been sighted off Northwestern Luzon, specifically around Calayan and Camiguin islands in the Babuyan chain (Fig. 1) by local residents since the 1960s (Sumangil, 2000; Tan, 1995). The species was first formally documented and photographed in this region by Yaptinchay (1999) who reported their occurrence off Fuga Island, Northern Luzon on 22-23 April 1999. Upon observation of a mother-calf-escort group and two adults during a two-day survey, he suggested that this area could possibly be a new wintering ground for humpback whales in the western North Pacific.

This study was motivated by these sightings and reports of residents and visitors of the coastal towns of mainland Luzon, and Babuyan Islands. Beginning in April 2000, dedicated cetacean vessel surveys were conducted by a team of researchers from WWF-Philippines. The purpose of this study was to investigate the current status of humpback whales in the waters of Northern Luzon, Philippines including their distribution, behaviour and relationship to other humpback whale populations in the western and central North Pacific.

METHODS

Study area

The primary study area was the Babuyan Islands, an archipelago located in Luzon Strait, north of Luzon Island, Philippines (19°18'N, 121°36'E). It consists of five major islands: Camiguin, Fuga, Calayan, Dalupiri and Babuyan Claro. The archipelago is bound by the Babuyan Channel in the south and the Balintang Channel in the north. It is centred 40-60km north of mainland Luzon (Fig. 1). For one

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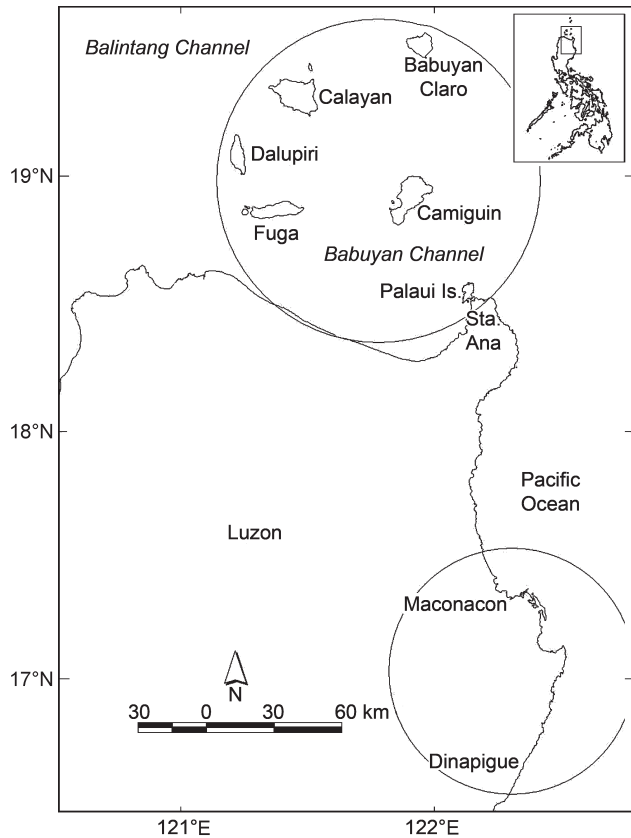


Fig. 1. Locations where photographic identification data were collected in the Philippines.

season, the vessel survey was extended to Palau Island, on the northeastern tip of mainland Luzon ($18^{\circ}33'N$, $122^{\circ}07'E$). An independent vessel survey was also conducted further south, along the eastern coast of the Northern Sierra Madre, from Maconacon ($17^{\circ}32'54''N$, $122^{\circ}12'08''E$) to Dinapigue ($16^{\circ}40'05''N$, $122^{\circ}22'06''E$); (Fig. 1).

Fieldwork

Small-vessel surveys were conducted each season from 2000-03 around the Babuyan Islands. Surveys were conducted during the period from late February to May when the best weather for survey work was likely to be encountered. Predetermined tracklines were set at least 1km from shore, with each leg extending to approximately 2km. The track legs were set to run perpendicular and parallel (alternately) to shore to cover the entire survey region (Fig. 2). Tracklines were also followed when crossing to different islands whenever conditions were favourable. Transects were followed using an 11m long outrigger boat. A 6m long single-engine boat was used to get closer to the whales for photo-identification and skin sampling. Eight to ten volunteer observers comprised the research team. The team surveyed the waters around each island for a minimum of four days. The survey conducted along the eastern coast of Northern Sierra Madre Natural Park used an outrigger boat approximately 14-16m long with a platform 2.5m high. Predetermined tracklines were set at least 1km from shore with each leg extending from 3-4km. The track legs were similarly set to run perpendicular and parallel (alternately) to shore to cover the entire survey area (Fig. 2).

On each sighting, the location, pod composition and behaviour of the whales were noted. The smaller boat was used to approach whales to get fluke photographs and

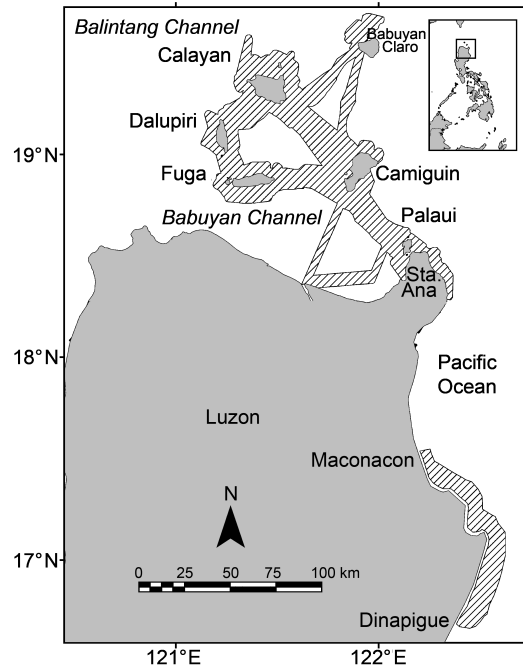


Fig. 2. Map showing actual survey areas covered from 2000 to 2003.

sloughed skin or biopsy samples. Photographs were taken using Single Lens Reflex (SLR) cameras with 35-350mm and 80-200mm lenses. Most photographs were taken using ASA 400 colour print and slide films and shot at a shutter speed of 1,000th of a second. Digital video cameras were also used to document the companions and behaviour of the animals. Whenever possible, fluke shots were also captured on video. A crossbow darting biopsy technique was only used for whales that permitted the vessel to get close enough to take a shot. A modified kitchen sieve on a long pole was used to collect sloughed skin from whales that were surface active. Samples were kept in plastic vials with dimethyl sulfoxide (DMSO) in a saturated saline solution. An omnidirectional hydrophone with a 10m long cable was used to detect and record humpback whale vocalisations. The hydrophone was lowered from the boat up to the full extent of the cable at predetermined waypoints set at least four kilometres from shore. Vocalisations were recorded on cassette tapes. The behaviour and surface times of the singers or nearby whales were noted. If possible, photographs of the flukes of singers were taken.

Processing and analysis

Photographs were processed into colour prints and slides. Good-quality photographs in which an individual was clearly identifiable, were scanned and compared. Individuals were assigned identification numbers and catalogued. Repeat identifications were used to determine length of stay within the area, movements between areas, behaviour and associations with other whales. Identification photographs were sent for comparison with the collection of the Ogasawara Marine Centre, the National Marine Mammal Laboratory in Seattle, the University of Alaska Fairbanks, the University of Alaska Southeast and the Humpback Whale Monitoring Program at Glacier Bay National Park and Preserve.

Recordings made in the Babuyan Islands on 24 March and 5 April 2002 were compared to songs recorded off Maui Hawaii on 9, 15 and 27 March 2002. Fives songs, one partial (on 24 March) and four complete (5 April), from two different singers in the Philippines were compared to five

songs (one from each of five different singers) from Hawaii. Using sound analysis software (*Avisoft Saslab*), spectrographs were made of the recordings, and the song composition, in terms of themes, phrases and units as defined by Payne and McVay (1971). The macro-composition of songs from both regions were qualitatively compared for similarities and differences. This analysis was based on the assumption that similarities in the songs indicate some degree of acoustic if not physical interaction between the populations (Cerchio *et al.*, 2001; Noad *et al.*, 2000; Payne and Guinee, 1983; Winn *et al.*, 1981).

Sloughed skin and biopsy samples were taken to Dan Lindstrom at the Silliman University Marine Laboratory in Dumaguete City, Philippines. Genomic DNA was extracted from the samples using Qiagen *DNeasy* kits and portions of the extracts were sent to Scott Baker at the University of Auckland in New Zealand for analysis. The results of this genetic analysis are to be presented elsewhere.

RESULTS

Sightings and distribution

A total of 367 sightings were documented in the Babuyan Islands during four seasons 2000-03, with the number of sightings generally increasing with number of survey days (Tables 1 and 2). The 213 sightings over 51 days in 2003, an average of about four sightings a day, provides a measure of the density of whales in the survey region.

Current knowledge of the distribution of humpback whales in northern Luzon is illustrated in Fig. 3.

Each year, humpback whales were sighted in social groups common to breeding grounds including cow-calf pairs, escorts, singers and surface active groups. Most whales were sighted within the 200m line depth around the leeward side of Camiguin, Fuga and Calayan Island. Whales were also observed on the northwestern side of Palau Island, which is approximately 40km from the Babuyan Islands. In addition on 29 April 2003, a cow-calf pair was sighted on the Maconacon coast of eastern Luzon (17°25' 59.9"N, 122°15' 13.7"E), approximately 188km from the Babuyan study area. Sightings have also been reported and photographed farther south off the coast of Maconacon in Dialinawan (17°33' 35.41"N, 122°25' 34"E) by Lavieren (2001) on 15 April 2000 and near Dicotcotan beach in Palanan (approx. 17°13'N, 122° 52'E), by a local news photographer in 2002.

Photo-identification

A total of 69 individuals were photographically identified from 1999-2003 (Table 3). With the exception of 2000, new whales were identified each year, with few repeat sightings, indicating that 69 is a minimum population size.

Eight individuals returned to the Babuyan Islands over different seasons (Table 4). One individual was sighted for three consecutive years (2001-03) and four individuals for two consecutive years (2001-02 and 2002-03), while three individuals were sighted in two different years (1999 and 2002; 2001 and 2003). Further data on resightings can be found in Table 5.

Table 2
Number of humpback whale sightings, photo-identified animals, skin samples taken and length of songs recorded per year.

Year	Sightings	Photo-IDs	Skin samples	Song (min)
1999	4	2	None	None
2000	16	0	2 skin	216
2001	47	7	1 skin; 1 biopsy	180
2002	91	31	4 skin	143
2003	213	38	3 biopsy	1,149

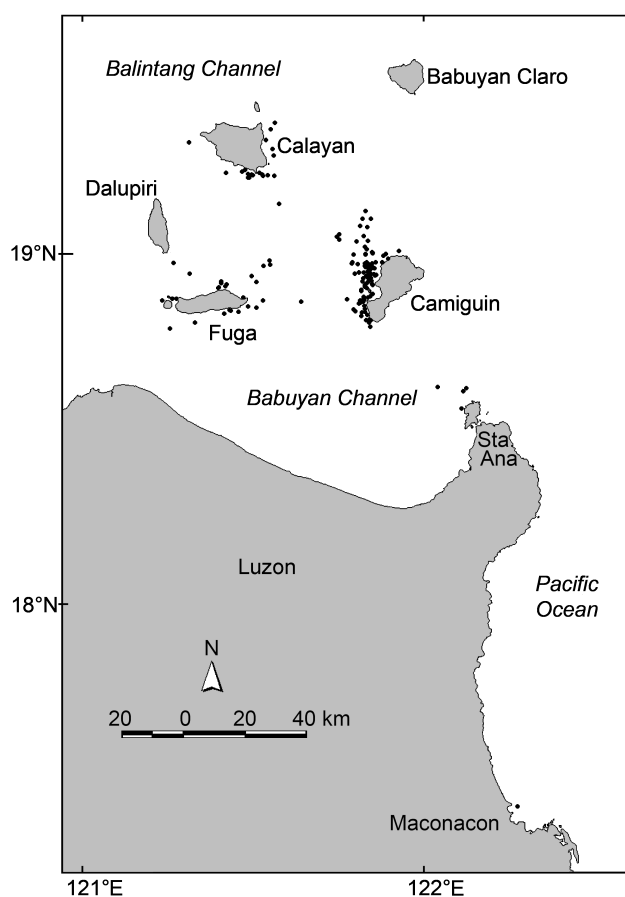


Fig. 3. Distribution of sightings of humpback whales in Northern Luzon, Philippines.

Table 1
Survey locations and effort 2000-2003.

Year	Location	Date	Survey effort (days)	Distance covered (km)
2000	Babuyan Islands	10-16 Apr.; 22-28 Apr.	14	1,120
2001	Babuyan Is. to Palaui Is.	12 Mar.; 14-19 Mar.; 21-22, 24 Mar.; 3-6 Apr.; 8-9 Apr.; 29-30 Apr.	43	3,130
2002	Babuyan Is. to Palaui Is.	Mar. 2-26; Apr. 2- May 1	47	1,811
2003	Babuyan Is.	26-28 Feb.; 1-7 Mar., 13-14; 16-22; 25-28; 1-4 Apr.; 8-13 Apr.; 23-30 Apr.; May 1	51	2,649
2003	East coast Luzon (17°25'59.9"N, 122°15'13.7"E)	Apr. 29- May 5	7	336.6
Total			155	8,710

Table 3
Number of repeat sightings from previous years.

Year	Total no. of ID	No. of repeat sightings	No. of new whales
By year			
1999	2	0	2
2000	0	0	0
2001	7	0	7
2002	31	4	27
2003	38	5	33
Cumulatively 1999-2003	78	9	69

Table 4
Summary of re-sightings across years.

ID	1999	2000	2001	2002	2003
PH 002			X	X	X
PH 004			X	X	
PH 016				X	X
PH 009				X	X
PH 011				X	X
FG 9900	X			X	
FG 9901	X			X	
PH 007			X		X

Table 5
Other examples of repeat sightings of individuals within a year.

ID	Year	Length of stay	Inferred sex
PH 002	2002	21 days (3-23 Mar.)	Escort
PH 034	2002	33 days (17 Mar.-18 Apr.)	Cow with calf
PH 037	2003	17 days (8-24 Apr.)	Cow with calf
PH 040	2003	31 days (29 Mar.-1, 26, 27, 28 Apr.)	Escort

Timing and individual length of stay

Interviews with residents of the islands and coastline indicated that the whales may arrive as early as November and leave in May. The Pacific Seaboard project of the University of the Philippines Marine Science Institute documented a sighting of a group of five humpback whales on 17 July 2002 off the eastern coast of Luzon (Villanoy, pers. comm.). The animals were seen moving eastward.

In the Babuyan Islands, whales were sighted from 27 February (2003) to 29 April (2003). They were photo-identified from early March to late April. At Camiguin Island, the whale (PH 016) was seen on 3 March, again on 4 March and again on 11 April; a period of 40 days. This is the longest recorded stay of one whale in the islands. This whale was seen with different whales each time and on one occasion it was seen with a cow-calf pair. It was also sighted while songs were heard. Another whale, PH 031, identified as a mother with a calf, was seen on 3, 8, 9 and 26 April; a period of 24 days. During this time, it was seen twice with the same escort.

Relationship with Japanese and other North Pacific humpback whale populations

Photo-identification matches

To date, 12 of the 69 photo-identified individuals have been found in the Ryukyu and Ogasawara regions of Japan (Table 6). An initial matching effort was completed in 2001, comparing nine identifications from the Philippines taken from 1999-2001 to 490 individuals from Ogasawara, 1988-

99, and 89 individuals from the Ryukyu Islands, 1989-94 (Yamaguchi *et al.*, 2002). Five of the nine Philippine whales matched with humpback whales in Ogasawara and Ryukyu Islands: one was identified in the Ryukyu Islands only; one was identified in both Ryukyu Islands and Ogasawara; and the remaining three were identified in Ogasawara only. A further matching effort compared an additional 27 whales from 2000-02 Philippine identifications with the same Japanese catalogue, and five more matches were found between Ogasawara and the Philippines (Acebes and Lesaca, 2003). All except one match were from different regions in different years. The exception was one whale (FG9901) seen in Ogasawara and Philippines within the 1999 season (Yamaguchi *et al.*, 2002); (Fig. 4). It was identified in Ogasawara on 3 March and then in the Babuyan Islands on 22 April. Ogasawara is approximately 2,700-3,000km from the Babuyan Islands (Fig. 5).

There have been no photo-identification matches to date between the Philippine whales and the master Pacific humpback whale fluke catalogue held at NMFS National Marine Mammal Laboratory in Seattle, WA, USA, or several Alaska-specific location catalogues.

Comparison of Hawaii and Philippine songs

A total of nine distinctive themes were identified in songs from Hawaii and the Philippines (Fig. 6). Seven of these themes were common in both locations. That is, in seven of nine themes, the specific sound units and patterns (phrases) of sounds were found in both regions and were immediately recognisable both aurally and through comparisons of spectrographs. Whereas six of these seven common themes were found in all five Philippine songs, the remaining theme (IX) was identified in only one of the Philippine songs. Two themes found in all the Hawaii songs were not present in the Philippines. The order of the themes in the song was the same in both locations, i.e., I, II, III, IV, V, (VI, VII,) VIII, IX. The two additional unique Hawaii themes, VI and VII, were between themes V and VIII, common to both Hawaii and the Philippines.

DISCUSSION

Northern Luzon, Philippines, as proposed by Yaptinchay (1999), appears to be a wintering ground for humpback whales in the western North Pacific. Significant numbers of humpback whales were sighted in each of the four consecutive seasons 2000-03, some individuals seen over multiple years, some present for periods more than five weeks, and all involved in activities associated with breeding such as cows with young calves escorted by males, aggressive-competitive behaviour and singing (Acebes, 2001).

Prior to these studies in the Philippines, it was believed that the historical winter range of humpback whales in the western North Pacific only included the waters around the Ryukyu Islands, Ogasawara, Taiwan, Hainan, the Marianas and Marshall Islands, although records from the last two locations are sparse (Darling and Mori, 1993; Nishiwaki, 1959; 1960; 1962; Tomilin, 1957). The Hainan region has not been surveyed in recent times and it is recommended to look into this area to determine whether humpback whales still winter there. The nearest, historically well-documented breeding grounds were off the southern end of Taiwan, (21°50'N, 121°50'E) just 325km north of Babuyan Islands. Whaling records indicated a large recurring winter population off Taiwan until at least the 1960s and decimation by hunting (Darling and Mori, 1993). However,

Table 6
Photo-ID matches between Japan (Ogasawara and Ryukyu Islands) and the Philippines.

Japan		Years sighted		Philippines				
ID	Ogasawara	Ryukyu	ID	1999	2000	2001	2002	2003
O-268	92		PH 010				X	
O-176	91, 92, 93, 94, 01		PH 013				X	
O-403	93, 98		PH 007			X		X
O-397	93, 94, 00		PH 014				X	
O-559	94		PH 016				X	X
O-414	93		PH 004			X	X	
O-400	93, 94, 95, 02		PH 005			X		
O-560/R-19	94, 95, 96, 99	91	FG9901	X			X	
R-8	95, 97	90, 91, 92, 93, 94, 96, 98, 99	PH 002			X	X	X
O-226	91, 98		PH 051					X
O-191			PH 017				X	
O-354			PH 062					X



Fig. 4. Photo-identified whale (FG9901) in the Philippines sighted in Japan within the same season (1999).

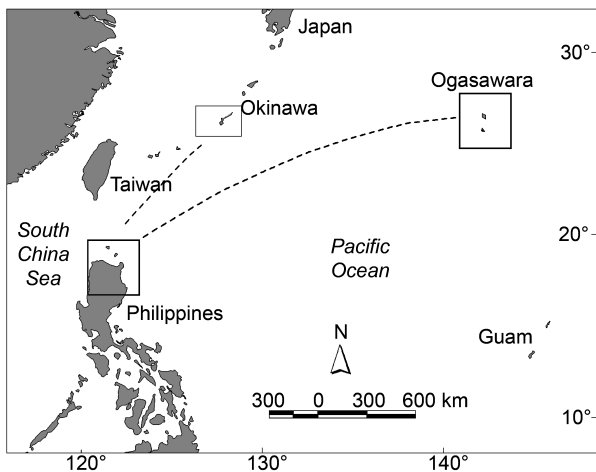


Fig. 5. Locations in the Philippines and Japan where the whales were identified. The lines do not indicate the route between areas but only connect the sightings.

humpback whales have been sighted recently in southern Taiwan waters off Hualien City and Orchid island in 1994, 1999, 2000 and 2002 in cow-calf pairs or lone adults (J.Y. Wang, pers. comm.) The most recent sighting was in 27 May 2003 of a mother and calf pair off Hualien City (S. Yang, pers. comm.). It is not known if Northern Luzon has always been the southern reach of the traditional winter grounds of the 'Ogasawara-Ryukyu-Taiwan population' and simply gone undocumented by whalers or science, or if use of the area is new. Interviews with residents of Babuyan Islands and coastal northern Luzon indicate that humpback whales have been sighted here as early as the 1960s (Sumangil, 2000). The idea that humpback whales may colonise new winter grounds has precedent. It has been hypothesised, based on the lack of any historical documentation, that the Hawaiian breeding ground is relatively new (Herman, 1979).

The determination of basic population parameters and behaviour of the Philippine humpback whales is at an early stage. Sightings in the Babuyan Islands at 19°N and off the Maconacon coast at 17°N on the eastern coast of mainland Luzon may well indicate that the humpback whales range throughout this region. These areas may be the southernmost breeding area for humpback whales in the western North Pacific. However, as eastern Pacific humpback whales utilise waters as far south as Costa Rica at 6°N (Steiger *et al.*, 1991), it is possible that western humpback whales range even further south than these Luzon locations.

Sightings to date indicate the whales are present from November to May or even June, with a peak during February through March or April as is typical in other North Pacific winter grounds. Repeat sightings of individuals

HAWAII (Maui)				THEMES									SONG LENGTH (sec.)
DATE	SINGER	SONG #	QUALITY	I	II	III	IV	V	VI	VII	VIII	IX	
Mar. 9	B	1	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	810
Mar. 15	B	1	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	890
Mar. 15	D	1	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	540 (incomplete)
Mar. 27	C	1	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	680
Mar. 27	F	1	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	1000
PHILIPPINES (Babuyan Is.)													
Mar. 24	A	1	C	✓	✓		✓	✓			✓	*	990 (incomplete)
Apr. 5	A	1	B	✓	✓		✓	✓			✓		515
		2	B	✓	✓		✓	✓			✓		260
		3	B	✓	✓		✓	✓			✓		205
		4	B	✓	✓		✓	✓			✓	✓	255

Fig. 6. Comparison of themes between Hawaii songs and Philippine songs in 2002. *=Theme present but not clearly IX.

indicate some whales remain in the area for periods of weeks involved in behaviour consistent with breeding activities. Any abundance estimate would be premature at this time. However, photo-identification work has determined an absolute minimum number of 69 whales and, with the continued discovery of new animals this is likely just a portion of the population.

The matching of 12 of the 40 (30%) individuals identified from 1999-2002 in the Philippines with identifications from Ogasawara and Ryukyu Islands, including one whale that moved between regions in one season, suggests that the Philippine whales are part of a general western Pacific humpback whale population whose winter grounds extends from Ogasawara to Luzon. The dynamics of movement within the larger area, or if there exists some degree of fidelity of some individuals to sub-regions, is unknown.

The similarity of the songs between the Philippines and Hawaii suggests that humpback whales in the Philippines mix to some degree, at least acoustically, with the whales in Hawaii and the rest of the North Pacific basin (Cerchio *et al.*, 2001; Noad *et al.*, 2000; Payne and Guinee, 1983; Winn *et al.*, 1981). This is not surprising considering the movement of individuals between the Philippines and Japan, and the known connections of Japanese humpback whales to the rest of the Pacific. Humpback whales identified in Japan have been found in Hawaii (Darling and Cerchio, 1993; Salden *et al.*, 1999) and Canada (Darling *et al.*, 1996) and whales in Hawaii found in Mexico (Darling and Jurasz, 1983; Darling and McSweeney, 1985). The similarity of songs throughout the North Pacific basin is presumably the result of travel of individual whales between regions, however the extent of this mixing is unknown (Cerchio *et al.*, 2001; Darling and Mori, 1993; Payne and Guinee, 1983; Winn *et al.*, 1981). The small sample from the Philippines, with all complete songs from a single individual, necessitates caution in emphasising the difference between the two regions. Larger sample sizes, more geographic comparison points, and more detailed analysis are required to conclude if the differences in the songs are reflective of relative degrees of mixing.

These surveys have described a new, or previously undocumented, breeding ground for humpback whales. Further research is required to better define the population and understand its behaviour, habitat needs and counter potential threats. We are aware of blast fishing in close proximity to whales (within 200m), unregulated fishing activities including long-line and drift net fishing by Taiwanese vessels, and unconfirmed reports of pirate whaling which may impact this population (Acebes and Lesaca, 2003). The discovery and confirmation of this breeding ground adds another nation, the Philippines, to those countries responsible for the management and conservation of the species.

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