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RESULTS OF MARINE MAMMAL SIGHTING SURVEYS
IN THE MID-LATITUDINAL NORTH PACIFIC
IN AUGUST-SEPTEMBER 1988

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ABSTRACT

To obtain information on marine mammal distribution and abundance in the mid- latitudinal North Pacific, the sightings surveys were conducted in latitudes between 30°N and 45°N, and in longitudes from the Pacific coast of Japan to the US 200 mile zone, in August - September 1988. During 13,556 n. miles of transect length of four research vessels in the research area, nineteen species of marine mammals were recorded. The surface water temperature in the surveyed area was from 10°C to 28°C. Dall's porpoises (PD) were dominant marine mammals north of 40°N. Northern right whale dolphins (LB), Pacific white-sided dolphins (LO) and northern fur seals (CU) inhabit near the southern range. They usually inhabited surface water range below 22°C, but the preferred temperature became colder in the order of, LB, LO, CU and PD. The area south of 40°N was inhabited by common dolphins (DD), striped dolphins (SC), spotted dolphins (SA), spinner dolphin (SL), false killer whale (PC), southern form of short-finned pilot whales (GM), Risso's dolphin (GG). They inhabited over 18°C, with the most frequent temperature becoming warmer in the order of DD, GG, SL, SC, SA and GM. The higher limit of surface temperature range of some cetacean sightings in the offshore area of Japan was 3 or 4°C higher than that in the eastern Pacific. This possibly reflects the difference in the sub-surface oceanographical structure. Some cetaceans had a discontinuity of distribution, which suggests the presence of stocks. We should pay attention to assess the affects of incidental take by driftnet fisheries to marine mammals stock by stock.

INTRODUCTION

Marine mammals such as Dall's porpoise, Phocoenoides dalli, Pacific white-sided dolphin, Lagenorhynchus obliquidens, northern right whale dolphin, Lissodelphis borealis, common dolphin, Delphinus delphis and northern fur seal, Callorhinus ursinus have been incidentally taken by the driftnet fisheries for salmon, flying squid and tuna in the North Pacific (Mizue and Yoshida, 1965; Nakata, 1987). There is concern about the possible effects of the incidental take to the stocks of these marine mammals. However there is little information about the distribution and abundance of these marine mammals, because there was no systematic sighting survey in this extensive area. Therefore the sighting cruises using four research vessels was initiated to obtain information on the distribution and abundance of marine mammals in the mid-latitudinal waters in the North Pacific in the summer of 1988. This report summarizes the information on distribution of marine mammals obtained through these cruises.

MATERIALS AND METHODS

Four vessels were chartered by the Fisheries Agency of Japan for the marine mammal sighting survey in the mid-latitudinal waters in the North Pacific in 1988 (Table 1). The Toshimaru No.25 (T25) (739.9 gross ton, 68.3 m in total length) and the Shonanmaru No.2 (SM2) (916.4 gross ton, 70.6 m) were whale catcher boats and the Shinhoyomaru (HSI) (495.5 gross ton, 47.7 m) and Hoyomaru No.12 (H12) (299.2 gross ton, 42.6 m) were tuna long-line fishing boats. On each of the former two vessels, we placed two observers in the crow's nest (about 18 m high from the sea level) and one researcher and two to five crew on the upper wheel deck (about 11 m high from the sea level). On each of the latter two vessels, two researchers with five to ten crew engaged in sighting on the upper wheel deck (H12: about 7.5 m from the sea level, HSI: about 9 m from the sea level) (Table 1).

Crew of T25 and SM2 had sighting experience in the southern hemisphere minke whale assessment cruise by IWC or in the previous sighting cruises in the North Pacific. The researchers on these two vessels (Horiuchi, Zenitani and Baba) had no experience in sightings. One of the researchers on each H12 and HSI (Okumura on H12 and Uematsu on HSI) were crew of whale catcher boat and had a experience to participate in sightings. The other researchers on H12 and HSI (Nakagawa and Mori) had participated in the previous Dall's porpoise research cruises on board of the H12 in 1987. Some crew of H12 and HSI had also participated in the previous Dall's porpoise research cruise.

The surveys were conducted in August and September, because the surface water temperature became highest in this season in the North Pacific (Dodimead, Favorite and Hirano, 1963), and the northern limit of the range of marine mammals inhabiting the subtropic region is presumably northern most in this season.

On these vessels, from 1 August to 2 October 1988, a total of 24 zigzag transects were run during the daylight hours between 140°E to 130°W longitude and between 30°N and 45°N latitude (Figure 1). The research area was latitudinally divided at 37° 30'N to raise the efficiency of searching and avoid the effect of time lag between the beginning and the end of the cruise. T25 and H12 started searching in the southern legs to northern legs, while HSI and SM2 started from the northern legs to the southern legs.

Weather, wind direction, wind force, surface water temperature, visibility were hourly recorded when the sighting was conducted.

Surveys were conducted along predetermined track line placed systematically (Figure 1). Sighting effort has been usually continued during daytime from 30 minutes after sunrise to 30 minutes before sunset except the unfavorable conditions when visibility is less than 1 nautical miles or the wind force is Beaufort scale 5 or over. Only sightings effort during searching mode in the research area under good weather conditions (described above) and with mast-top observers (T25 and SM2) or

with upper-wheel deck (HSI and H12) was used as primary effort, and sighting made under these conditions was defined as primary sightings. The sightings other than the primary sightings are dealt as secondary sightings, i.e., the sightings incident to the primary sightings during closing or observing the marine mammals primarily sighted, the sightings made on the way to and away from the research area, the sightings when the mast-top observers could not engaged in sighting due to the bad weather (T25 and SM2), the sightings when observation from the upper-wheel deck could not be conducted due to the bad weather (H12 and HSI). Both types of sightings in the research areas are used in this paper, where the major objective is to analyze the distributional ranges of marine mammals.

All the marine mammals sighted were attempted to approach for identification of species and estimation of school size. The sighting time, sighting cue, position and swimming direction of the school when first seen were recorded. The angle from the bow of the vessel to the school was estimated using angle measuring board on T25 and SM2, and using hand-held angle measuring board on H12 and HSI. The radial distance was estimated visually when the school was within about 0.5 n. miles but when it was apart for over the distance it was estimated from the vessel speed and the time required for closure to a certain position from the school where the rest of distance could be estimated visually. Surface water temperature at the position of school was recorded in addition to the oceanographical data.

RESULTS

The survey period in the research area and the transect length for each vessel were as follows;

- T25: 4-26 August and 5-21 September, 3,109 n. miles
- HSI: 7 August - 7 September, 3,581 n. miles
- H12: 12 August - 13 September, 3,259 n. miles
- SM2: 14 August - 16 September, 3,607 n. miles.

During the cruises, nineteen species of marine mammals were identified including secondary sightings (Table 2). There were nine unidentified species of cetaceans and seals as well.

The surface water temperature in the surveyed area ranged from 10 to 28 °C (Table 3). The surface isotherm was drawn by freehand based on the hourly recorded surface water temperature (Figures 2-6). Although this does not reflect the actual isotherm at any particular moment, it is useful to indicate the relationship between the distribution of marine mammals and surface water temperature. At the same latitude south of 40°N, the temperature tends to become gradually cooler from west to east. This is same as the fifteen years (1966-1980) mean of the temperature in August (Maritime Safety Agency, 1982).

Dall's porpoise, *Phocoenoides dalli* (True, 1885), (Figure 2)
80 groups with 476 Dalli-type Dall's porpoises were sighted at

the surface water temperature of 10 to 23 °C. Most of them (93 %) were distributed in the temperature below 18°C. The southern limit of range was about 40°N, but the northern limit was not confirmed because the sighting surveys did not cover the area below 10°C. The temperature range was 20°C in the west of 170°W, but it was 18°C in the eastern waters. The range of the species partially overlapped with northern right whale dolphins, Pacific white-sided dolphins and northern fur seals (Figures 3 and 4). Three groups of truei-type were sighted on 25 September in the Japanese coastal waters (40°55' N, 148°17'E; 40°54'N, 148°12'E; 40°54'N, 148°12'E), which was isolated from the dalli-type sighting positions.

Pacific white-sided dolphin, Lagenorhynchus obliquidens Gill, 1865 , (Figure 3)

23 groups with 1,538 Pacific white-sided dolphins at the temperature of 10 to 23°C. The high sighting frequency was recorded below 16°C (Table 3). The southern limit of range was 41° N except a sighting made at 38°N, 179°E. The distribution was limited to waters to 23°C (west of 170 W) or below 18°C (eastern waters). The range partially overlapped with Dall's porpoises, northern right-whale dolphin and northern fur seals. The distribution appears to be continuous in the surveyed area.

Northern right whale dolphin, Lissodelphis borealis (Peale, 1848), (Figure 3)

16 groups with 699 northern right whale dolphin were sighted at the temperature of 10 to 23°C. Most of them (87 %) were sighted over 14°C. Therefore the high sighting frequency was observed in slightly higher temperature than Dall's porpoises and Pacific white-sided dolphins (see above). The southern limit of range was 41°N without a sighting at 32°N, 140°W. The sighting were made in the three isolated areas in longitudes, i.e., 155°E - 160°E, 175°W - 170°W, 150°W - 140°W.

Common dolphin, Delphinus delphis Linnaeus, 1758, (Figure 2)

57 groups with 5,360 common dolphins were sighted. Almost all (98 %) were sighted between 18 to 28°C (Table 2). The northern limit of range was 40-41°N, which is just south of northern right whale dolphins, Pacific white-sided dolphins and Dall's porpoises. The southern limit of range was not confirmed. The water temperature range was approximately 4°C warmer in the western part of the research area ($\geq 20^\circ\text{C}$) than the eastern part ($\geq 18^\circ\text{C}$). There were three isolated concentration of sightings; 145°E - 165°E, 175°E - 155°W, 140°W - 130°W.

Striped dolphin, Stenella coeruleoalba (Meyen, 1833), (Figure 2)

74 groups with 7298 animals were sighted. The water temperature range was 18 - 28°C (Table 2). The species were sighted slightly south of common dolphins, which reflected the high frequency of sightings were observed in the higher temperature range (22 - 28 °C) than that of common dolphins (18 - 24°C). There were no clear

discontinuity of sightings, but the high density areas were observed between 145°E - 157°E and 77°W - 152°W. The sightings became scanty in the area east of 150°W.

Spotted dolphin, *Stenella attenuata* (Gray, 1846), (Figure 2)
Eleven groups with 2,110 spotted dolphins were sighted. All the schools were sighted between 22 and 28°C in the surface water temperature (Table 3). The northern limit of distribution was at about 37 - 38°N. They inhabited slightly warmer areas than striped dolphins, and the range partially overlapped with that of striped dolphins, but . There were two isolated areas where the species were sighted; 150°E - 160°E, and 160°W - 155°W.

Spinner dolphin, *Stenella longirostris* (Gray, 1828), (Figure 3)
Seven groups with 810 spinner dolphins were sighted at the temperature of 22 to 25°C (Table 3). There were two apparently areas of distribution at 155°E - 165°E, and 150°E - 140°W. Although the water temperature range overlapped that of other *stenella* spp., they appear to segregate geographically (Figures 2 and 3).

Killer whale, *Orcinus orca* (Linnaeus, 1758), (Figure 3)
Ten groups with 92 killer whales were sighted at the temperature of 16 to 28°C (Table 3). There were no high density area of sightings, but they dispersed in wide area (Figure 3).

Risso's dolphin, *Grampus griseus* G. Cuvier, 1812, (Figure 4)
14 groups with 518 Risso's dolphins were sighted. All sightings were occurred over 22°C (Table 3). The water temperature range of the sightings in the western part of the research area (20-27°C) was approximately 3°C warmer than the eastern part (22-24°C). There was discontinuity of sightings between 155°E - 180° and 165°W - 150°W.

Bottlenose dolphin, *Tursiops truncatus* (Montagu, 1821) (Figure 4)
Ten groups with 551 bottlenose dolphins were sighted. The water temperature at the sighting ranged from 16 to 28°C (Table 3).

False killer whale, *Pseudorca crassidens* (Owen, 1846) (Figure 4)
Four groups with 570 false killer whales were sighted. All were sighted in the waters over 22°C (Table 3).

Bryde's whale, *Balaenoptera edeni* Anderson, 1878 (Figure 5)
64 groups with 96 Bryde's whales were sighted, which was most common baleen whales in the research area. The distribution of the species continues westward at 157°W. The sightings occurred between 16 to 28°C (Table 3), but again there is suggested some geographical difference in the lower temperature range.

Blue whale, *Balaenoptera musculus* (Linnaeus, 1758), (Figure 5)
Seven groups with nine blue whales were sighted. All sightings occurred east of 165°E.

Minke whale, *Balaenoptera acutorostrata* Lecepede, 1804, (Figure 5)

Three groups with six minke whales were sighted. The water temperature at the sightings ranged from 14 to 23°C (Table 3).

Fin whale, *Balaenoptera physalus* (Linnaeus, 1758), (Figure 6)

Nine groups with twelve fin whales were sighted. There was discontinuity of sightings between 170°E to 165°W. The highest limit of water temperature range of the sightings in the western part of the research area was approximately 4°C warmer than the eastern part.

Sei whale, *Balaenoptera borealis* Lesson, 1828, (Figure 6)

Twelve groups with 27 sei whales were sighted. The water temperature at the sightings ranged from 12 to 23°C (Table 3). The temperature at the sighting positions over 18°C occurred west of 180°. The eastern sightings tends to occur in lower temperature.

Sperm whales, *Physeter catodon* Linnaeus, 1758 (Figure 7)

79 groups with 318 sperm whales were sighted from 147°E to 135°W. All the individuals 46 feet or over in body length which are expected to be mature males (Ohsumi, 1966), were sighted as singletons or with relatively large individuals. Five schools included individuals 46 feet or over, and tended to occur in the northern part of the range of the present sperm whale sightings.

Short-finned pilot whale, *Globicephala macrorhynchus*, Gray, 1946, (Figure 7)

Three schools with 277 northern form of short-finned pilot whales were sighted close to the Japanese coast at the water temperature between 16 to 18°C. On the other hand, southern forms were found in areas between 26 to 28 C isolated from the northern forms.

Northern fur seal, *Callorhinus ursinus* Gray, 1859, (Figure 4)

The water temperature ranged from 12 to 21°C, but most of them (87.5 %) was found in the waters below 16°C. Sightings were occurred in higher numbers in the same areas where Dall's porpoise were abundant (Figures 2 and 4).

DISCUSSION

We confirmed previous understanding that warm and cold water delphinids in the North Pacific segregate apparently at the surface water temperature of 18-22°C (Kasuya and Jones, 1984). The former includes three species; Dall's porpoises, Pacific white-sided dolphins and northern right whale dolphins. The southern range of Dall's porpoise overlapped with water temperature at highest density, however the surface water

temperature was warmer in the order of Dall's porpoises, Pacific white-sided dolphins and northern right whale dolphins. The latter includes warm water delphinids, and the temperature at sightings became warmer in the order of common dolphins, striped dolphins, spinner and spotted dolphins.

In most of delphinids sighted during the cruises, there was an apparent discontinuity of distribution over the whole longitudinal range. These species were northern right whale dolphins, common dolphins, spotted dolphins, spinner dolphins, killer whales, Risso's dolphins, false killer whales. These suggest the possibility of the separate stocks in these cetaceans. In the case of dalli-type Dall's porpoises, Kasuya and Ogi (1987) believed there were at least three local stocks in the western North Pacific based on the discontinuous calving grounds. Recently Miyazaki and Shikano (1989) distinguished that there were two forms of Pacific white-sided dolphins in the Japanese waters based on the osteological study. Distribution of many delphinids showed longitudinal discontinuous aggregation, and suggested the possibility of separate stock. Although it is true that there has to be collected more data to clarify these aggregation, it will be safety to manage these aggregations as independent stock unless there are firm data against it.

Many delphinids tended to inhabit 3-4°C colder waters in the eastern North Pacific compared with the conspecific in the western part of the ocean. This was possibly caused by the difference in sub-surface oceanographical structure such as the shape of thermocline. The thermocline is shallower and the gradient are steeper in the western part than the eastern part (Dodimead, Favorite and Hirano, 1963).

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REFERENCES

- Dodimead, A.J., F. Favorite and T. Hirano. 1963. Review of oceanography of the Subarctic Pacific region. Bul. Int. North Pac. Fish. Comm., 13:1-195.
- Fisheries Agency of Japan. 1989. Summary of observation for Japanese squid driftnet fishery in 1988, International North Pacific Fisheries Commission, Seattle, U.S.A., October 29 -November 9, 1989.
- Jones, L.L. 1988. Distribution and incidental take of marine

- mammals in the area of the high seas squid driftnet fishery. International North Pacific Fisheries Commission, Tokyo, Japan, March 14-17, 1988. 25pp.
- Kasuya, T. and L.L. Jones. 1984. Behavior and segregation of the Dall's porpoise in the northwestern North Pacific ocean. Sci. Rep. Whales Res. Inst., 35:107-128.
- Kasuya, T. and H, Ogi. 1987. Distribution of mother-calf Dall's porpoise pairs as an indication of calving grounds and stock identity. Sci. Rep. Whales Res. Inst.38:125-140.
- Maritime Safety Agency (Tokyo). 1982. Current Chart in the North Pacific Ocean. 1p.
- Miyazaki, N. and C. Shikano. 1989. Two forms of Lagenorhynchus obliquidens in the Japanese waters. Document submitted to the Symposium on SOCIAL STRUCTURE OF CETACEANS, 5th International Therological Congress, Roma, 22-29 August 1989, 2pp.
- Mizue, N. and K. Yoshida. 1965. On the porpoise caught by the salmon gillnet in Bering Sea and the North Pacific Ocean. Bull. Fac. Fish. Nagasaki Univ.,19:1-36. (in Japanese with English summary)
- Nakai, I. 1987. Squid driftnet fishery. In: K. Takagi, ed., Comprehensive report on research on marine mammals in the North Pacific Ocean, relating to Japanese salmon driftnet fisheries, 1984-1986. Document submitted to the Annual Meeting of the International North Pacific Fisheries Commission. 112pp.

Table 1. Allocation of vessels, researchers, and area for the surveys
in August-September 1988.

Vessel	Cruise period	Area allocated in longitude	Research distance (n.miles)	Researcher
<u>Toshimaru No.25</u>	1 Aug. - 28 Sep.	140°00'E - 168°00'E	3,848	A. Horiuchi (1/8 - 31/8) R. Zenitani (1/9 - 28/9)
<u>Shonanmaru No.2</u>	1 Aug. - 2 Oct.	168°00'E - 172°00'W	5,424	K. Baba
<u>Shinhoyomaru</u>	2 Aug. - 27 Sep.	172°00'W - 152°30'W	5,108	S. Nakagawa S. Uematsu
<u>Hoyomaru No.12</u>	3 Aug. - 27 Sep.	152°30'W - 130°00'W	5,439	K. Mori T. Okumura

Table 2. Number of schools and animals of marine mammals sighted during the four cruises in August-September 1988.

Species	Name of vessel*			
	T25	HSI	H12	SM2
Blue whale	1/1	1/1	1/1	6/4
Fin whale	7/5		3/2	2/2
Sei whale	2/2	2/1	1/1	22/8
Bryde's whale	36/30	43/24	5/3	12/7
Minke whale	1/1		4/1	1/1
Sperm whale	149/28	18/6	19/10	132/35
Killer whale	27/3	8/2	14/2	43/3
False killer whale	540/3			30/1
Short-finned pilot whale				
northern form		27/2	250/1	
southern form		50/1		55/2
Risso's dolphin	150/4	29/3		339/7
Common dolphin	1710/20	726/14	1384/11	1540/12
Striped dolphin	4906/39	799/14	753/13	840/8
Spotted dolphin	1860/9	250/2		
Spinner dolphin	200/1			610/6
Northern right whale dolphin	412/4	6/3		281/9
Pacific white-sided dolphin	415/3	51/9	22/5	1,050/6
Bottlenose dolphin	485/4	2/1	30/1	44/4
Dall's porpoise				
dalli type	66/12	255/47	82/12	73/9
truei type			12/3	
type unidentified	10/1	43/15		
Unidentified ziphiidae	28/14	47/22	81/41	161/64
Mesoplodon sp.		2/1	2/1	
Kogia sp.	1/1			
Unidentified dolphin	1,120/27	403/14	168/25	413/7
Unidentified small cetacean		19/9	38/3	41/7
Unidentified large cetacean	1/1	6/4	15/14	1/1
Unidentified cetacea	15/7	10/8	5/5	
Northern fur seal	13/12	5/4		
Unidentified seals				5/4

(no. of animals/no. of schools)

*: T25; Toshimaru No.25 , HSI; Shinoyomaru , H12; Hoyomaru No.12
SM2; Shonanmaru No.2

Table 3. Sightings of marine mammal schools in relation to the surface water temperature during the North Pacific, August/September 1988.

Species	Surface water temperature (°C)									
	10.0- 11.9	12.0- 13.9	14.0- 15.9	16.0- 17.9	18.0- 19.9	20.0- 21.9	22.0- 23.9	24.0- 25.9	26.0- 28.9	
Number of weather records	38	82	167	223	349	298	431	488	626	
Blue whale			1	3	1		1	1		
Fin whale			1	2	1	2	2		1	
Sei whale		1	1	7	1	1	1			
Bryde's whale				1	2		15	20	25	
Minke whale			1		1		1			
Sperm whale		1		8	4	11	21	5	24	
Killer whale				3	3	2			2	
False killer whale							1	1	2	
Short-finned pilot whale										
southern form										3
northern form				2	1					
Risso's dolphin							10	2	2	
Common dolphin		1				9	16	23	7	1
Striped dolphin						1	5	20	30	18
Spotted dolphin								1	5	5
Spinner dolphin								5	2	
Northern right whale dolphin	1	1	4	4	3		2			
Pacific white-sided dolphin	1	9	9	1	1	1	1			
Bottlenose dolphin				1	1	1			2	5
Dall's porpoise dalli-type	16	34	12	12	4	1	1			
truei-type	6	7	2		1					
unknown type			1	2						
Northern fur seal		1	12	1	1	1				

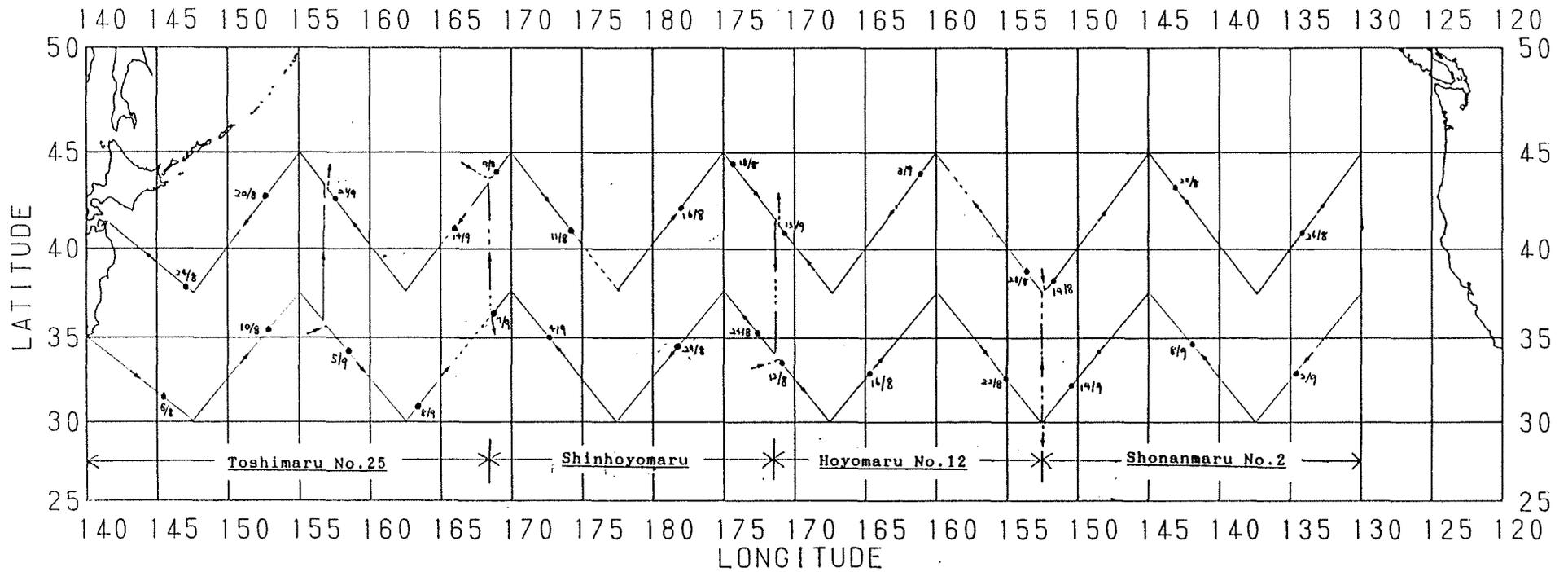


Fig. 1. The track lines of Toshimaru No. 25, Shinhojyomaru, Hoyomaru No. 12 and Shonanmaru No. 2 in the research area. Solid line with arrow head indicates the track line with sighting effort. Dotted line with arrow head indicates the track line without sighting effort. Dot indicates noon positions (day/month).

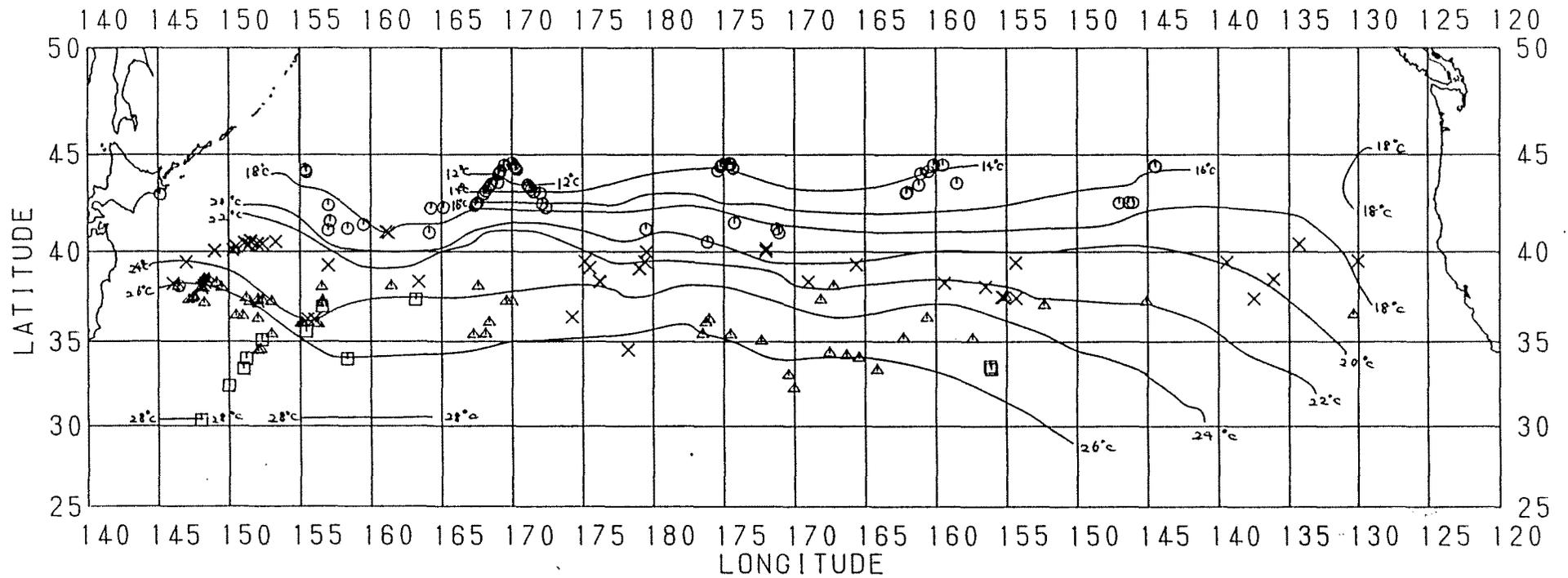


Fig. 2. Sighting positions of marine mammal schools in the North Pacific in 1988.

- =Dall's porpoise (dalli-type)
- × =Common dolphin
- △ =Striped dolphin
- =Spotted dolphin

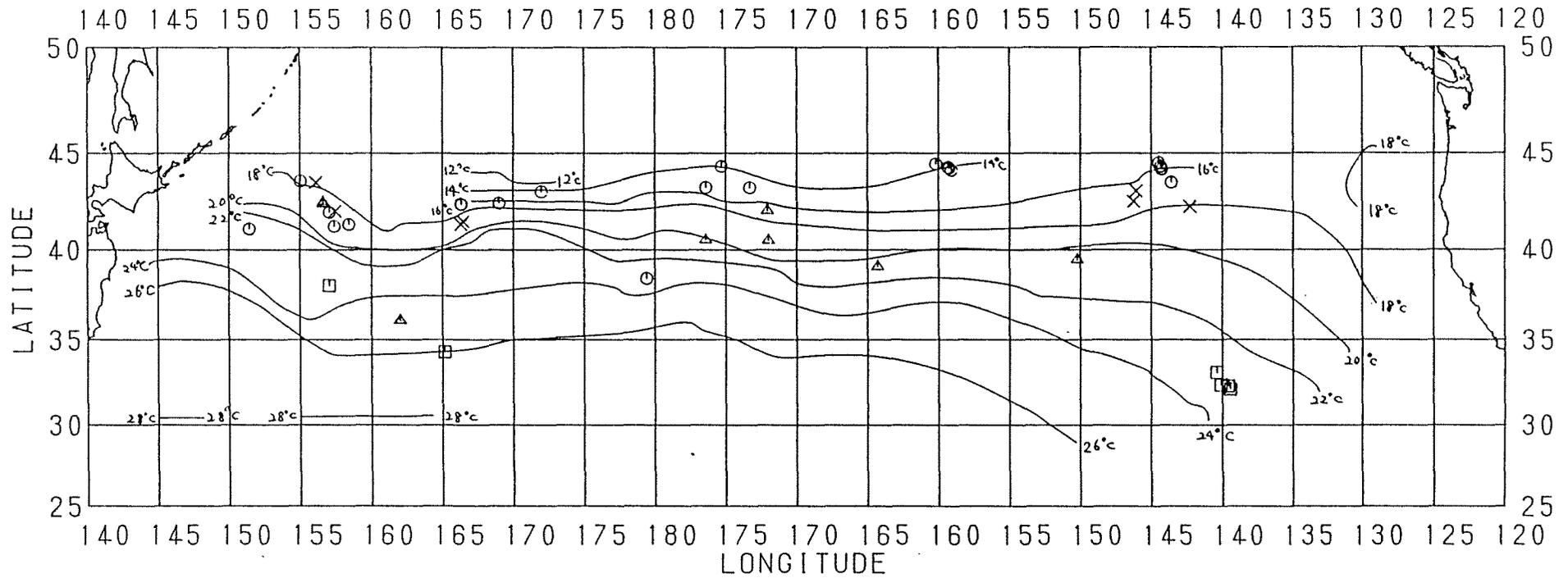


Fig. 3. Sighting positions of marine mammal schools in the North Pacific in 1988.

- = Pacific white-sided dolphin
- × = Northern right whale dolphin
- ▲ = Killer whale
- = Spinner dolphin

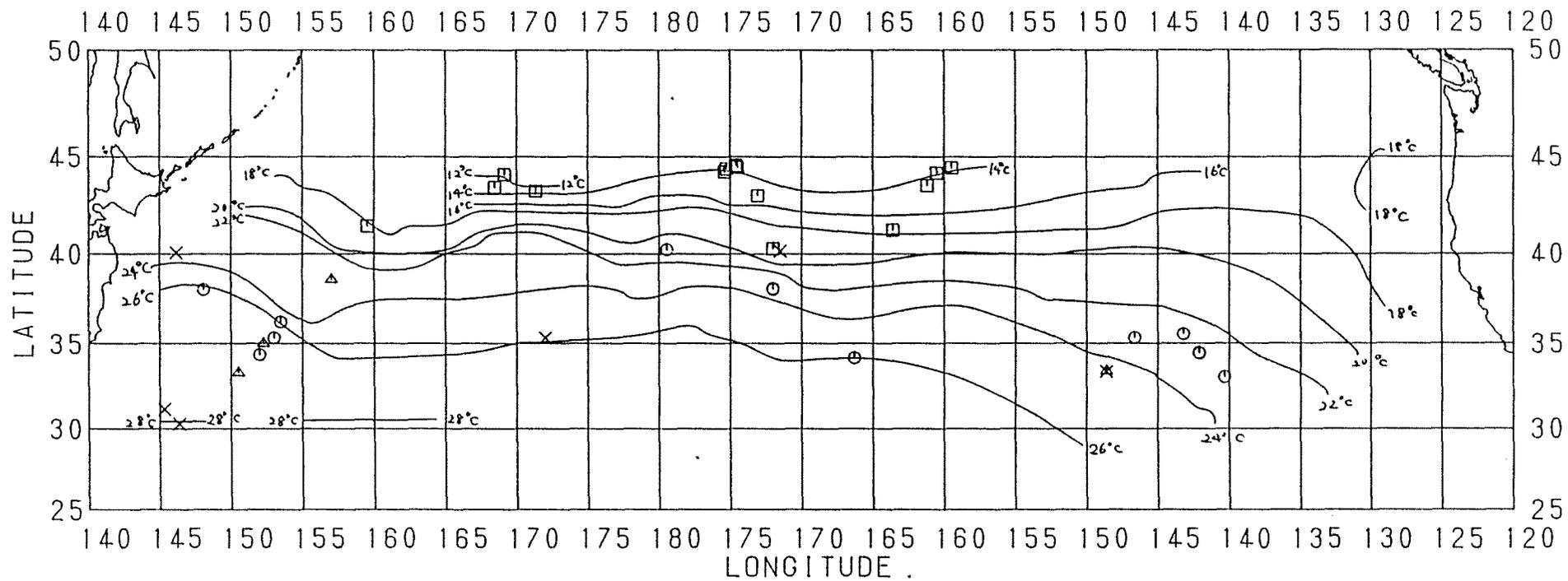


Fig. 4. Sighting positions of marine mammal schools in the North Pacific in 1988.

- =Risso's dolphin
- × =Bottlenose dolphin
- △ =False killer whale
- =Northern fur seal

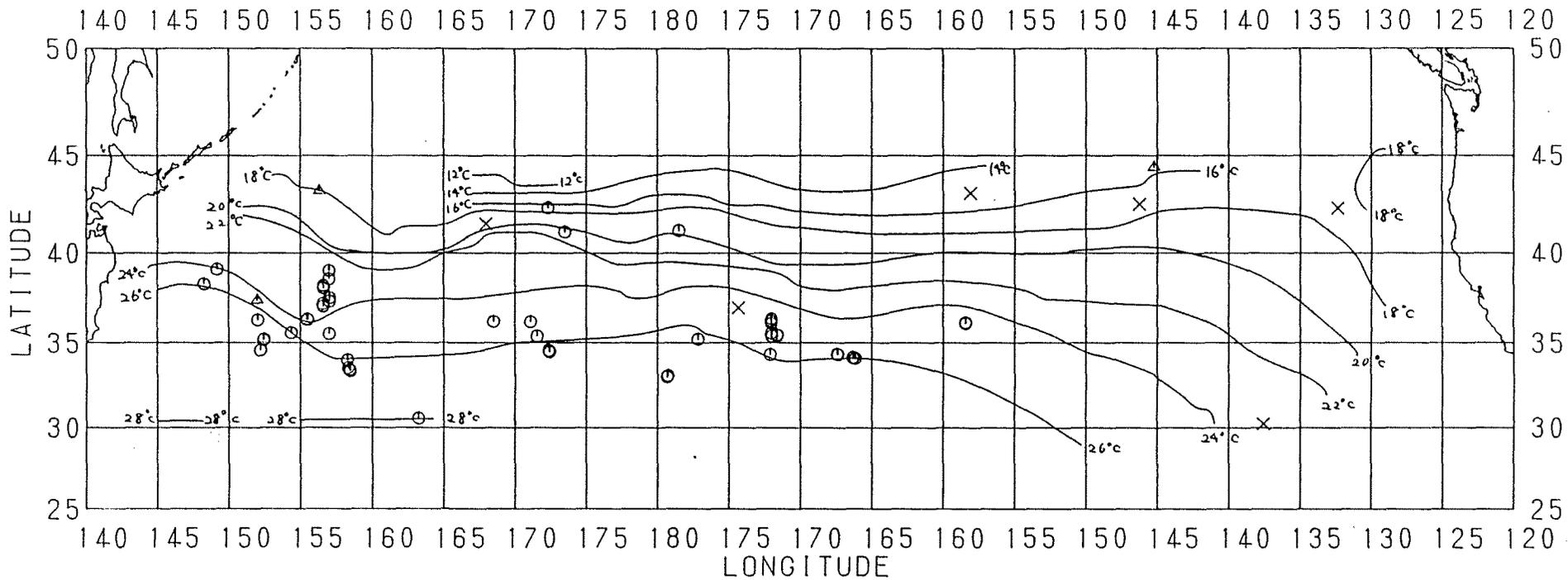


Fig. 5. Sighting positions of marine mammal schools in the North Pacific in 1988.

- = Bryde's whale
- x = Blue whale
- △ = Minke whale

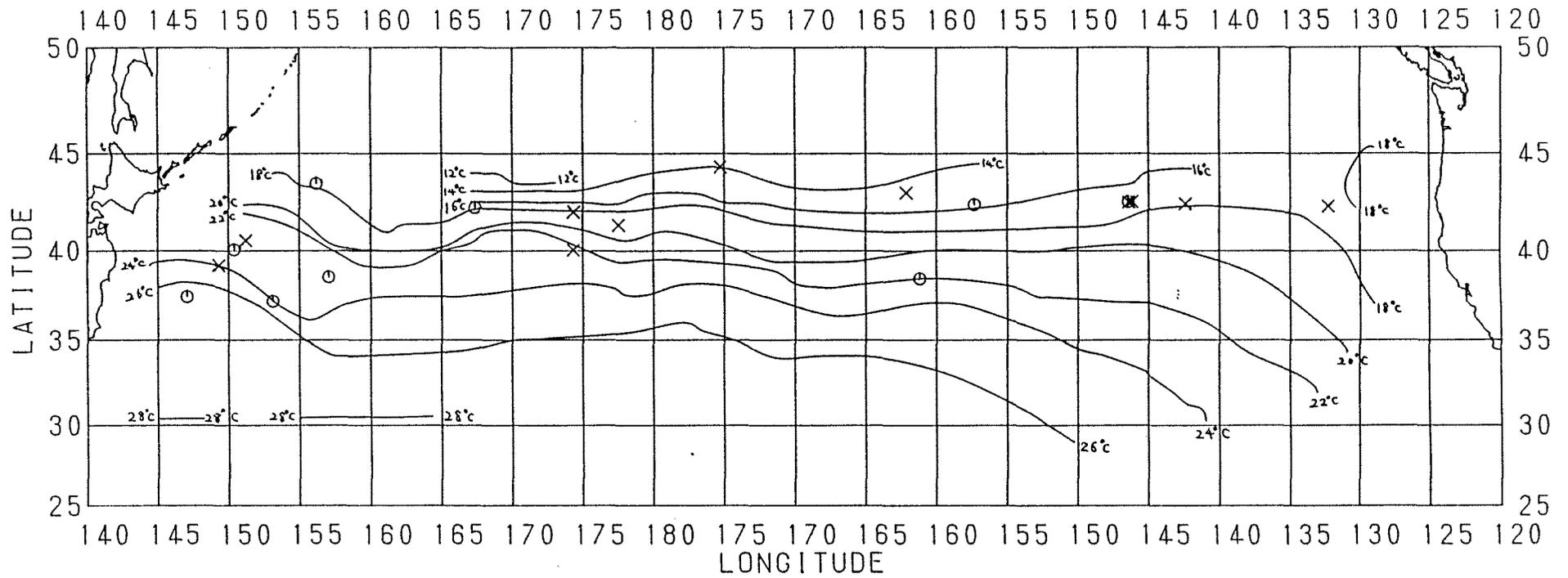


Fig. 6. Sighting positions of marine mammal schools in the North Pacific in 1988.

○ = Fin whale

× = Sei whale

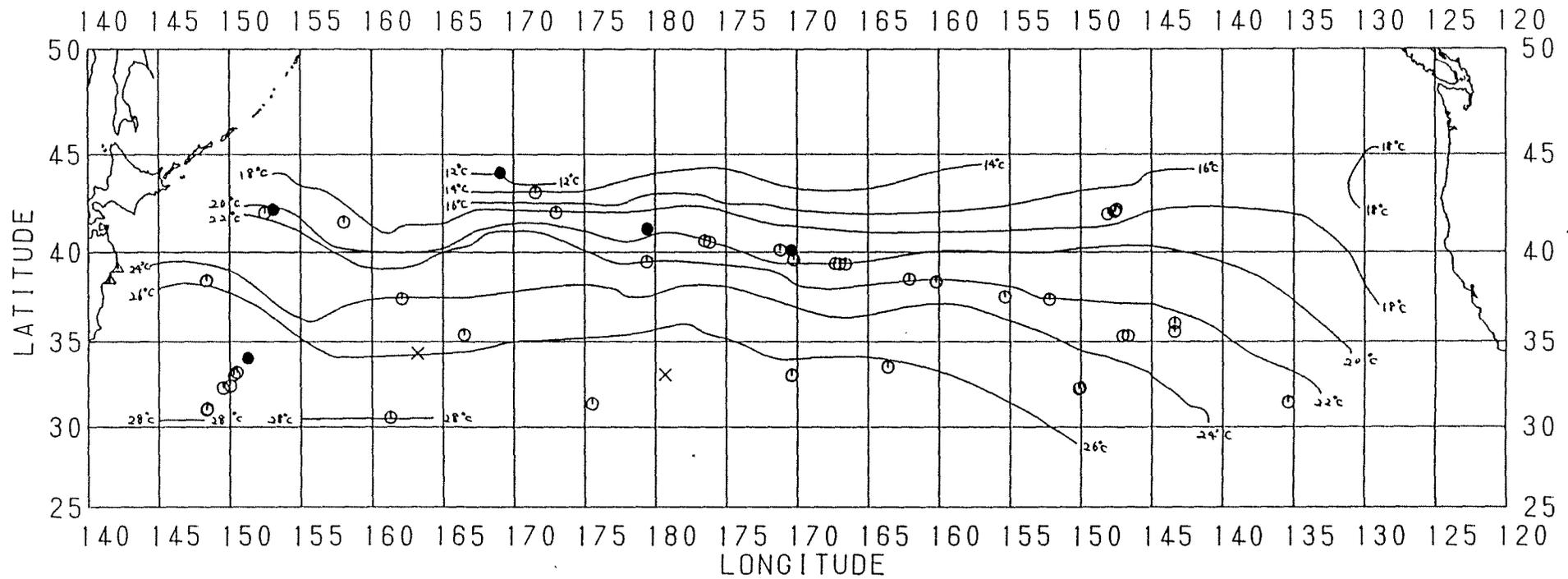


Fig. 7. Sighting positions of marine mammal schools in the North Pacific in 1988.

- = Sperm whale
- = Sperm whale (including individuals 46 ft or over)
- x = Short-finned pilot whale (southern form)
- △ = Short-finned pilot whale (northern form)

