

Matching of the Gray Whales of off Sakhalin and the Pacific Coast of Japan, with a Note on the Stranding at Wadaura, Japan in March, 2016

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Abstract

The coast of Japan is a migratory corridor for the western stock of the gray whales (*Eschrichtius robustus*), which was once considered as extinct and remains endangered. According to the historical records, from 1955 to 2014, only 21 gray whales occurrence has been recorded in 59 years. However, from 2015 to 2016, intensive occurrence including the seven sightings and the two strandings were noted. In this paper, we found that those sightings were re-sightings of the same individual, which was initially sighted off Sakhalin during August, 2014. On 4 March, 2016, a young female gray whale (8.9 m in body length) was stranded at *Wadaura* beach, Chiba prefecture. We also conducted research on this animal including taking pictures and external measurements. In addition, we flensed this animal to observe the internal organs and collect a skeletal specimen. The reason for the death of this animal remains unclear; however, from its external characteristics, we identified that this animal was not an identical one, sighted off Sakhalin and the coast of Japan from 2014 to 2016. On 5 April, 2016, another young female gray whale (7 m in body length) was stranded at Arai beach, Shizuoka prefecture. We concluded that from 2015 to 2016, at least three distinct gray whales have migrated along the coast of Japan.

Keywords

Gray Whale, *Eschrichtius robustus*, Stock, Stranding

1. Introduction

The gray whale (*Eschrichtius robustus*) is the only modern species in this genus

and the family of Eschrichtiidae. The International Whaling Commission (IWC) manages them as two distinct stocks [1]. Eastern gray whales (California stock) breed near the coastal lagoons of Baja California, Mexico, during winter, whereas they migrate to the Bering and Chukchi seas during summer for feeding [2]. Western gray whales (Asian stock) are believed to breed in the western part of the Hainan Island and migrate to the coast of Sakhalin in the Okhotsk Sea for feeding [3]. These two stocks show distinct population dynamics. Eastern gray whales were depleted by historical American whaling as well as modern whaling, however, it was dramatically recovered after 1960s, with individuals estimated at approximately 20,990 (95% Highest Posterior Density Interval (HDPI) 12,230 - 22,900), almost reaching the limit of the carrying capacity of their habitat [4]. On the other hand, land-based whaling at Ulsan or other modern whaling also depleted the abundance of the western gray whales. During 1960, it was believed that the western gray whales were near extinct [5]. Subsequently, although the western gray whales were no longer in immediate danger of extinction [6], the abundance of this population has not yet recovered [7] [8]. The population of the western gray whales is estimated to be only 121 (95% CV 112 - 130) individuals by IWC scientific committee; therefore, concerns of extinction [9].

Japan locates from the Okhotsk Sea in the north, which is the feeding ground of the western gray whales, to the East China Sea in the south. Therefore, the coast of Japan is thought to be the migratory corridor for the western gray whales [10]. Gray whales scarcely appeared around the Japanese coast. From 1955 to 2014, only 21 sightings or strandings of gray whales have been reported along the Japanese coast [11]. From 2015 to April 2016, seven sightings and two strandings of gray whales have been reported. The sightings at *Kozushima* Island, *Nijjima* Island, and *Miho* in 2015 were identified as identical animal, which was also sighted off Sakhalin Island in 2014 [11] [12]. However, no information is available on whether other sighted and stranded animals are of the same individual. In addition, we had an opportunity to conduct a detailed observation of one of the stranded animals at *Wadaura* beach, Minamiboso city, Chiba prefecture on 4 March, 2016.

Therefore, in the current report, we aimed to integrate and identify individuals within recent sightings as well as report the detail of the stranded animal at *Wadaura* beach.

2. Materials and Methods

The sighting and stranding data before April 2015 were cited from published papers [11] [12]. The data after May 2015, including pictures, sighting locations, and dates were sourced directly from the individual people who found the gray whales and submitted information to the Fisheries Agency of Japan and TUMSAT or posted to the internet through the Social Networking Service (SNS) and/or news. We also collected the data from the animal (female, 8.90 m) stranded at *Wadaura* beach, Chiba prefecture on 4 March, 2016.

3. Results

3.1. Sightings and Stranding of Gray Whales from March 2015 to April 2016

During this period, local divers or citizens had coincidentally sighted gray whales (Figure 1, Table 1). In 2015, four sightings had been reported at *Kozushima* Island, Tokyo (20 March); *Nijijima* Island, Tokyo (24 March); *Teradomari*, Niigata prefecture (31 March); and *Miho* beach, Shizuoka (19 April) [11]. As mentioned above, sightings made at *Kozushima* and *Nijijima* Islands, and *Miho* beach have been identified as the same animal, which was also sighted off Sakhalin Island [12].

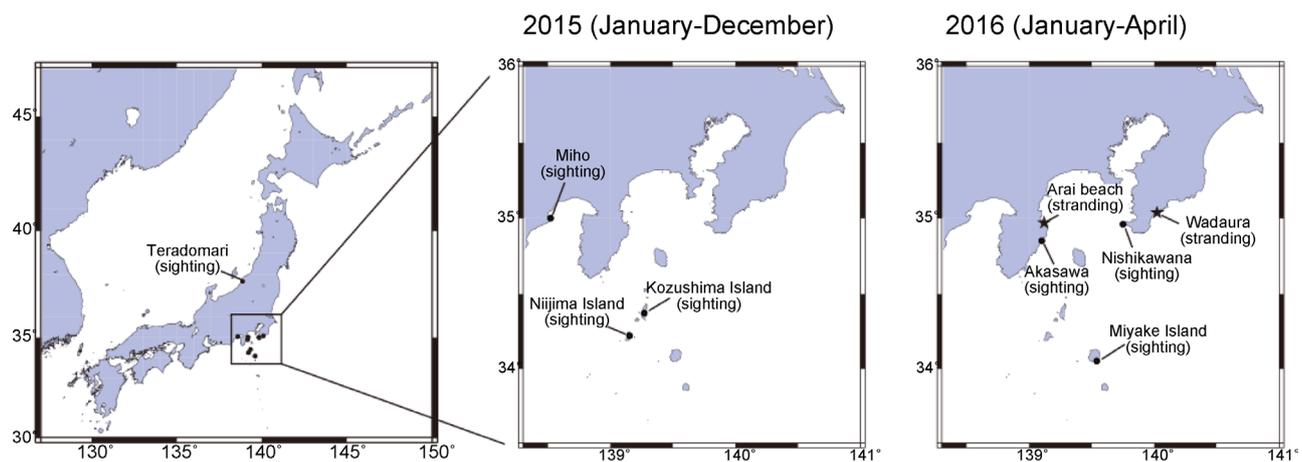


Figure 1. Location of the sighting (●) and stranding (★) from January, 2015 to April, 2016.

Table 1. Sighting and stranding of the gray whales from March 2015 to April 2016.

YearDate	n	Status	Locality	Reference/Source
2014August	1*	Sighting	Off Sakhalin Island, Russia	Weller <i>et al.</i> (2015) [12]
201520March	1	Sighting	Off <i>Kozushima</i> Island, Tokyo 34°12.137'N - 139°9.489'E	Kato <i>et al.</i> (2015) [11]
201524 March	1	Sighting	Off <i>Nijijima</i> Island, Tokyo 34°22.231'N - 139°16.389'E	Kato <i>et al.</i> (2015) [11]
201531 March	1	Sighting	Off <i>Teradomari</i> , Niigata 37°38'N - 138°48'E	Kato <i>et al.</i> (2015) [11]
201519 April	1	Sighting	Off <i>Miho</i> , Shizuoka 35°0'N - 138°31'E	Kato <i>et al.</i> (2015) [11]
201612 January	1	Sighting	Off <i>Nishikawana</i> , Tateyama, Chiba 34°57.416'N - 139°45.103'E	http://nop.chips.jp/frame/003.html (Retrieved at 14 October, 2016)
201614 January	1	Sighting	Off <i>Akasawa</i> , Ito, Shizuoka 34°51.101'N - 139°5.771'E	https://oceana.ne.jp/domestic/59265 (Retrieved at 14 October, 2016)
20169 February	1	Sighting	Off <i>Miyakejima</i> Island, Tokyo 34°3.221'N - 139°32.449'E	https://www.facebook.com/eiji.yamazaki.7/videos/929475013827287/?fref=nf (Retrieved at 14 October, 2016)
20164 March	1	Stranding	<i>Wadoura</i> beach, Minamiboso, Chiba 35°2.085'N - 140°1.05'E	Present study
20165 April	1	Stranding	<i>Arai</i> beach, Ito, Shizuoka 34°58.057'N - 139°07.398'E	http://izu-np.co.jp/ito/news/20160406iz000000018000c.html (Retrieved at 14 October, 2016)

*This animal was first sighted with her mother.

From January to April, 2016, three sightings and two strandings of gray whales have been reported. Locations and other information are as follows;

1) Off *Nishikawana* (sighting): A gray whale was sighted by a local diver off *Nishikawana*, Tateyama City, Chiba prefecture (34°57.416'N - 139°45.103'E) on 12 January, 2016. Tateyama is in the southern tip of Boso peninsula. The diver captured video footage of the right surface of the whale's body.

2) Off *Akasawa* (sighting): A gray whale was sighted by a local diver off *Akasawa*, Ito City, Shizuoka prefecture (34°51.101'N - 139°5.771'E) on 14 January, 2016. *Akasawa* is in the middle part of Izu peninsula and faces Sagami bay. The diver captured images and videos of the left side of the animal's body.

3) Off *Miyakejima* Island (sighting): A gray whale was sighted at the pier of *Miike* port, *Miyakejima* Island (34°3.221'N - 139°32.449'E) on 9 February, 2016. *Miyakejima* Island is one of the seven islands comprising Izu Archipelago and is approximately 180 km south of Tokyo. Several tourists and local people observed this animal. Images and videos of the dorsal surface were obtained.

4) *Wadaura* beach (stranding): A young female gray whale was stranded at *Wadaura* beach, Minamiboso City, Chiba prefecture (35°2.085'N - 140°1.05'E) on 4 March, 2016. External measurement, sampling, and other research were conducted by researchers from the Tokyo University of Marine Science and Technology (TUMSAT) and the Kamogawa Sea World, the details of which are described in another chapter of this paper.

5) *Arai* beach (stranding): A young female gray whale was stranded at *Arai* beach, Ito, Shizuoka prefecture (34°58.06'N - 139°07.40'E) on 5 April, 2016. Two days before, this animal was found dead and floating near the coast of Atami city, approximately 15 km north of *Arai* beach. Researchers from the National Museum of Nature and Science, Tokyo conducted the research. According to the news released, this animal was a young female with a body length of 7 m.

3.2. Photo-Identification of Sighted and Stranded Animals.

The present study compared the external characteristics of each animals sighted and stranded during 2016 to identify individuals.

1) *Nishikawana* animal: The photograph of this animal was captured from the right side. Therefore, we compared the positions of the white spots on the flipper. These spots on the *Nishikawana* animal clearly coincided with those on the animal which was sighted at off *Kozushima* Island, during 2015 (**Figure 2**).

2) *Akasawa* animal: The photograph of this animal was captured from the right side. The photographs were of insufficient clarity to identify the individual definitively. However, from the white spots pattern of the body, this animal appears to be the same individual which was sighted at off *Nishikawana*.

3) *Miyakejima* animal: Dorsal surface of this animal was photographed from the pier of *Miike* port of *Miyakejima* Island. Compared to the dorsal view of the *Kozushima* animal, the positions of the barnacles are distinctly different. However, the white spots of the dorsal surface and around the nasal area coincided with those on the *Kozushima* animal (**Figure 3**). Therefore, we concluded that this animal is also the *Kozushima* animal.

Nishikawana (12 January, 2016)

Kozushima Island (20 March, 2015)

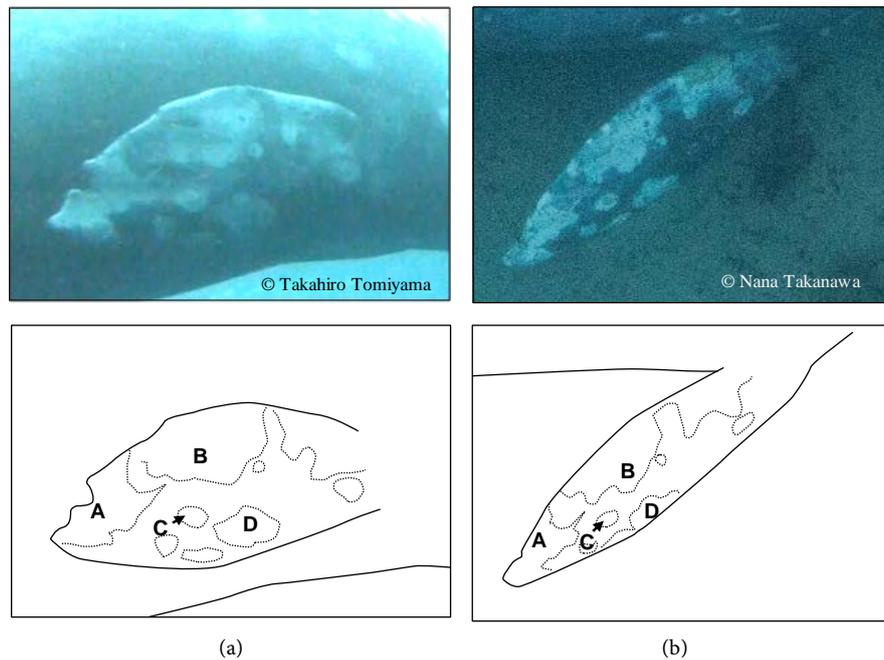


Figure 2. Comparison of the white spots of the right flipper between *Nishikawana* (a) and *Kozushima* animal (b). The shape and distribution of the white spots were matched. A; White spots at the tip of flipper. B; Largest white spots at dorsal ridge. C; White spots surrounded by A, B and D. D; White spots at the center of the flipper.

Miyakejima Island (9 February, 2016)

Kozushima Island (20 March, 2015)

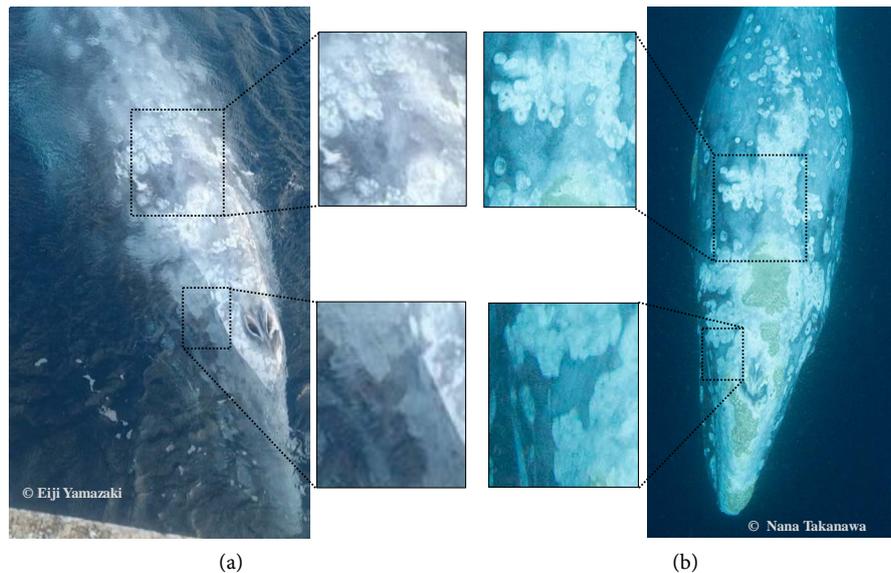


Figure 3. Comparison of the white spots of the dorsal surface between *Miyakejima* (a) and *Kozushima* animal (b). The shape and distribution of the white spots were matched.

4) *Wadaura* animal: This animal was found floating on its back and was pulled up with left side up. Therefore, we could not obtain sufficient images of the right surface. For the photo identification, we used the shape of the flipper. The *Nishikawana* animal (confirmed as identical to the *Kozushima* animal) had a notch

on the right flipper. On the other hand, in the *Wadoura* animal, such a notch was not observed (**Figure 4**). Therefore, we concluded that this animal must be a distinctly different individual from those previously reported.

5) *Arai* animal: When this animal was found, it had already been dead for a few days. The body was in an advanced stage of decomposition, and its skin had almost totally been removed. Therefore, we could not identify the individual from the photograph.

3.3. Status of the Stranded Animal at *Wadoura* Beach

On 4 March, 2016, a single dead gray whale was found floating outside the *Wadoura* beach, Minami-Boso City, Chiba prefecture (**Figure 5**, **Table 2**). When this animal was found, its intestines were protruding from its mouth and the smell of decomposition was evident. On the following day (5 March), the research staff of the TUMSAT and Kamogawa Sea World arrived at the site and conducted research. However, the site where the animal was floating was a shallow (0.5 - 1.0 m) rocky area and was not suitable for research. Therefore, the animal was towed by a boat to a sandy beach approximately three km south from the *Wada* port, where it was hoisted onto the beach using a power shovel. We collected images of the external body surface and skin samples for DNA analysis and ectoparasites, such as whale barnacles and whale lice. In addition, we measured body length, 21 external measurement points, and eight points of blubber thickness (**Appendix**). After the external observation, the animal was flensed for the internal observation and sampling of the bone structure.

This animal was a young female of 8.90 m in body length. The age of this animal was unclear because its ear plug was not yet fully developed or corrupted. Using the growth curve relating age and body length proposed by Sumich (1986) [13], this animal was estimated to be approximately 18 - 19 months of age. The blubber thickness was sufficient (4.0 - 17.6 cm), and the large intestine (protruding from its mouth) was filled with feces. We could not study other internal organs, such as the lungs, heart, stomach and ovaries, as they were decomposed and some had been lost outside the body. From the external observation, no

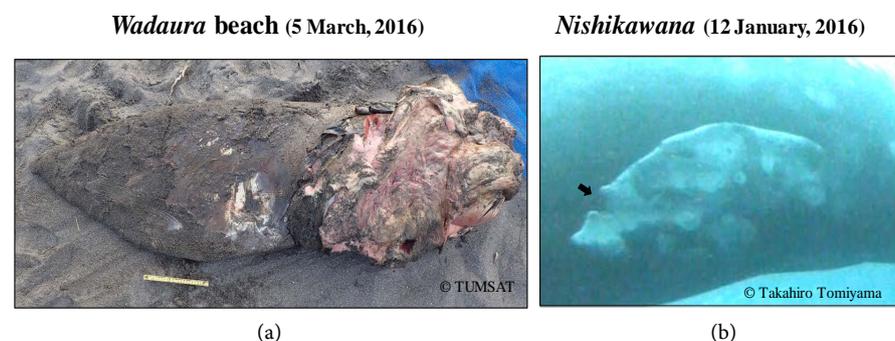


Figure 4. Comparison of the shape of the right flipper between *Wadoura* (a) and *Nishikawana* animal (b). Note that the picture of the flipper of *Wadoura* animal is showing inner surface. *Nishikawana* animal had a notch (pointed by the arrow) at dorsal ridge of flipper, whereas such notch was not observed in *Wadoura* animal.



(a)



(b)



(c)

Figure 5. The dead gray whales found floating at *Wadoura* beach, Chiba prefecture (a). Ventral surface (b) and left lateral view (c) of the animal, landed at the beach for observation.

human-induced injuries such as those from ship strikes or entanglement were observed. In addition, there were no traces of killer whale attacks. Therefore, we could not determine the cause of death of this animal.

4. Discussion

According to previous studies, this animal was firstly observed as a calf off Sakhalin during August 2014 [11] [12]. This indicates that this animal migrates to the coast of Japan and uses as migratory corridor for two consecutive years.

We could not define whether the animal stranded at Arai beach was the identical to the *Kozushima* animal or not only from its picture. Gray whale birth at 4.5 m in body length and reaches 7.0 m in six month after birth. After weaning, increase rate diminish and reach 8 m by one year and 9 m by two years [13]. The body length of the *Arai* animal was reported as 7 m. Therefore, this animal was

Table 2. Evidence of matching of the gray whale sighted off Sakhalin and the coast of Japan.

	Locality						
	A. Sakhalin	B. Kozushima	C. Niijima	D. Miho	E. Nishikawana	F. Akasawa	G. Miyakejima
A. Off Sakhalin Island, Russia August, 2014							
B. Off Kozushima Island, Tokyo 20 March, 2015		Weller <i>et al.</i> (2015)					
C. Niijima Island, Tokyo 24 March, 2015		Weller <i>et al.</i> (2015)	—				
D. Off Miho, Shizuoka 19 April, 2015		Kato <i>et al.</i> (2015)	—	—			
E. Off Nishikawana, Tateyama, Chiba 12 January, 2016	—	White spots of the right flipper were matched. (Figure 4)	—	—			
F. Off Akasawa, Ito, Shizuoka 14 January, 2016	—	—	—	—	White spots pattern on the right surface of the body were matched.		
G. Off Miyakejima Island, Tokyo 9 February, 2016	—	White spots on the dorsal surface were matched. (Figure 5)	—	—	—	—	

estimated about 6-month-old. On the other hand, from the sighting record, *Kozushima* animal was estimated to 20-month old [12], when *Arai* animal was stranded (April, 2016) and should be about 9 m in body length. Therefore, we concluded that *Arai* animal was not identical to the *Kozushima* animal.

From the historical record, 21 occurrences of gray whales have been noted from 1955 to 2014 [11]. Sighting rate was only 0.36 animals/year on average and the sighting of the gray whales around the coast of Japan is very rare. However, from 2015 to 2016, nine occurrences were noted. Present study revealed that within these sightings, some of them were re-sightings of the same animal. However, we also indicated that at least three distinct animals have been migrated to the Japanese coast in this period. The increase in the numbers of occurrence in these two years may indicate the recovery of the western gray whales. On the other hand, certain studies have suggested the possibility of the expansion of the eastern gray whales to the western gray whales feeding ground and mixing of these two stocks [14]. At present, the information is not enough to conclude whether the increase of the sightings is the result of the recovery of the western gray whales.

5. Conclusion

During 2015 through 2016, a total of seven sightings and two strandings of gray whales were recorded around the coast of Japan. Within these sightings, we concluded that at least three distinct animals were observed, one of which has been

recorded at Sakhalin during 2014 and at *Kozushima* during 2015. We found that this animal migrated to the coast of Japan for two consecutive years.

Acknowledgements

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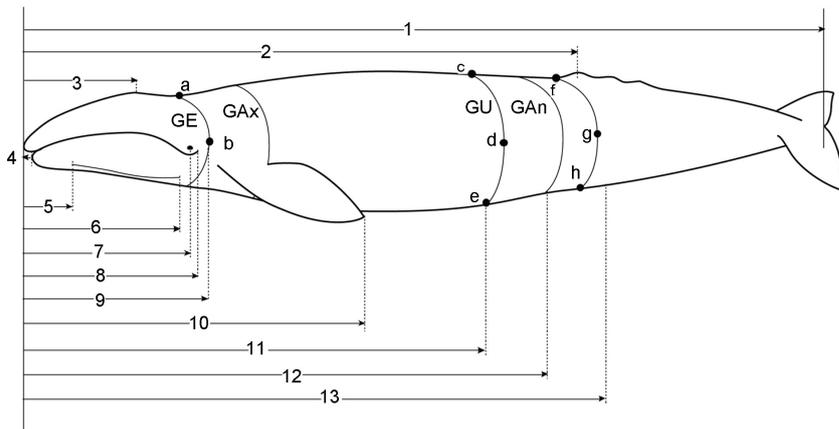
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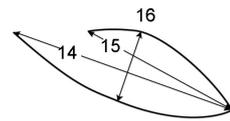
Appendix

Body proportion of the gray whale stranded at Wadoura, Japan.

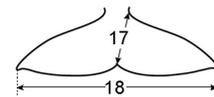
[Body proportion, girth and blubber thickness]



[Flipper]



[Tail fluke]



# Measurement point	cm	#	Measurement point	cm
1 Total length	890	GE	Girth at ear	193
2 Tip of snout to the highest point of dorsal fin	580	GAX	Girth at axilla	231
3 Tip of snout to blowhole	134	GU	Girth at umbilicus	203
4 Projection of tip of snout to lower jaw	10	GAn	Girth at anus	135
5 Tip of snout to the beginning of ventral groove	44	a	Blubber thickness at GE (dorsal site)	6.8
6 Tip of snout to the terminal point of ventral groove	196	b	Blubber thickness at GE (lateral site)	4.0
7 Tip of snout to eye (center)	152	c	Blubber thickness at GU (dorsal site)	14.6
8 Tip of snout to angle of gape	145	d	Blubber thickness at GU (lateral site)	8.8
9 Tip of snout to ear	198	e	Blubber thickness at GU (ventral site)	10.0
10 Tip of snout to tip of flipper	394	f	Blubber thickness at the front of the ridge (dorsal site)	17.6
11 Tip of snout to umbilicus	471	g	Blubber thickness at the front of the ridge (lateral site)	6.1
12 Tip of snout to reproductive aperture	584	h	Blubber thickness at the front of the ridge (ventral site)	10.8
13 Tip of snout to anus	629			
14 Flipper, tip to anterior insertion	143			
15 Flipper, tip to posterior insertion	117			
16 Flipper, maximum width	58			
17 Flukes, depth	77			
18 Flukes, tip to tip	216			

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