

Winter sightings of humpback and Bryde's whales in tropical waters of the western and central North Pacific

Hiroshi Ohizumi^{1*}, Takashi Matsuishi^{2**}, and Hirohisa Kishino³

¹Otsuchi Marine Research Center, Ocean Research Institute, University of Tokyo, 2-206-1 Akahama, Otsuchi, Iwate 028-1102, Japan

²Ocean Research Institute, University of Tokyo, 1-15-1 Minamidai, Nakano, Tokyo 164-0014, Japan

³Laboratory of Biometrics, Graduate School of Agriculture and Life Sciences, University of Tokyo, 1-1-1 Yayoi, Bunkyo, Tokyo 113-8657, Japan

Abstract

Sighting surveys of cetaceans were conducted in tropical waters of the western and central North Pacific during January and February 1993. In total, 51 schools and 1815 individuals were sighted, including humpback whales, Bryde's whales, sperm whales, striped dolphins, and other unidentified cetaceans. Humpback whales were sighted around Hawaii and Iwo Island. Surveys around the Pagan and Agrihan Islands in the northern Mariana Islands yielded no sightings. The probable southernmost area of the common wintering and breeding grounds of humpback whales in the Ogasawara-Mariana region is around the Kazan Islands, including Iwo Island. A solitary humpback whale was sighted some distance from Hawaii, which may have been a 'wanderer' that was flexible in its selection of wintering grounds. Bryde's whales were sighted in the central North Pacific at about 20°N. This area is just south of the summer distribution of Bryde's whales. The wintering area of Bryde's whales in the central North Pacific partially overlaps with the summering area. About 20°N may be the northernmost boundary of the pelagic wintering area that extends from the western North Pacific to the central Pacific.

Key words: Bryde's whale, humpback whale, North Pacific, sighting survey, tropical area, wintering distribution.

Current addresses: *Cetacean Population Biology Section, National Research Institute of Far Seas Fisheries, 5-7-1 Ordo, Shimizu, Shizuoka 424-8633, Japan. **Graduate School of Fisheries Sciences, Faculty of Fisheries, Hokkaido University, 3-1-1 Minatocho, Hakodate, Hokkaido 041-8611, Japan.

Introduction

Many species of cetaceans, especially baleen whales, migrate to tropical and subtropical zones to breed during the winter. In the western North Pacific, humpback whales (*Megaptera novaeangliae*) breed in coastal waters of the tropical and subtropical zones (Darling & Mori, 1993; Mori *et al.*, 1998). Bryde's whales (*Balaenoptera edeni*) are one of the more common baleen whales in pelagic areas (Miyashita *et al.*, 1996). However, data on the winter distribution of these whales, particularly of the Bryde's whale, are still quite limited. Information from western longitudes is especially needed for stock identification of Bryde's whales in the western and eastern North Pacific (IWC, 1996). We present the results of a sighting survey that provides information on the winter distribution of whales, which is important to conservation and stock management.

Materials and Methods

We conducted sighting survey cruises across the tropical zone of the western North Pacific. Sighting surveys were carried-out from 24 January to 7 February 1993 and from 14 to 28 February 1993 (Fig. 1). For the survey cruises, we used the *Hakuho-maru* (3987 t), a vessel that we shared with several other oceanography research groups. Four observers of the cetacean research group were positioned on the upper bridge and searched for whales with 8 × binoculars. Observers included a professional whaler and a researcher (Ohizumi) trained by the International Decade of Cetacean Research (IWC/IDCR) whale observation program. Typical cruising speed was 28.7 km/h (15.5 kt). Surveys began 30 min after sunrise and ended 30 min before sunset every day. Occasionally, survey efforts were interrupted by unfavourable

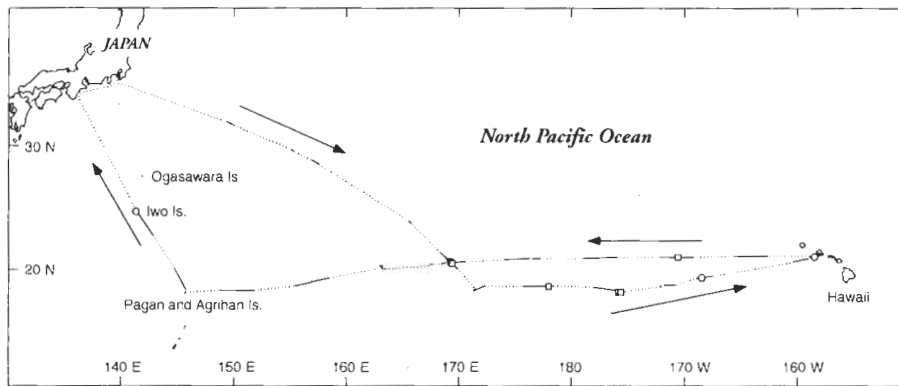


Figure 1. Cruise track-line and sighting positions of Bryde's whales (square) and humpback whales (circle). Solid lines: on-effort; broken lines: off-effort.

weather conditions, such as wind speeds exceeding 12.8 m/s (25 kt) or visibility below 2.78 km (1.5 nautical miles), which impeded searching for blows. The survey track line was not completed under such poor conditions or at night, enabling us to complete non-related study programs. When we found cetaceans, the vessel tried to approach the school to identify the species; however, the time available for the cetacean survey was limited, and in many cases we had to abandon our pursuit of a school.

Results

Species identification was sometimes difficult, because in most cases the vessel could not approach whales closely enough. As a result, we made many sightings of unidentified species. Nevertheless, a total of 51 pods and 1815 individuals were sighted (Table 1), including confirmed humpback whales, Bryde's whales, sperm whales (*Physeter macrocephalus*), and striped dolphins (*Stenella coeruleoalba*). Humpback whales were observed near Hawaii, and a solitary humpback whale was sighted some distance from Hawaii (19°23'N, 168°39'W). We also confirmed humpback sightings, including one mother and calf pair, around Iwo Island in the Kazan Islands. Bryde's whales were found in the pelagic area south of about 20°N and east of about 170°E (Fig. 1).

Discussion

Humpback whales use three major wintering regions in the North Pacific to breed: the Ogasawara, Kazan, and Ryukyu (Okinawa) Islands in the western North Pacific; Hawaii in the central North Pacific; and the Mexican coast including the Revillagigedo Islands in the eastern North Pacific (Urbán *et al.*, 2000). Humpback whale groups that

migrate to these areas are recognized as fairly independent subpopulations, because migration between wintering areas is limited (Daring & McSweeney, 1985; Baker *et al.*, 1986; Darling & Cerchio, 1993; Salden *et al.*, 1999), each wintering group has a fairly specific feeding area (Daring & McSweeney, 1985; Baker *et al.*, 1986; Urbán *et al.*, 2000), and mitochondrial DNA haplotypes are segregated between the Hawaiian group and the Mexican group (Baker *et al.*, 1990). However, subpopulations are not completely segregated, and there is some migration between wintering areas.

Hawaii represents the main breeding ground of humpback whales in the North Pacific, so sightings of humpback whales near Hawaii are expected; however, we found a solitary humpback whale quite distant from Hawaii. Several individuals have been confirmed both near Hawaii and Ogasawara by photo identification matches (Darling & Cerchio, 1993; Salden *et al.*, 1999). These humpback whales are probably males, called 'wanderers', that are very flexible in their selection of breeding grounds. Although we have no examples of wanderers appearing both in Hawaii and Ogasawara during the same breeding season, a humpback whale was identified in February 1986 in Mexico and was identified again 7 weeks later in Hawaii, some 4700 km from the original sighting (Darling & Cerchio, 1993). The solitary humpback whale observed during the present investigation may have been a wanderer between Hawaii and the western North Pacific.

Many humpback whales migrate to the Ogasawara Islands during the winter to breed (Daring & Mori, 1993; Mori *et al.*, 1998). However, another breeding ground is suspected to be located farther south of the Ogasawara Islands (Ohizumi, 1992; Mori *et al.*, 1998) because around Ogasawara: (1) the migration period of mother and calf pairs is

Table 1. Results of sighting surveys.

Species	Number of animals	Number of calves	Date	Latitude	Longitude
Bryde's whale	1		29 January 1993	20°22'N	169°36'E
<i>(Balaenoptera edeni)</i>	1		29 January 1993	20°17'N	169°42'E
	1		1 February 1993	18°36'N	178°3'E
	1		2 February 1993	18°29'N	175°11'W
	1		2 February 1993	18°25'N	175°19'W
	1		16 February 1993	21°5'N	170°49'W
Humpback whale	1		5 February 1993	19°23'N	168°39'W
<i>(Megaptera novaeangliae)</i>	2		7 February 1993	21°13'N	157°57'W
	1		14 February 1993	21°11'N	158°26'W
	1		14 February 1993	21°11'N	158°40'W
	2		28 February 1993	24°38'N	141°28'E
	2		28 February 1993	24°49'N	141°18'E
	1		28 February 1993	24°49'N	141°18'E
	2	1	28 February 1993	24°49'N	141°18'E
	2		28 February 1993	24°49'N	141°18'E
	1		28 February 1993	24°48'N	141°22'E
Sperm whale	4		5 February 1993	19°30'N	167°50'W
<i>(Physeter macrocephalus)</i>	3		5 February 1993	19°28'N	167°48'W
	1		5 February 1993	19°28'N	167°48'W
	3	1	16 February 1993	21°5'N	171°3'W
	1		22 February 1993	20°39'N	170°15'E
Ziphiid sp.	2		29 January 1993	21°17'N	168°36'E
	1		21 February 1993	20°54'N	175°29'E
Striped dolphin	60	3	15 February 1993	21°9'N	164°38'W
<i>(Stenella coeruleoalba)</i>	150		26 February 1993	18°13'N	150°2'E
Common dolphin?	6		16 February 1993	21°5'N	172°5'W
<i>(Delphinus delphis)</i>					
Spinner dolphin?	2		14 February 1993	21°11'N	158°37'W
<i>(Stenella longirostris)</i>					
Unidentified baleen whale	1		14 February 1993	21°11'N	158°38'W
	1		16 February 1993	21°6'N	170°13'W
Unidentified toothed whale	5		14 February 1993	21°11'N	158°42'W
	1		15 February 1993	21°9'N	164°45'W
Unidentified dolphin	300		29 January 1993	20°50'N	169°6'E
	400		29 January 1993	20°26'N	169°32'E
	150		31 January 1994	18°38'N	171°52'E
	100		1 February 1993	18°35'N	177°23'W
	30		1 February 1993	18°35'N	176°53'W
	40		1 February 1993	18°33'N	176°43'W
	80		2 February 1993	18°10'N	175°9'W
	40		3 February 1993	18°40'N	172°10'W
	10		4 February 1993	19°19'N	169°2'W
	1		7 February 1993	20°50'N	159°48'W
	6		15 February 1993	21°8'N	165°26'W
	70		17 February 1993	21°2'N	176°9'W
	300		25 February 1993	19°4'N	157°22'E
	1		28 February 1993	24°49'N	141°18'E
	20		28 February 1993	24°48'N	141°22'E
Unidentified whale	1		29 February 1993	20°22'N	169°36'E
	1		1 February 1993	18°36'N	176°39'E
	1		1 February 1993	18°31'N	176°37'W
	1		3 February 1993	18°47'N	170°46'W
	1		14 February 1993	21°11'N	158°39'W

later than in Hawaiian waters, (2) there are fewer breeding activities such as 'mating pods' and fewer calves compared to Hawaii, and (3) the water temperature is colder by about 5°C than the water temperature (about 25°C) preferred by breeding humpback whales (Dawbin, 1966). Humpback whales prefer coastal areas shallower than 200 m for breeding activities (Dawbin, 1966; Herman & Antinaja, 1977; Urbán & Aguayo, 1987), so we surveyed areas near islands farther south of Ogasawara. On 27 February, we conducted surveys about 5 km off the coast of the Pagan and Agrihan Islands in the northern Mariana Islands, but made no sightings. Darling & Mori (1993) reported that Saipan Island is not a regular wintering area for humpback whales. In the area farther south of Ogasawara, the southernmost sightings of humpback whales occurred near Iwo Island, where we confirmed a calf. Mori *et al.* (1998) found humpback whales in the Kazan Islands, including Iwo, and they also found a calf (Marine Environmental Association of Tokyo, 2000).

Historically, humpback whales were distributed as far south as the Mariana Islands (Townsend, 1935). However, once whaling ceased, information on humpback whales in the Mariana Islands became scarce. Although some were recently observed by locals (Darling & Mori, 1993; Marine Environmental Association of Tokyo, 2000), they are still not common in the Mariana Islands. The Kazan Islands, including Iwo, are probably the southernmost common wintering and breeding areas for humpback whales that migrate in the Ogasawara-Mariana region.

During the winter, Bryde's whales are known to be distributed in the western North Pacific around the Mariana, Ogasawara, Kazan, and Philippine Islands, as well as near New Guinea. Sightings have also been made far off these islands (Miyashita *et al.*, 1996; Kishiro, 1996). We found Bryde's whales in western longitudes suggesting that their wintering area also extends farther east. Studies of tagged animals show that Bryde's whales migrate between New Guinea, Ogasawara, and the western North Pacific off the coast of Japan (Nishiwaki, 1966; Ohsumi & Masaki, 1975; Kishiro, 1996), but several whales tagged near New Guinea in winter were found at about 30°N, around the 180° meridian, in summer (Kishiro, 1996). This suggests that Bryde's whales undertake considerable east-west migrations, and that the stock in the western and central North Pacific is the same (Kishiro, 1996). Mitochondrial DNA analysis also supports the uniformity of the stock structure in the western and central North Pacific (Pastene *et al.*, 1997). The IWC (1996) provisionally agrees that the distribution of western North Pacific stock extends to 150°W, and as far south as 2°S.

In summer, the distribution of Bryde's whales in the western North Pacific extends as far north as about 40°N, but many remain in lower latitudes, as far south as about 5°N (Shimada and Miyashita, 1995; Shimada and Nishiwaki, 1997; Shimada, 1999; Shimada, 2001). This suggests that the winter and part of the summer distributions in the western North Pacific overlap remarkably. Bryde's whales are also distributed in the central North Pacific in summer, and they were hunted from April to September until 1987. The whaling area spanned approximately 160°E to 160°W and 20°N to 40°N (Kishiro, 1996). In August and September of 1999, sighting surveys were conducted in the area between the 165°E and 180° meridians, and many Bryde's whales were found between 20°N and 40°N (Shimada, 2000). The present sightings in waters just south of these areas were probably wintering Bryde's whales that migrate to the central North Pacific whaling area in summer. The southernmost summer distribution of Bryde's whales inhabiting the central North Pacific is about 20°N (Kishiro, 1996; Shimada, 2000), again suggesting that winter and summer grounds partially overlap. The present sightings of Bryde's whales may have been along the northernmost boundary of the central North Pacific wintering area, because by November Bryde's whales are usually absent from their central North Pacific summering area (Miyashita *et al.*, 1995); in the western North Pacific, they migrate as far south as the equator in winter (Miyashita *et al.*, 1996; Kishiro, 1996). In March, Bryde's whales are found at high densities in several areas of the central Pacific, approximately from 175°E to 150°W and 15°N to 5°S, (Miyashita *et al.*, 1995). The IWC (1996) pointed-out that the winter range of the northern hemisphere pelagic Bryde's whales may extend a few degrees into the southern hemisphere. Present and past studies suggest that Bryde's whales' large wintering grounds may extend from the western North Pacific to the central Pacific.

Acknowledgments

We thank Mr. N. Kasai from Kyodo Senpaku Co. Ltd., whose professional skills allowed us to find and approach cetaceans. We also thank the crew of the *Hakuho-maru* for their help on the vessel. Two referees provided valuable suggestions for improving the manuscript.

Literature Cited

- Baker, C. S., Herman, L. M., Perry, A., Lawton, W. S., Straley, J. M., Wolman, A. A., Kaufman, G. D., Winn, H. E., Hall, J. D., Reinke, J. M. & Östman, J. (1986) Migratory movement and population structure of humpback whales (*Megaptera novaeangliae*) in the

- central and eastern North Pacific. *Marine Ecology Progress Series*. **31**, 105–119.
- Baker, C. S., Palumbi, S. R., Lambertsen, R. H., Weinrich, M. T., Calambokidis, J. & O'Brien, S. J. (1990) Influence of seasonal migration on geographic distribution of mitochondrial DNA haplotypes in humpback whales. *Nature*. **344**, 238–240.
- Darling, J. D. & McSweeney, D. J. (1985) Observation on the migrations of North Pacific humpback whales (*Megaptera novaeangliae*). *Canadian Journal of Zoology*. **63**, 308–314.
- Darling, J. D. & Cerchio, S. (1993) Movement of a humpback whale (*Megaptera novaeangliae*) between Japan and Hawaii. *Marine Mammal Science*. **9**, 84–89.
- Darling, J. D. & Mori, K. (1993) Recent observations of humpback whales (*Megaptera novaeangliae*) in Japanese waters off Ogasawara and Okinawa. *Canadian Journal of Zoology*. **71**, 325–333.
- Dawbin, W. H. (1966) The seasonal migratory cycle of humpback whales. In: K. S. Norris (ed.) *Whales, Dolphins, and Porpoises*, pp. 145–170. University of California Press, Berkeley and Los Angeles.
- Herman, L. M. & Antinofa, R. C. (1977) Humpback whales in the Hawaiian breeding waters: population and pod characteristics. *The Scientific Reports of the Whales Research Institute*. **29**, 59–85.
- International Whaling Commission (1996) Report of the scientific committee, Annex G. Report of the subcommittee on North Pacific Bryde's whales. *Report of the International Whaling Commission*. **46**, 147–159.
- Kishiro, T. (1996) Movements of marked Bryde's whales in the western North Pacific. *Report of the International Whaling Commission*. **46**, 421–428.
- Marine Environmental Association of Tokyo, Ogasawara Marine Center (2000) *Humpback Whales in Ogasawara and Okinawa*. Marine Environmental Association of Tokyo (in Japanese with English notes).
- Miyashita, T., Kato, H. & Kasuya, T. (1995) *Worldwide Map of Cetacean Distribution Based on Japanese Sighting Data*. I. National Research Institute of Far Seas Fisheries, Shimizu, Japan.
- Miyasita, T., Kishiro, T., Higashi, N., Sato, F., Mori, K. & Kato, H. (1996) Winter distribution of cetaceans in the western North Pacific inferred from sighting cruises 1993–1995. *Report of the International Whaling Commission*. **46**, 436–441.
- Mori, K., Sato, F., Yamaguchi, M., Suganuma, H. & Ueyanagi, S. (1998) Distribution, migration and local movements of humpback whale (*Megaptera novaeangliae*) in the adjacent waters of the Ogasawara (Bonin) Islands, Japan. *Journal of the School of Marine Science and Technology Tokai University*. **45**, 197–213.
- Nishiwaki, M. (1966) Distribution and migration of the larger cetaceans in the North Pacific as shown by Japanese whaling results. In: K. S. Norris (ed.) *Whales, Dolphins, and Porpoises*, pp. 171–191. University of California Press, Berkeley and Los Angeles.
- Ohizumi, H. (1992) Major breeding ground of western North Pacific humpback whales (*Megaptera novaeangliae*) is suspected to be south of Ogasawara. Graduate thesis. Department of Basic Human Sciences, School of Human Sciences, Waseda University (unpublished).
- Ohsumi, S. & Masaki, Y. (1975) Japanese whale marking in the North Pacific, 1963–1972. *Far Seas Fisheries Research Laboratory Bulletin*. **12**, 171–219.
- Pastene, L. A., Goto, M., Itoh, S., Wada, S. & Kato, H. (1997) Intra- and inter-oceanic patterns of mitochondrial DNA variation in the Bryde's whale, *Balaenoptera edeni*. *Report of the International Whaling Commission*. **47**, 569–574.
- Salden, D. R., Herman, L. M., Yamaguchi, M. & Sato, F. (1999) Multiple visits of individual humpback whales (*Megaptera novaeangliae*) between the Hawaiian and Japanese winter grounds. *Canadian Journal of Zoology*. **77**, 504–508.
- Shimada, H. & Miyashita, T. (1995) Estimation of current population size of the western North Pacific Bryde's whale using sighting data from 1988 to 1994. Document submitted to scientific committee, IWC. SC/47/NP9 (unpublished).
- Shimada, H. & Nishiwaki, S. (1997) Cruise report of the cetacean sighting survey in low latitude of the North Pacific, in summer 1996. Document submitted to scientific committee, IWC. SC/49/NP15 (unpublished).
- Shimada, H. (1999) Report of the western North Pacific Bryde's whale sighting survey in summer, 1998. Document submitted to scientific committee, IWC. SC/51/RMP4 (unpublished).
- Shimada, H. (2000) Report of a sighting survey on western North Pacific Bryde's whale conducted in August–September 1999. Document submitted to scientific committee, IWC. SC/52/RMP9 (unpublished).
- Shimada, H. (2001) Report of a sighting survey on western North Pacific Bryde's whale conducted in August–September 2000. Document submitted to scientific committee, IWC. SC/53/RMP8 (unpublished).
- Townsend, C. H. (1935) The distribution of certain whales as shown by logbook records of American whaleships. *Zoologica*. **19**, 1–50.
- Urbán, J. R. & Aguayo, A. L. (1987) Spatial and seasonal distribution of the humpback whale, *Megaptera novaeangliae*, in the Mexican Pacific. *Marine Mammal Science*. **3**, 333–344.
- Urbán, J. R., Jaramillo, A. L., Aguayo, A. L., Ladrón de Guevara, P. P., Salinas, M. Z., Alvarez, C. F., Medrano, L. G., Jacobsen, J. K., Balcomb, K. C., Claridge, D. E., Calambokidis, J., Steiger, G. H., Straley, J. M., Von Ziegesar, O., Waite, J. M., Mizroch, S., Dahlheim, M. E., Darling, J. D. & Baker, C. S. (2000) Migratory destinations of humpback whales wintering in the Mexican Pacific. *The Journal of Cetacean Research and Management*. **2**, 101–110.