Aquatic Mammals 2021, *47*(2), 216-226, DOI 10.1578/AM.47.2.2021.216

Short Note

First Confirmed Sighting of Steller Sea Lion (*Eumetopias jubatus*) in China Since 1990

Sara Platto[1,2] Jinfeng Zhou,[2] Wang Yanqing,[2] and Wang Huo[2]

[1]*Department of Biotechnology, College of Life Sciences, Jianghan University, No. 8, Sanjiaohu Road, Wuhan Economic & Technological Development Zone, Hubei, China*
[2]*China Biodiversity Conservation and Green Development Foundation, 12D, Building 6, Empark International Apartment, No. 69, Banjing Road, Haidian District, Beijing, China*
E-mail: saraplatto@cbcgdf.org

Steller sea lions (*Eumetopias jubatus*) have a wide distribution range in the North Pacific Ocean that extends from California to Alaska (Bering Strait) in the northwest, and from the western Bering Sea along the Asian coast to Sakalin and Hokkaido Islands in the northeast (Chapsky, 1963; Nishiwaki, 1966; Heptner et al., 1976; Figure 1). The distribution of these pinnipeds throughout Asia is not uniform, occurring year-round in some regions and seasonally in others (Burkanov & Loughlin, 2005). The Steller sea lion is not a migratory species, but individuals do disperse during different times of the year. Young animals up to 4 years of age tend to disperse further than adults. When young individuals approach the age when they begin to breed, they will generally stay in the vicinity of the breeding grounds. As a general rule, adult Steller sea lions return to their birthplace to breed (Burkanov & Loughlin, 2005). The breeding season extends from late May to early July throughout the distribution range in the Pacific regions. Males establish their territories during mid-May on grounds usually used by females during the birthing period (Burkanov & Loughlin, 2005).

On the Asian coast, the Steller sea lion's land territories are grouped into seven main areas that include five main rookery sites (places used during the breeding season where pupping occurs), and two areas that are mainly haulout sites (places used outside the breeding season by

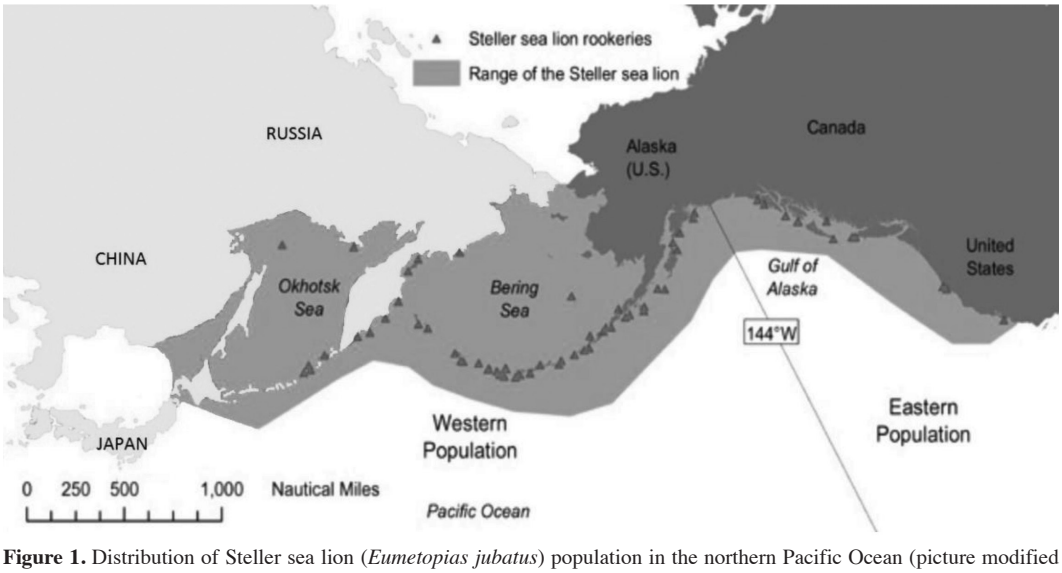

Figure 1. Distribution of Steller sea lion (*Eumetopias jubatus*) population in the northern Pacific Ocean (picture modified from Burkanov & Loughlin, 2005)

primarily nonbreeding adults and by other ages throughout the year) (Burkanov et al., 1995). The breeding sites include the Commander Islands (11 sites), Kamchatka (17 sites), the Kuril Islands (45 sites), Sakhalin Island (12 sites), and the north Sea of Okhotsk (10 sites). The three areas where haulouts are present include the Japan and Siberian coasts (20 sites) and the West Bering Sea (15 sites) (Burkanov & Loughlin, 2005; Figure 2). The boundaries between these regions are not well defined, and sightings of marked Steller sea lions indicate that they often move from one region to another. Over time, changes may occur in the use of these sites with rookeries becoming haulouts and vice versa (Perlov, 1980; Burkanov & Loughlin, 2005). These transformations have been particularly rapid during the last 30 years, which have been characterized by a considerable decline of the Asian population of the Steller sea lion (Burkanov & Loughlin, 2005).

Historically, Steller sea lions were quite common along the entire Asian coast from the mouth of the Amur River (53° N) to the Korean Peninsula (36° N), and they were often also seen in the Yellow Sea (Burkanov & Loughlin, 2005; Figure 3). Currently, the species does not occur in the Yellow Sea, while its presence in the Sea of Japan is limited to coastal waters along the west coast of Hokkaido Island and the southwest coast of Sakhalin Island where there are several permanent winter haulout sites. In fact, the southern border of the Steller sea lion range moved northward 500 to 900 km, with the present southern limit placed in the Tsugaru Strait (Japan, 42° N) (Burkanov & Loughlin, 2005). Despite retraction of the Steller sea lion range, occasional sightings of this species have occurred within the last 50 years in the Yellow Sea (China).

The earliest record of a Steller sea lion in the Yellow Sea is 6 April 1966 when a male was captured on the beach of Lysigang in Jiangsu

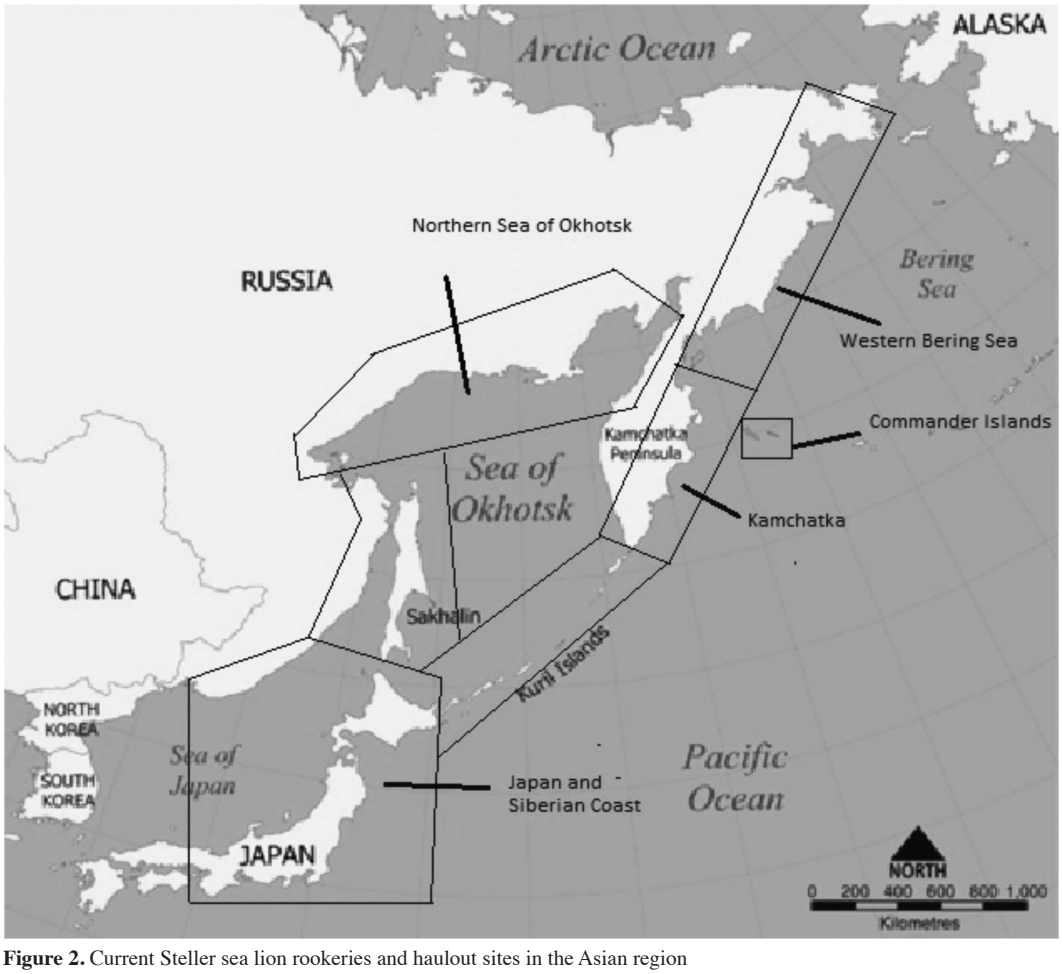

Figure 2. Current Steller sea lion rookeries and haulout sites in the Asian region

province (32° N). This animal weighed 585 kg and was 2.85 m long. It was brought to the Nanjing Xuanwu Lake Zoo where he died a few months later (Huang, 1984). A second Steller sea lion record on the coast of China was reported on 11 July 1990 north of Liadong Bay, Liaoning province (40° N). The animal was a young male that weighed 63.5 kg and was 1.61 m in length. The animal died during transport to the Dalian Zoo (Wang & Han, 1995). Anecdotal records from local fishermen in Lixing waters outside Yantai Peninsula during the 1930s and 1940s reported different sightings of Steller sea lions, but their descriptions could not be verified by photography or systematic observations (Allen, 1938). Four sightings of the same Steller sea lion between 6 June and 13 July 2020 in the Bohai Sea, 30 years after the last appearance of this species in the region, are reported in this short note. (The Bohai Sea is a semi-enclosed continental shelf sea in northern China, connected with the Yellow Sea through the narrow Bohai Strait between Shandong and Liaodong Peninsulas.)

Behavioral Observations

GPS data were collected for each Steller sea lion (SSL) sighting (Figure 4). The animal (the same individual during all sightings) was identified as a female SSL from morphological characteristics. Data on the SSL's activities were collected with an all-occurrence sampling method (Altmann, 1974; Mann, 1999) by direct observations of the individual by volunteers of the China Biodiversity Conservation and Green Development Foundation (CBCGDF) and local police enforcement. Videos and photographs were taken by local people present at the sightings and then sent to CBCGDF. This material was used to gain additional information on the animal activity, to assess its body conditions, and to identify the individual during the different sightings. An ethogram with five main behavioral categories was defined to assess the sea lion's activity: (1) haulout position, (2) swimming at surface, (3) sit-on-hind-flippers position, (4) walking, and (5) boundary display (Table 1). Observations of the SSL were performed at a

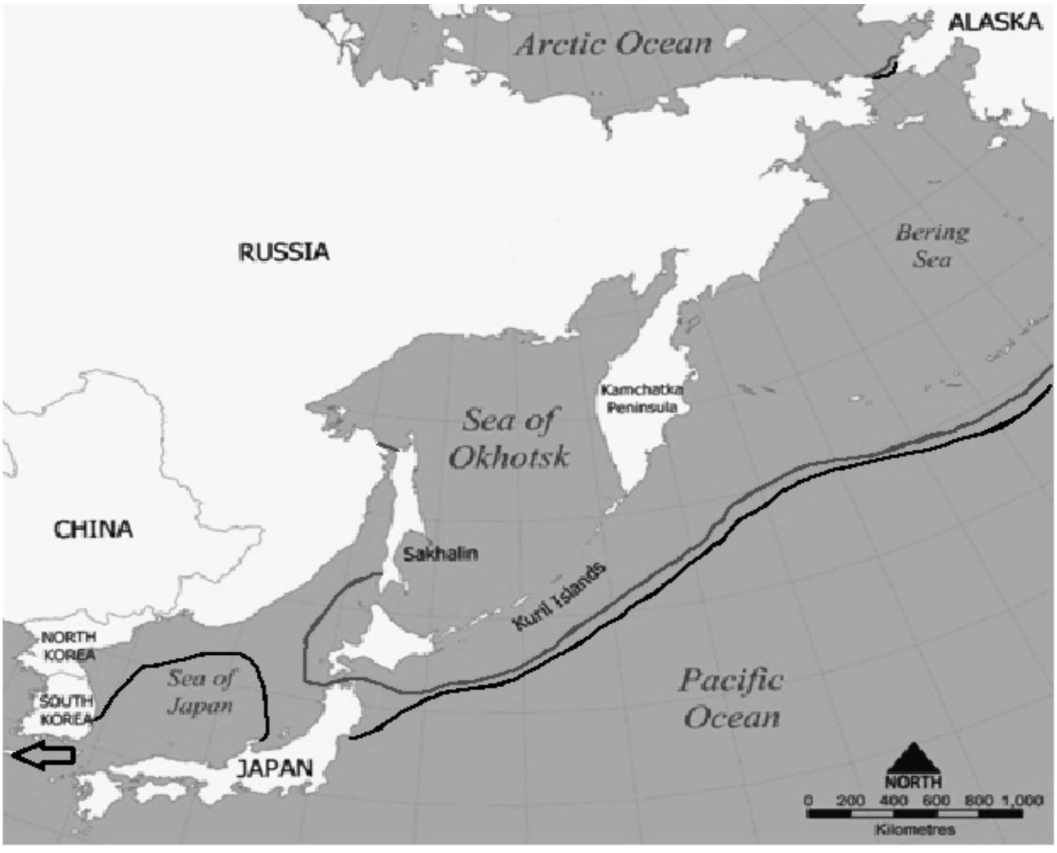

Figure 3. Steller sea lion's historical (black line and arrow) and current (gray line) distribution range

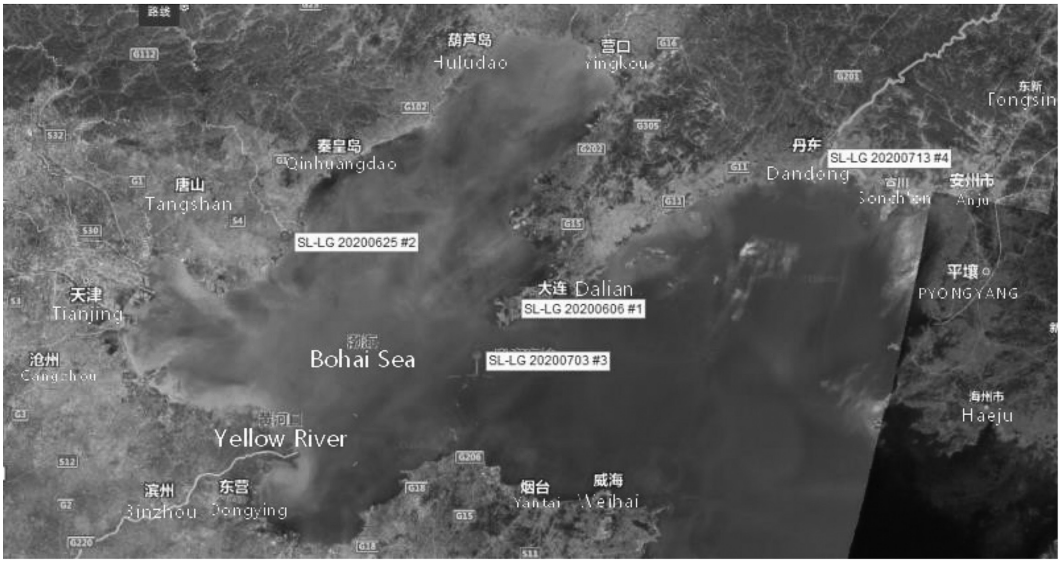

Figure 4. Locations of the Steller sea lion sightings in the Bohai Sea (Yellow Sea) (China): 6 June (point #1), 25 June (point #2), 3 July (point #3), and 13 July (point #4).

Table 1. Ethogram of the main activities observed in the Steller sea lion (*Eumetopias jubatus*)

Behaviors	Description
Haulout	The Steller sea lion (SSL) is on land, stationary, belly down, flat on land, with head down in line with the body, with front flipper either positioned outward from the body or along the side of the body. The hind flipper can be either distended behind the body or tucked under it.
Swimming-at-surface	The SSL moves on the surface of the water, propelled by the fore-flippers.
Sit-on-hind-flippers	The SSL uses the four flippers to support its body in an upright position, with head held up, fore-flippers outstretched from the body, and hind flippers either outstretched from the body or tucked underneath the hind quarters.
Walking	The SSL uses the four flippers to support its body in an upright position, using alternatively the right and left fore- and hind-flippers to advance on the land.
Boundary display	The SSL is in a sit-on-hind-flippers position with the mouth open, initially with no vocalization. If the intruder does not retreat, the SSL, holding the same position as above, starts to emit vocalization with slight swinging of its head from one side to the other.

variable distance between 10 and 20 m with naked eyes. The SSL did not show any tags or branding scars that could allow for identification with the region of origin.

Sighting on 6 June 2020

The first SSL sighting occurred on 6 June 2020 outside the coast of Dalian on Snake Island (Shedao, Liaoning province, China) (38° 44' 53.546" N, 121° 10' 32.343" E; Figure 4). The weather was sunny, and average temperatures ranged between 21° to 27°C. Two fishermen spotted the animal from a fishing boat. They approached where the SSL was stationed, keeping a distance of approximately 10 m. The fishermen recorded 60 s of video.

Sighting on 25 & 26 June 2020

The second SSL sighting occurred on 25 June 2020 in Caofeidian District, Tangshan City, Hebei province (China) (39° 21' 47.6496" N, 119° 11' 17.0448" E; Figure 4). The weather was sunny, and average temperatures ranged between 19° to 28°C. One of the staff of the PetroChina Jingtang Liquefied Natural Gas Company Limited spotted the SSL. The animal was identified as the same one previously sighted on 6 June by comparing body features, such as marks on the fore-flippers, from videos and photographs of the animal on the two different days (Figure 5). On 25 June, observations of the SSL were carried out at four different times during the day, starting at 1400 h and ending at 2130 h (1st observation from 1400 to

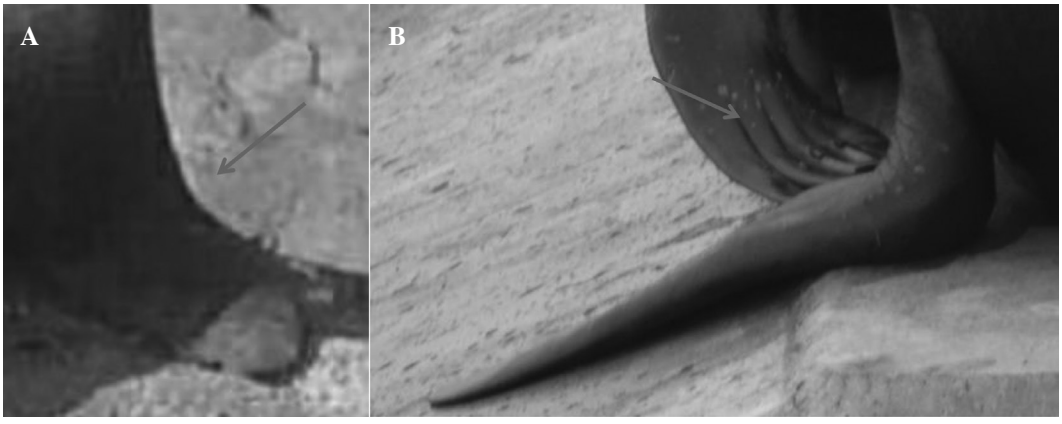

Figure 5. Details of the Steller sea lion's right fore-flipper on (A) 6 June and (B) 25 June (*Photo credits:* Volunteers of CBCGDF)

Figure 6. Steller sea lion on 3 July (*Photo credit:* Volunteers of CBCGDF)

1440 h; 2nd observation from 1600 to 1640 h; 3rd observation from 1840 to 1931 h; and 4th observation from 2040 to 2130 h), with a total duration of 181 min. During this time, videos were also recorded by the company worker and CBCGDF volunteers, with a total duration of 2 min. The next day, 26 June, observations were performed three times starting at 0840 h and ending at 2040 h (1st observation from 0840 to 1020 h; 2nd observation from 1128 to 1330 h; and 3rd observation from 2000 to 2040 h), with a total duration of 262 min. Videos were also recorded for a total duration of 2 min and 15 s. At 1000 h on 27 June, local people went to check on the SSL, but it had left the area.

Sighting on 3 July 2020

After 1 wk with no further sightings of this SSL, the animal reappeared at Beihuangcheng, Changdao, around the Yantai Peninsula (Shandong province, China) (38° 23' 13.254" N, 120° 54' 41.3316" E; Figure 6). The weather was cloudy, and average temperatures ranged between 20° to 27°C. A fisherman passing by the island noticed the SSL; and except for a 15-s video and some photographs taken by the fisherman, there were no other observations for this sighting. The SSL was in haulout position on a rookery (Figure 6). From high-definition photographs, the animal was identified as the same individual as in the two previous sightings, which was confirmed by characteristics of the fore-flippers. There was no further follow-up from local people.

Sighting from 13 to 16 July 2020

After 10 d, on 13 July 2020, the same SSL was spotted again at the port of Donggang City, Liaoning province (China) (39° 52' 44.091" N,

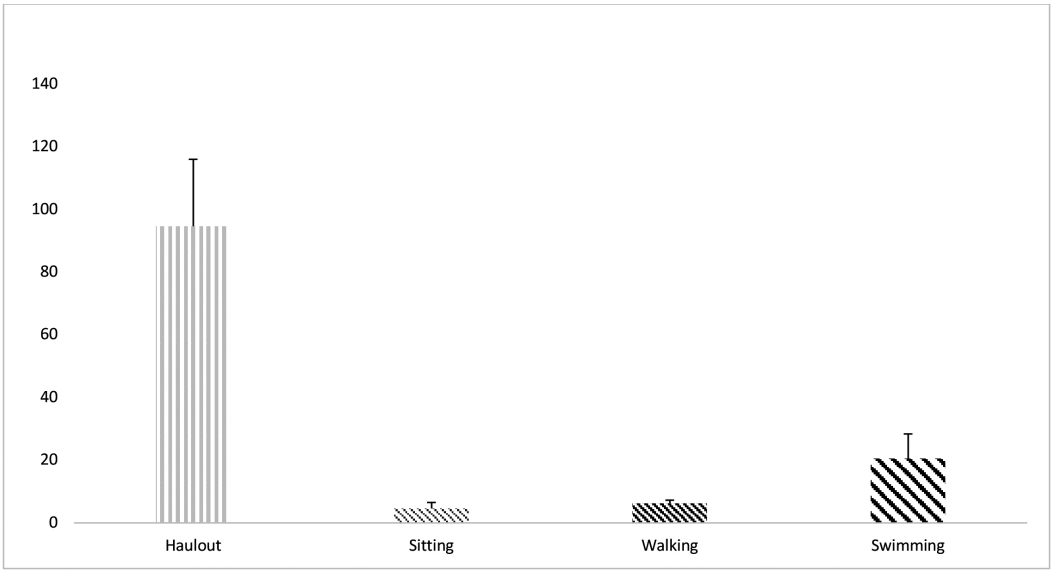

Figure 7. Mean values of the total time in min (± SE) spent by the individual Steller sea lion in different activities during the sightings

124° 8' 45.052" E; Figure 4). The weather was cloudy, and average temperatures ranged between 19° to 27°C. The animal was monitored by a local policeman for 4 d between 7 and 18 h/d (13 July from 1330 to 2348 h; 14 July from 0500 to 2337 h; 15 July from 0745 to 1921 h; and 16 July from 0056 to 0856 h), yielding approximately a total of 2,800 min of direct observation and 27 min and 45 s of video recordings. The area was fenced to keep the public from getting too close to the animal. On 16 July, the SSL swam towards the Korean Peninsula coast, and no further sightings of the animal were reported.

A total of 54 h (3,240 min) of direct observations of the SSL activity were performed, and 33 min and 35 s of video were recorded. The videos recorded during the first (6 June) and third (3 July) sightings were not included in the analysis because of their very limited duration of less than a minute (Table 2). The comparison of the total time spent by this SSL engaging in the different behavioral categories during the sightings was performed by using a Friedman test. The comparison did not show any remarkable differences (Friedman test: $df = 3$, $\chi^2 = 5.357$, $p = 0.147$). Despite this result, this SSL spent most of its time (82.7%) during observations in a *haulout position* with a mean duration (± SE) of 94.632 (± SE 21.348), followed by 10.4% of time *swimming at surface* (20.559 ± SE 7.830), 3.8% of time *walking* (6.274 ± SE 0.973), and 3.1% in a *sit-on-hind-flippers position* (4.621 ± SE 1.90) (Figure 7). On one occasion, a person tried to approach the SSL. The animal changed to a *sit-on-hind-flippers position*, opening its mouth initially without vocalizations. When the person showed no intention of retreating, the SSL emitted vocalizations while holding the position previously described and swinging its head from one side to the other. The SSL kept this stance for 15 s until the person withdrew to his initial distance. This behavior resembled the *boundary display* that SSLs generally perform as agonistic activity to keep territorial intruders at bay (Gentry, 1974; Miller, 1991; Table 1).

Table 2. Time spent by the Steller sea lion (in min) during the sightings (The values from the first and third sightings have been eliminated from the table because they were on the order of a few seconds each.)

Date (d/mo/y)	Haulout	Sitting	Walking	Swimming
25/6/20	153	28	0	0
26/6/20	223	29	0	10
13/7/20	436	19	10	138
14/720	977	0	72	59
15/7/20	478	26	31	93
16/7/20	438	0	10	40

Body Condition

According to observations by fishermen during the first sighting (6 June), the SSL's movements were not fluid but slow, and it displayed some difficulty over the rocks. Generally, SSLs are known to be well adapted to moving on rocks since rocky places are common haulout sites for these pinnipeds (Altukhov et al., 2015). Moreover, from the videos and photographs taken on 13 July, this SSL showed signs of emaciation such as visible ribs, vertebral dorsal processes, and pelvic bones (Figure 8). Even though it was reported that the SSL went back to sea at certain intervals during the sightings, it was not possible to assess if the animal was able to fish. In addition, further examination of the videos and photographs across the different sightings allowed physical alterations on this SSL's body to become evident such as whitish/reddish round marks on the dorsal surface of the flippers and nodules on the neck's ventral surface, which later ulcerated leaving clear marks (Figure 9). The possible differential diagnosis could be (1) calicivirus, which is well known to develop vesicles most prevalent on the dorsal surface of the flippers that can later leave plaque-like lesions once eroded; and (2) poxviruses, which leave nodules on the head, neck, and flippers that can ulcerate and leave an area of alopecia and scar tissue after resolution (Kennedy-Stoskopf, 2001). Both diseases do not appear to cause systemic infections in pinnipeds that could lead to death. In fact, depending on the extension of the lesions, the infection can remit within 5 to 9 wks, even though lesions can sometimes persist longer (Kennedy-Stoskopf, 2001). Only histopathological analysis of poxviruses or throat and rectal swabs, and aspiration of the vesicular fluid for calicivirus, would allow for a precise diagnosis. Unfortunately, it was not possible to collect samples.

Discussion

The occurrence of a SSL in the Bohai Sea represents an exceptional sighting of this pinniped species and only the third such sighting in 30 years in China. The female SSL spent most of her time hauled out, followed by swimming-at-surface, walking, and sitting-on-hind-flippers. Her activity pattern reflects well the general trend for different behavioral activities by SSLs on rookery sites. Specifically, female SSLs spend most of their time on land hauled out, followed by swimming and other movements on land (Merrick, 1987; Kastelein & Weltz, 1990).

This SSL's movements on land were slow, not fluid. The animal showed clear signs of emaciation and possible infection with lesions observed on her body, suggesting the presence of either poxvirus or calicivirus, or both. Poxviruses

Figure 8. Steller sea lion on 13 July with visible signs of emaciation (black arrows) (*Photo credit:* Volunteers of CBCGDF)

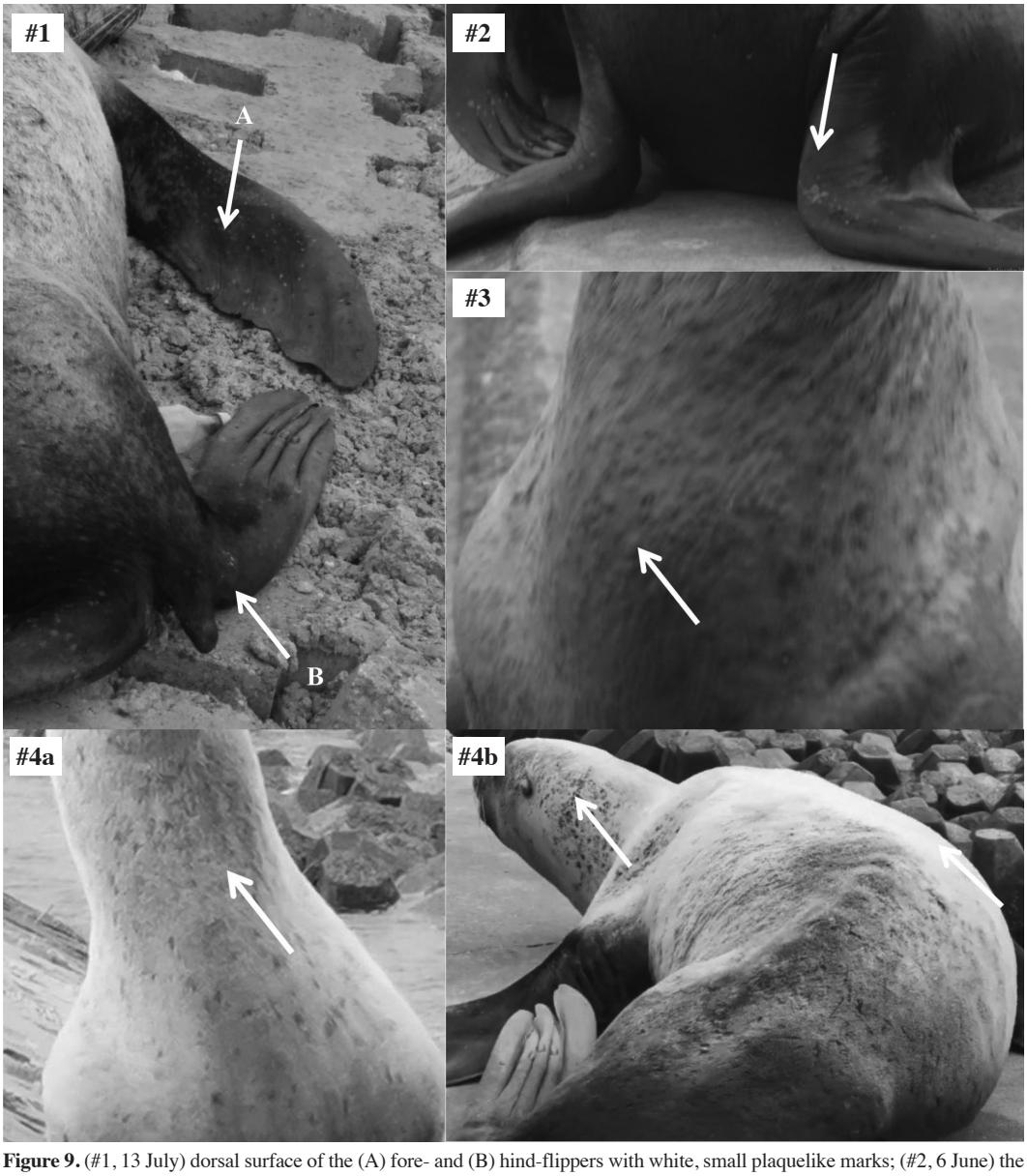

Figure 9. (#1, 13 July) dorsal surface of the (A) fore- and (B) hind-flippers with white, small plaquelike marks; (#2, 6 June) the fore-flippers with reddish, round marks; (#3, 6 June) ventral surface of the neck with nodules; and (#4a & b, 13 July) ventral surface of the neck with lesions caused by possible ulceration of the nodules, and lesions on the body and the neck caused by possible ulceration of the nodules.

associated with pinniped lesions are identified as parapoxviruses, and they typically produce raised, nodular, sometimes ulcerated skin nodules scattered across the body, including the head, neck, and flippers (Kennedy-Stoskopf, 2001; Trites & Donnelly, 2003; Burek et al., 2005). Regarding calicivirus, pinniped populations show different VESV (vesicular exanthema of swine virus) serotypes, and antibody prevalence to a variety of caliciviruses appears widespread among SSLs. Different serotypes may have different levels of pathogenicity (Smith, 2000). Antibodies of calicivirus were detected at moderate to high frequency in SSL populations for which a major decline in Asian and Western stocks has been observed (Burek et al., 2005). In

fact, the great decline of the SSL population in these regions through the 1980s was rapid, and this pattern might be consistent with disease outbreaks (Burek et al., 2005). Pathogens such as poxvirus or calicivirus might not directly affect pinniped survival, but they are often associated with other major deadly diseases such as morbillivirus and influenza A (Burek et al., 2003). Unfortunately, it was not possible to safely capture this SSL to directly assess its health conditions. Rescuing this SSL would have allowed the collection of samples to test for any viruses and to perform DNA testing to determine the animal's colony of origin, as well as to apply a tracking device before release.

Studies of dispersal, distribution at sea, and movement patterns of SSLs can play a critical role in understanding these pinnipeds' behavior (Merrick & Loughlin, 1997; Burns & Castellini, 1998; Burns et al., 1999; McConnell et al., 2002), leading to information regarding survival, population trends, and variations of their marine ecosystem (Eberhardt & Siniff, 1977; York, 1994; Craig & Ragen, 1999; Hastings et al., 1999). At the same time, genetic analysis would have allowed verification of individual dispersal, providing information on trends and genetic diversity in a specific region. For example, genetic and morphological analyses have been able to identify two subspecies of SSL: one includes the Asian (from Commander Islands to the Sea of Japan) and Western (Bering Sea) stocks, and the other includes the Eastern stock (North America) (Burdin et al., 2009; Phillips et al., 2009).

We propose two hypotheses related to the presence of this SSL in the Bohai Sea. The first is that this female could have come from one of the haulout sites on the northwest coast of Hokkaido Island (Japan) or the southern coast of Sakhalin Island, traveling a distance of more than 2,500 km. Both locations represent an exceptional journey for the SSL, even though it is well known that these pinnipeds can travel such a distance (Baba et al., 2000; Suzuki et al., 2014). Considering the SSL can travel at an average speed of 8 to 18 km/h with a maximum speed of 27 km/h (Baba et al., 2000; Suzuki et al., 2014), it would have taken this female SSL approximately a month to travel to one of the closest haulout sites (either on Hokkaido or Sakhalin Islands). Nevertheless, it seems unusual that an adult female SSL would disperse this far during the breeding season (May to July). As a general rule, SSLs return to their birthplace during this season (Burkanov & Loughlin, 2005). The second hypothesis considers the potential presence of undetected rookery/haulout sites far south of the current known range of the SSL Asian stock. In fact, accounts of individual sightings of this species have been reported every year on the west coast of South Korea during summer, and on the east coast during winter and spring seasons (Lee et al., 2016). These sightings might represent a change in the distribution range of these pinnipeds compared to previous surveys (Burkanov & Loughlin, 2005), which would explain the presence of adult individuals in the current southern study sites.

A third possible explanation might consider the influence of variations in population trends of the SSL Asian stock. In fact, an increase has been registered of the number of SSL individuals on some rookeries in Russia, such as the Kuril Islands, with an annual growth of 7.7% per year since 2004 (Burkanov et al., 2008). This population growth might lead some SSL individuals to search for new rookery sites or new foraging areas. For example, several studies have shown that stable or increasing SSL populations exhibit longer foraging trips (Milette & Trites, 2003; Rehberg et al., 2009). It is also important to remember that the marine Russian regions are characterized by intense fishery activities that exert great pressure on the fish stock also consumed by SSLs. This situation might be one of the causes of the increased dispersal of some individuals of this pinniped species. In addition, the beginning of 2020 has been characterized by restrictions in activities, including fisheries, caused by the COVID-19 pandemic. Therefore, it is possible that an unprecedented reduction of maritime traffic might have facilitated the movements of these pinnipeds.

Nevertheless, whatever the circumstances that resulted in the presence and observations of this individual SSL in the Bohai Sea, this represents the first account of this species in China in 30 years (Elorriaga-Verplancken et al., 2014). Given the potential ecological implications of the return of this species to the Yellow Sea, isolated events such as this are important to document. This species of pinniped can influence the benthic fauna, impacting the abundance of prey that are, in turn, predators of other species (Trites, 1997). SSLs contribute to nutrient recycling through their excrement, and they also host a number of different parasites that can impact the environment (Myers, 1970; McClelland, 1980; Grenfell & Gulland, 1996). Therefore, tracking and recording these unusual sightings should continue along with further development of cooperative research programs among institutions of neighboring countries such as China, South Korea, Japan, and Russia. A satellite tracking program would allow assessment of possible undetected new SSL sites that could lead to the development of a

conservation program for the Asian stock of this threatened pinniped species (International Union for Conservation of Nature [IUCN], 2016).

Acknowledgments

We would like to express our deep and sincere gratitude to Mr. Yang Mingliang of PetroChina Jingtang Liquefied Natural Gas Company Limited for his detailed description about the Steller sea lion activity, which helped with the assessment of the animal's main behaviors, and to Ms. Gu Wenwen of the PetroChina company for offering short video recordings. Our appreciation also goes to Mr. Tian Zhiwei and Mr. Zhang Yunbo, volunteers of the China Biodiversity Conservation and Green Development Foundation, for sharing their observations of the Steller sea lion. We deeply thank Rebecca Frank for proofreading the manuscript. We also thank Mr. Wang Jianlong, officer of the Dandong Municipal Public Security Bureau, Port and Channel Branch, who spent 72 hours recording the Steller sea lion's activities and keeping the public from approaching the animal.

Literature Cited

Allen, G. M. (1938). The mammals of China and Mongolia. In W. Granger (Ed.), *Natural history of Central Asia* (Vol. 11, Part 1, pp. 490-493). American Museum of Natural History. https://doi.org/10.5962/bhl.title.12195

Altmann, J. (1974). Observational study of behavior: Sampling methods. *Behaviour*, *49*(3/4), 227-267. https://doi.org/10.1163/156853974X00534

Altukhov, A. V., Andrews, R. D., Calkins, D. G., Gelatt, T. S., Gurarie, E. D., Loughlin, T. R., Mamaev, E. G., Nikulin, V. S., Permyakov, P. A., Ryazanov, S. D., Vertyankin, V. V., & Burkanov, V. N. (2015). Age specific survival rates of Steller sea lions at rookeries with divergent population trends in the Russian Far East. *PLOS ONE*, *10*(5), e0127292. https://doi.org/10.1371/journal.pone.0127292

Baba, N., Nitto, H., & Nitta, A. (2000). Satellite tracking of young Steller sea lion off the coast of northern Hokkaido. *Fisheries Science*, *66*, 180-181. https://doi.org/10.1046/j.1444-2906.2000.00030.x

Burdin, A. M., Hennen, D. R., Calkins, D. G., Burkanov, V. N., Nikulin, V. S., & Lisistina, T. Y. U. (2009). Can we see a cohort effect on survival of Steller sea lions (*Eumetopias jubatus*) at Kozlova Cape rookery (eastern Kamchatka, Russia)? *Marine Mammal Science*, *25*(4), 888-901. https://doi.org/10.1111/j.1748-7692.2009.00294.x

Burek, K. A., Beckmen, K., Gelatt, T., Fraser, W., Bracht, A. J., Smolarek, K. A., & Romero, C. H. (2005). Poxvirus infection in Steller sea lions (*Eumetopias jubatus*) in Alaska. *Journal of Wildlife Diseases*, *41*(4), 745-752. https://doi.org/10.7589/0090-3558-41.4.745

Burek, K. A., Gulland, F. M. D., Sheffield, G., Keyes, E., Spraker, T. R., Smith, A. W., Skilling, D. E., Evermann, J., Stott, J. L., & Trites, A. W. (2003). Disease agents in Steller sea lions in Alaska: A review and analysis of serology data from 1975-2000. *Fisheries Centre Research Reports*, *11*(4), 1-27.

Burkanov, V. N., & Loughlin, T. R. (2005). Distribution and abundance of Steller sea lions, *Eumetopias jubatus*, on the Asian Coast, 1720's-2005. *Marine Fisheries Review*, *67*(2), 1-62.

Burkanov, V. N., Vertyankin, V. V., & Mamaev, E. G. (1995). Movements of tagged Steller sea lions in the Kamchatka region. *Proceedings of the Eleventh Biennial Conference on the Biology of Marine Mammals*, Orlando, FL.

Burkanov, V. N., Altukhov, A. V., Andrews, R., Blokhin, I. A., Calkins, D. G., Generalov, A. A., Grachev, A. I., Kuzin, A. E., Mamaev, E. G., Nikulin, V. S., Panteleeva, O. I., Permyakov, P. A., Trukhin, A. M., Vertyankin, V. V., Waite, J. N., Zagrebelny, S. V., & Zakharchenko, L. D. (2008). Brief results of Steller sea lion (*Eumetopias jubatus*) survey in Russian waters, 2006-2007. *Marine mammals of the Holarctic: Collection of scientific papers after the Fifth International Conference* (pp. 116-123), Odessa, Ukraine, Russia.

Burns, J. M., & Castellini, M. A. (1998). Dive data from satellite tags and time-depth recorders: A comparison in Weddell seal pups. *Marine Mammal Science*, *14*, 750-764. https://doi.org/10.1111/j.1748-7692.1998.tb00760.x

Burns, J. M., Castellini, M. A., & Testa, J. W. (1999). Movements and diving behavior of weaned Weddell seal (*Leptonychotes weddellii*) pups. *Polar Biology*, *21*, 23-36. https://doi.org/10.1007/s003000050329

Chapsky, K. K. (1963). *Otryad Pinnipedia* [Order Pinnipedia]. In K. K. Chapsky (Ed.), *Mlekopitayushchie fauny USSR* 2 [Mammals of the fauna of the Ukrainian SSR 2] (pp. 895-964). Izdat. AN USSR, Moscow, Leningrad.

Craig, M. P., & Ragen, T. J. (1999). Body size, survival, and decline of juvenile Hawaiian monk seals, *Monachus schauinslandi*. *Marine Mammal Science*, *15*, 786-809. https://doi.org/10.1111/j.1748-7692.1999.tb00843.x

Eberhardt, L. L., & Siniff, D. B. (1977). Population dynamics and marine mammal management policies. *Journal of the Fisheries Research Board of Canada*, *34*, 183-190. https://doi.org/10.1139/f77-028

Elorriaga-Verplancken, F. R., Tennis, M. J., & Brown, R. F. (2014). Unprecedented resighting in Mexico of a male California sea lion (*Zalophus californianus*) from Oregon during the 2014 breeding season. *Aquatic Mammals*, *40*(4), 364-367. https://doi.org/10.1578/AM.40.4.2014.364

Gentry, R. L. (1974). The development of social behavior through play in the Steller sea lion. *American Zoologist*, *14*, 391-403. https://doi.org/10.1093/icb/14.1.391

Grenfell, B., & Gulland, F. M. D. (1996). Introduction: Ecological impact of parasitism on wildlife host populations. *Parasitology*, *11*(1), 3-14. https://doi.org/10.1017/S0031182000075788

Hastings, K. K., Testa, J. W., & Rexstad, E. A. (1999). Interannual variation in survival of juvenile Weddell seals (*Leptonychotes weddellii*) from McMurdo Sound, Antarctica: Effects of cohort, sex, and age. *Journal of Zoology*, *248*, 307-323. https://doi.org/10.1111/j.1469-7998.1999.tb01031.x

Heptner, V. G., Chapsky, K. K., Arsenyev, V. A., & Sokolov, V. E. (1976). Pinnipeds and toothed whales. In V. G. Heptner (Ed.), *Mammals of the Soviet Union* (Vol. 2, Part 3, pp. 25-51). Vysshaia Shkola.

Huang, Y. (1984). North sea lion captured in Lu Sigang, Jiangsu province. *Chinese Journal of Zoology*, (2), 42-43.

International Union for Conservation of Nature (IUCN). (2016). *The IUCN red list of threatened species*. https://www.iucnredlist.org/species/8239/45225749

Kastelein, R. A., & Weltz, F. C. (1990). Distribution, abundance, reproduction and behavior of SSL (*Eumetopias jubatus*) in Prince William Sound, Alaska. *Aquatic Mammals*, *15*(4), 145-147.

Kennedy-Stoskopf, S. (2001). Viral diseases. In L. A. Dierauf & F. M. D. Gulland (Eds.), *Handbook of marine mammal medicine* (2nd ed., pp. 285-307). CRC Press. https://doi.org/10.1201/9781420041637.sec3

Lee, K., Kim, J-Y., Chan, S. J., Lee, H-S., Her, M., & Chae, C. (2016). First isolation of *Streptococcus halichoeri* and *Streptococcus phocae* from a Steller sea lion (*Eumetopias jubatus*) in South Korea. *Journal of Wildlife Diseases*, *52*(1), 183-185. https://doi.org/10.7589/2015-05-112

Mann, J. (1999). Behavioral sampling methods for cetaceans: A review and critique. *Marine Mammal Science*, *15*(1), 102-122. https://doi.org/10.1111/j.1748-7692.1999.tb00784.x

McClelland, G. (1980). *Phocanema decipiens*: Growth, reproduction and survival in seals. *Experimental Parasitology*, *49*(2), 175-187. https://doi.org/10.1016/0014-4894(80)90115-0

McConnell, B., Fedak, M., Burton, H. R., Engelhard, G. H., & Reijnders, P. J. H. (2002). Movements and foraging areas of naive, recently weaned southern elephant seal pups. *Journal of Animal Ecology*, *71*, 65-78. https://doi.org/10.1046/j.0021-8790.2001.00576.x

Merrick, R. L. (1987). *Behavioral and demographic characteristics of northern sea lion rookeries* (Master's thesis). Oregon State University, Corvallis.

Merrick, R. L., & Loughlin, T. R. (1997). Foraging behavior of adult female and young-of-the-year Steller sea lions in Alaskan waters. *Canadian Journal of Zoology*, *75*(5), 776-786. https://doi.org/10.1139/z97-099

Milette, L. L., & Trites, A. W. (2003). Maternal attendance patterns of Steller sea lions (*Eumetopias jubatus*) from stable and declining populations in Alaska. *Canadian Journal of Zoology*, *81*(2), 340-348. https://doi.org/10.1139/z03-008

Miller, E. H. (1991). Communication in pinnipeds, with special reference to non-acoustic signalling. In D. Renouf (Ed.), *The behaviour of pinnipeds* (pp. 128-235). Chapman and Hall. https://doi.org/10.1007/978-94-011-3100-1_4

Myers, B. J. (1970). Nematodes transmitted to man by fish and aquatic mammals. *Journal of Wildlife Diseases*, *6*, 266-292. https://doi.org/10.7589/0090-3558-6.4.266

Nishiwaki, M. (1966). Distribution and migration of marine mammals in the North Pacific area. *Proceedings of the Eleventh Pacific Science Congress*, Tokyo. 48 pp.

Perlov, A. S. (1980). Vozrastnoy sostav i sootnoshenie polov u sivuchey (*Eumetopias jubatus* (Otariidae) na lezhbishchakh Kuril'skikh ostrovov [Age composition and sex ratio of Steller sea lions (*Eumetopias jubatus* (Otariidae) from rookeries of the Kuril Islands]. *Zoologicheskii Zhurnal*, *59*(10), 1545-1553.

Phillips, C. D., Bickham, J. W., Patton, J. C., & Gelatt, T. S. (2009). Systematics of Steller sea lions (*Eumetopias jubatus*): Subspecies recognition based on concordance of genetics and morphometrics. *Occasional Papers – Museum of Texas Tech University*, *283*, 1-16.

Rehberg, M. J., Andrews, R. D., Swain, U. G., & Calkins, D. G. (2009). Foraging behavior of adult female Steller sea lions during the breeding season in southeast Alaska. *Marine Mammal Science*, *25*, 588-604. https://doi.org/10.1111/j.1748-7692.2008.00278.x

Smith, A. W. (2000). Virus cycles in aquatic mammals, poikilotherms, and invertebrates. In C. J. Hurst (Ed.), *Viral ecology* (pp. 447-491). Academic Press. https://doi.org/10.1016/B978-012362675-2/50013-6

Suzuki, I., Sato, K., Fahlman, A., Naito, Y., Miyazaki, N., & Trites, A. W. (2014). Drag, but not buoyancy, affects swim speed in captive Steller sea lion. *Biology Open*, *3*, 379-386. https://doi.org/10.1242/bio.20146130

Trites, A. W. (1997). The role of pinnipeds in the ecosystem. In G. Stone, J. Goebel, & S. Webster (Eds.), *Pinniped populations, eastern north Pacific: Status, trends and issues. A symposium of the 127th Annual Meeting of the American Fisheries Society* (pp. 31-39). New England Aquarium.

Trites, A. W., & Donnelly, C. P. (2003). The decline of Steller sea lions in Alaska: A review of the nutritional stress hypothesis. *Mammal Review*, *33*, 3-28. https://doi.org/10.1046/j.1365-2907.2003.00009.x

Wada, K. (1998). Steller sea lions: Present status of studies of migratory ecology, and conflict between fisheries and conservation in Japan. *Biosphere Conservation: For Nature, Wildlife, and Humans*, *1*(1), 1-6. https://doi.org/10.20798/biospherecons.1.1_1

Wang, P., & Han, J. (1995). Distribution of the northern sea lions and Otariidae found in Liaodong Bay and along the coast of China. *Fisheries Science*, *14*(2), 20-22.

York, A. E. (1994). The population dynamics of northern sea lions, 1975-1985. *Marine Mammal Science*, *10*, 38-51. https://doi.org/10.1111/j.1748-7692.1994.tb00388.x