

Short Paper

Satellite tracking of young Steller sea lion off the coast of northern Hokkaido

NORIHISA BABA,^{1*} HIROSHI NITTO² AND AKIRA NITTA³¹National Research Institute of Far Seas Fisheries, Shimizu, Shizuoka 424-8633, ²Otaru Aquarium, Shukutu, Otaru 047-0047 and ³Nihon NUS Co. Ltd, Kaigan, Minato, Tokyo 108-0022, Japan**KEY WORDS:** migration, satellite tracking, Steller sea lion.

Steller sea lions *Eumetopias jubatus* occur in the coastal waters of Hokkaido, Japan in the western North Pacific Ocean during the winter and along the coast of the Kamchatka peninsula and Kuril Islands in the western North Pacific and the islands off Sakhalin in the Sea of Okhotsk during the summer.¹ It has been assumed that Steller sea lions occurring off the coast of Hokkaido are from the Kuril Islands, and that those seen in the Sea of Japan are from Sakhalin.² However, Steller sea lion that was tagged on Kuril Islands was caught near Shakotan in the Sea of Japan off the coast of Hokkaido.³ These reports demonstrate the need for additional information on the distribution and migration of Steller sea lions.

To collect many location data and assess movement patterns of Steller sea lions in the southeastern portion of their range, two Platform Transmitter Terminals (PTTs), 5167 and 17974 were deployed on the same Steller sea lion. Platform Transmitter Terminal 5167 (model T-2050; Toyocom Co. Ltd) had a transmission power of 0.125 W and was approximately 8 cm in diameter, 3 cm in height, 140 g in weight, and had a battery life of 120 days with continuous transmission (no duty cycle). Platform Transmitter Terminal 17974 (model T-2038; Toyocom Co. Ltd, Kanagawa, Japan) had a transmission power of 0.5 W and was approximately 7 cm in diameter, 19 cm in length, 500 g in weight, and had a battery life of about 1 year with a duty cycle of 24 h on and 72 h off.

The Steller sea lion involved in this study was captured in a set net off the coast of Hama-Onisibetu, Sarufutu in northern Hokkaido on June 14, 1993 and to recover from the capture damage was kept in captivity for 5 months at the Otaru Aquarium prior to instrumentation and release. The Steller sea lion was 93 kg in weight, approximately 150 cm in length and was estimated to be 1 year of age.⁴

Platform Transmitter Terminal 5167 was attached to the pelage on the top of the head and PTT 17974 was attached on the back of the Steller sea lion with epoxy resin (Quick 5; Conishi Co. Ltd, Osaka, Japan) at the Otaru Aquarium on November 24, 1993. The attachment process was completed in 27 min and the air temperature was -6°C . The Steller sea lion was transported by rail for 10 h to Hama-Onisibetu where it was released at 11:55 am on November 25, 1993.

Location information from the PTT was obtained through CLS (Ramonville cedex, France) and location errors were estimated at 150 m, 350 m, and 1 km for class 3, 2, and 1 locations, respectively.⁵ Prior to development, it was determined that the maximum error of a Class 0 location was 19 km ($n=4$, mean = 7 km, SD = 8.2). All data from class 0–3 were used to determine locations, distance traveled and estimated speed according to local time.

Radio signals from PTT 5167 were not received, but signals from PTT 17974 were received for 52 days from November 25, 1993 to January 16, 1994. A total of 41 transmissions were recorded and 18 provided location information (12 = class 0, 6 = class 1, Table 1). After deployment, the Steller sea lion landed near the Cape Kuznetsova ($46^{\circ}03'\text{N}$, $141^{\circ}55'\text{E}$) south of Sakhalin on December 2, 6 and 10. On December 18, the Steller sea lion moved to a northwestern location approximately 32 km from Rebun Island; then the animal moved to a southern location 6 km from Skala Kamen rocks on December 30; and it subsequently returned to the vicinity of Cape Kuznetsova on December 31. On January 3, the Steller sea lion moved through the Sea of Okhotsk to the coastal waters near Cape Soya, Hokkaido (about 6 km east from Cape Soya) and then into the Sea of Japan on January 11 (20 km south of the Cape Nosappu; Fig. 1). Total migration distance was approximately 440.4 km, and maximum migration speed was estimated at 7.1 km/h (mean = 0.4 km/h).

Three Argos locations were received on three different days near Cape Kuznetsova. The number of trans-

*Corresponding author: Tel: 0543 366038. Fax: 0543 359642.

Received 31 May 1999.

Table 1 Location of tagged Steller sea lion

Year	Local time				C	Latitude (N)	Longitude (E)
	Month	Day	Hour	Min			
1993	12	2	6	12	1	46-3.1	141-54.5
1993	12	2	6	40	1	46-2.9	141-55.0
1993	12	6	6	53	1	46-2.9	141-54.9
1993	12	6	8	33	0	46-3.2	141-57.1
1993	12	6	16	39	0	46-2.8	141-54.6
1993	12	6	18	20	0	46-2.2	141-51.1
1993	12	10	6	15	0	46-6.0	141-55.1
1993	12	10	7	9	1	46-3.1	141-55.1
1993	12	10	8	48	0	46-2.0	141-48.7
1993	12	10	18	36	1	46-3.1	141-55.0
1993	12	18	7	36	0	45-35.5	140-36.6
1993	12	18	14	29	0	45-37.0	141-14.4
1993	12	30	19	41	0	45-44.1	142-14.1
1993	12	31	3	39	0	46-2.3	141-55.1
1994	1	3	6	53	0	45-31.4	142-2.0
1994	1	11	14	33	0	45-17.5	141-33.5
1994	1	16	3	38	1	45-31.7	141-55.3
1994	1	16	7	12	0	45-31.3	141-54.8

C, class of location. Release: 25.11.1993, 45-20N, 142-9.1E.

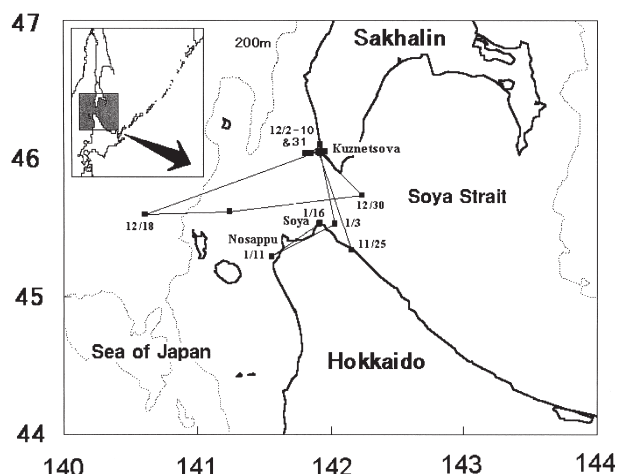


Fig. 1 Migration course of female young Steller sea lion tracked by satellite from November 25, 1993 to January 16, 1994.

missions (mean = 5.3, $n=4$) on 3 days was significantly higher than that (mean = 2, $n=12$) of other days (Wilcoxon rank-sum test, $z=-2.527$, $P=0.006$). Steller sea lion is considered to be landed for these days. Cape Kuznetsova has been previously reported as a hauling site for Steller sea lions from 1959 to 1962.⁶ Our data verify the use of this location as a hauling site and that Steller sea lions migrate to the coast of northern Hokkaido from Sakhalin.²

In December, the Steller sea lion traveled great distances within the vicinity of Soya Strait. Adult male and juvenile Steller sea lions have been reported to stay in coastal areas near Sarufutu in northern Hokkaido in

December.² However, this study indicates that the Steller sea lion moved within the coastal waters of the Okhotsk Sea and the Sea of Japan near Hokkaido during winter.

Drifting ice occurred at about 50°N in the Okhotsk Sea in December and about 48°N in January. The sea surface temperature at Soya Strait changed from 6 to 8°C (December) to 3-4°C (January).⁷⁻¹⁰ Steller sea lions migrate south to other locations when drifting ice covers the sea surface, and they appear as soon as the drifting ice is gone.¹¹ Steller sea lions have been observed at the edge but not within drifting ice.¹² The migration patterns of Steller sea lions from Sakhalin to the coast waters of northern Hokkaido are probably related to these environmental factors.

We would like to thank Mr S. Hayashi, president of Otaru Aquarium, Otaru, Japan, and his staff for their cooperation with the satellite tracking, and Dr K. Wakabayashi, National Research Institute of Far Seas Fisheries, Shimizu, Japan, and Dr G. A. Antonelis, South-west Fisheries Science Center, Honolulu, USA for reading the manuscript. This work was done as part of the Project Research of Japanese Fisheries Agency for Countermeasures to Fisheries Damage.

REFERENCES

- Loughlin TR, Perlov AS, Vladimirov VA. Range-wide survey and estimation of steller sea lions in 1989. *Mar. Mamm. Sci.* 1992; 8: 220-239.
- Yamanaka M, Ohtaishi N, Itoo T. In: Wada K, Itoo T, Niizuma A, Hayama S, Suzuki M (eds). *Ecology and Conservation of Kuril Seals*. Tokai University Press, Tokyo, 1986; 274-295 (in Japanese).
- Shimasaki K, Wada A. Distribution of Steller sea lion (*Eumetopias jubatus*) and their damage to fisheries in Hokkaido. *Aquabiology* 1995; 17: 60-63 (in Japanese).
- Spalding DJ. Age and growth of female sea lions in British Columbia. *J. Fish. Res. Bd. Canada* 1964; 21: 415-417.
- Taillade M. Animal tracking by satellite. In: Priede IG, Swift SM (eds). *Wildlife Telemetry, Remote Monitoring and Tracking of Animals*. Ellis Horwood Ltd, London, 1992; 149-160.
- Voronov VG. *Mammals of the Kuril Islands*. Nauka, Leningrad, 1974; 1-162 (in Russian).
- Japan Fisheries Information Service Center. Weekly Ocean Report of Japan Sea. *JFISC* 1993; 715, 1 (in Japanese).
- Japan Fisheries Information Service Center. Weekly Ocean Report of Japan Sea. *JFISC* 1994; 718, 1 (in Japanese).
- Japan Meteorological Agency Monthly Ocean Report, December 1993. *JMA* 1993; 12: 24 (in Japanese).
- Japan Meteorological Agency Monthly Ocean Report, January 1994. *JMA* 1994; 13: 24 (in Japanese).
- Itoo T, Kato H, Wada K, Shimasaki K, Arai K. Research report of Steller sea lion ecology in Hokkaido. *Geiken-tsushin* 1977; 306: 9-18 (in Japanese).
- Fay FH. The role of ice in the ecology of marine mammals of the Bering Sea. In: Hood DW, Kelley EJ (eds). *Oceanography of the Bering Sea*. Institute of Marine Science and Oceanography Publications, no. 2, University of Alaska, Fairbanks, 1974; 383-399.