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Area V. Protection Nature and the Organization of Preserves

Project 6. Marine Mammals

CRUISE REPORT

USSR-US Joint Pinniped Research
ZRS Zaslonovo
Bering Sea
28 March - 21 May 1991

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REPORT OF PRELIMINARY DATA
USSR-US Joint Pinniped Research aboard the ZRS Zaslonovo, in the Bering Sea, 28 March - 21 May 1991

SUMMARY

Three US scientists joined four USSR colleagues aboard the USSR marine mammal harvest vessel, ZRS Zaslonovo, for a pinniped research cruise 28 March-21 May 1991. From 30 March through 18 May, 506 (265 females, 241 males) Pacific walruses (*Odobenus rosmarus divergens*,) were harvested in four primary regions in US and USSR waters: northwestern Bristol Bay south of Nunivak Island (N=130), off the Koryak coast (N=186), southeast of St. Lawrence Island (N=60), and in Anadyr Gulf (N=130). Samples were taken from 305 ice seals (182 bearded seals (*Erignathus barbatus*), 57 largha seals (*Phoca largha*), and 66 ribbon seals (*Phoca fasciata*), primarily south of St. Lawrence Island and along the USSR coast from Cape Navarin to the mouth of the Kamchatka River. In US waters, 198 walruses (190 harvested and 8 struck and lost) and 159 bearded seals (134 harvested and 25 struck and lost) were taken under Marine Mammal Protection Act (MMPA) Permit 734, which allowed the All-Union Scientific Research Institute of Marine Fisheries and Oceanography (VNIRO), Moscow, USSR, to take up to 200 walruses and 200 bearded seals.

Samples collected from harvested walruses and bearded seals included stomach contents, reproductive tracts, teeth for aging, muscle tissue for genetic analysis, and, for walruses only, a variety of tissues for histopathological analysis. Samples for contaminants analysis included tissues collected from 220 walruses, 62 bearded seals, 12 ribbon seals, and 7 largha seals; and samples of stomach contents from 24 walruses. Skulls from 6 walruses and 2 bearded seals were taken for educational display.

From the small hunting boats, biologists observed hunting techniques and effectiveness (37 observer-days), and age-sex composition of groups of walruses hauled out on ice (2417 walruses in 154 groups). Satellite-linked transmitters (Platform Transmitter Terminal, PTT) were placed on 7 adult female walruses; one male was tagged with a VHF radio tag. Marine mammals and birds seen from the bridge, and weather and ice conditions were noted.

BACKGROUND

This cruise was the most recent in a series of joint US-USSR pinniped research cruises that have been conducted under the USA-USSR Agreement on Cooperation in the Field of Environmental Protection, Area V. Protection of Nature and the Organization of Preserves, Project 6. Marine Mammals. Previous cruises have been aboard various USSR hunting-fishing vessels (ZRS-class), and both US and USSR research vessels. Previous cruises took place

follows:

Alpha Helix	Summer	1973
Zagoriany	spring	1976
Surveyor	Spring	1978
Zubarevo	August	1978
Zviagino	Spring	1981
Entuziast	Summer	1982
Zykovo	Summer	1983
Zakharovo	Autumn	1984
Zakharovo	Spring	1985
Zakharovo	Autumn	1987

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OBJECTIVES

The goal of the cruise was to collect data on reproductive status, general physical condition, and feeding ecology of walruses and bearded seals for determination of their present status in comparison with data collected on previous cruises. In addition, several specific research needs were addressed.

Walruses. The proportion of females classified as "early birth/ late abortion" has increased in recent years. The distinction is important for determining recruitment rate for population assessment. The period of this cruise spanned the main time of births and results will be useful in determining the proportion of very early births and very late abortions. We also investigated the difference in interpretation of placental scars from uteruses examined fresh and after preservation.

Samples were collected for contaminants analysis to: 1) add to baseline data of contaminant compounds and levels; and 2) determine correlations between concentrations of key contaminants and the age, sex, matrilineal group or collection location.

Information on movements and hauling-out behavior of female walruses in spring, summer and autumn was needed to continue work on quantifying biases in aerial survey methodology. PTTs adapted for use on walruses are being developed in cooperation with biologists from Greenland Fisheries Research Institute. The most recent modification had been tested on male Atlantic walruses (hauling out primarily on land), and needed to be tested on female Pacific walruses in the pack ice. Genetic differentiation between animals taken in different locations, different ice floes, and different days was investigated to determine the degree of interchange between breeding season concentration areas.

The amount of bias in the sample of walruses harvested was determined by comparing sex and age composition of animals seen to that of the animals harvested.

A number of other samples and data were collected opportunistically: milk for Dr. O. Oftedal, muscle and blood for Dr. M. Castellini, stomach contents for contaminants analysis for Dr. K. Miles, histopathological samples for D. Seagars, and skulls for educational display.

Bearded Seals. Information pertaining to physical condition, reproductive status, foraging ecology and distribution of bearded seals in the spring pack ice was collected on the USSR-US pinniped cruise aboard the ZRS Zvyagino in 1981. The objective of the 1991 bearded seal research was to collect comparable material to that of the 1981 study to help determine if bearded seals have under gone changes in condition indices. Other areas

of interest included baseline information on levels of contaminant compounds found in bearded seals, and collection of tissue samples for genetic analysis in the future.

METHODS

Study Area and Itinerary. Three US scientists joined four USSR colleagues, Captain Sergei V. Zaitsev and the crew of the USSR marine mammal harvest vessel, ZRS Zaslonovo, at Dutch Harbor, Alaska on 28 March 1991. The ship proceeded to northwestern Bristol Bay where walruses were hunted and radio-tagged southeast of Nunivak Island 30 March - 8 April (Fig. 1).

Heavy ice restricted movement to the north, so on 9 April the ship left for the USSR zone, sailing south of the pack ice and just north of the Pribilof Islands. Male walruses were hunted in broken ice south of Cape Navarin 12 April - 25 April. Heavy ice blocked passage north into Anadyr Gulf, and the ship moved south to Ust' Kamchatka to refuel and offload the harvest. Seals and walruses were taken en route in Olyutorsky Bay, Karaginsky Bay, and Kamchatka Bay.

The ship proceeded northeast toward St. Matthew Island on 2 May. Although concentrations of bearded seals were reported northeast of St. Matthew Island by an aerial observer under contract to USFWS, that area was not searched thoroughly or hunted. Walruses reported southeast of St. Lawrence Island at the same time were hunted and radio-tagged 9 - 10 May.

Although heavy ice blocked passage to the north of St. Lawrence Island, the waters to the south and west of the island were open so the ship moved west into Anadyr Gulf on 11 May. En route, a concentration of bearded seals was passed but not hunted. Bearded seals were hunted and one female walrus was radio-tagged on May 12 while the ship was idled due to a broken generator. Intensive walrus harvesting followed May 13-15.

The ship left Anadyr Gulf to return to Dutch Harbor on 15 May. A large number of bearded seals were found and hunted south of St. Lawrence Island on 16 May. The last walruses taken under the US permit were taken southeast of St. Lawrence Island 17 - 18 May. The ship then proceeded directly to Dutch Harbor for a three-day port call and resupply, arriving on 20 May. The US participants remained in Dutch Harbor to assist with the resupply and the transfer of medical supplies donated to the Children's Hospital in Korsakov, Sakhalin Island.

Walruses. Walruses resting on ice were killed by hunters working from a 7 m hunting boat, using high-powered 7.62 mm rifles. Harvested walruses were hoisted aboard the ship by crane and deposited on the main deck. Animals taken on one ice floe were marked on the head with the same color spray paint, either by the

hunters on the ice or by the scientists on the ship, and a numbered metal tag was affixed to the head. Animals were suspended and weighed (to nearest 0.5 kg) on a digital tension scale, dorsal zoological length and tusk length were measured (to nearest 0.5 cm, Fig. 2), the age was estimated (Fig. 3), and tusk shapes and fractures were recorded. When many animals were taken in a short time, it was occasionally not possible to measure the animal before the onset of rigor, which made accurate measurements impossible. Sternal blubber depth was measured (Fay 1982) and, on some animals, blubber depth was measured dorsally at 60% of the zoological length (Ryg et al. 1990).

Various biological samples were collected as the animals were butchered. Wherever possible these included: muscle for DNA analysis, stomachs, and ovaries and uterus or testes and epididymis. Unusual or pathologic conditions were noted and samples taken as appropriate. Samples for contaminant analysis from livers, kidneys, blubber, vibrissae, and hair were taken from representatives from different age and sex groups and harvest areas. Fetuses were processed similarly, usually at the conclusion of a butchering and sampling session. Four sets of teeth (for USFWS, TINRO, VNIRO and Okhotskrybvod) were collected from all animals except fetuses or calves of the year. Teeth were numbered and wrapped in paper for subsequent sectioning and age determination. All tissue samples except ovaries and teeth were stored in the ships' freezer at -20° C.

Ovaries were fixed in a solution of formalin in sea water. Stomach contents were rinsed in sea water, sorted, identified, counted, and volume determined. Voucher specimens were collected for future reference and samples of relatively undigested contents were taken for contaminants analysis. Testes were weighed and the presence or absence of sperm noted. Uterine horns were examined externally and internally; scars present were measured and the color noted for most animals. Uteri were then frozen for later preservation. Ovaries were sectioned serially, corpora measured and their color noted. Uteri and ovaries were saved for future detailed analysis.

Walruses were assigned a preliminary reproductive code based on the following criteria:

> Males - calf (<3 yrs old); juvenile (3-5 yrs), sperm absent; "teenager"(6-15 yrs), sperm absent, "teenager" (6-15) with sperm present; adult (> 16 yrs) sperm absent, adult (> 16 yrs), sperm present
>
> Female - calf (<3 yrs old); juvenile (3-6 yrs, no corpus albicans, corpus luteum or placental scar); adults (6+ yrs).

The tusks, teeth and bacula were kept for carving in the Soviet Union. Gall bladders were saved by the crew. Hearts, tongues,

and occasionally testes were often saved for consumption on the ship. The remainder of the harvested walruses, except for the skull, blood and intestines, were ground, quick-frozen, and packaged on the ship for animal feed.

PTT and VHF radio transmitters were attached to the tusks of adult walruses that had been immobilized with etorphine (Hills et al. in prep.) under Fish and Wildlife Marine Mammal Permit PRT 690715 to the Alaska Fish and Wildlife Research Center.

The sex and age composition of groups of walruses was noted (Fay and Kelly 1989) by scientists working in the small boats to observe the walrus *hunting* (see Hunting Observations section) and during radio-tagging. Although Fay and Kelly (1989) recommended assessing composition from the main ship, it was not possible on this cruise.

Ice Seals. Although the objectives for the US side were to collect only bearded seals, and only bearded seals were sampled in US waters, other ice seals hunted in USSR waters were processed in the same manner. Seals were hunted in a *manner* similar to that for walruses. Seals were processed both on board the ship and on the ice after scientists began working in the hunting boats. When whole animals were brought back to the ship, sex, weight (to the nearest .5 kg, Fig. 4) and the following morphometrics were recorded (Calkins et al. 1981, Merrick and Hills 1988): dorsal standard length, dorsal zoological length, ventral standard length, ventral zoological length, maximum girth, axial girth, and sternal blubber thickness. For animals processed on the ice, measurements were recorded prior to flensing and butchering... Animals--could-not- be--weighed-on the--ice but whole animals were brought back at the end of the day to sub-sample for weights. This method was successful only if seals were brought to the ship before the onset of rigor, which made some measurements impossible.

On both the ship and on the ice, biological samples were collected during butchering. Whenever possible these included teeth, or claws for aging, stomach and intestinal tracts, female reproductive tracts (males were checked for spermatogenesis when possible), and muscle tissue for mtDNA analysis. Large intestines were collected from animals whose stomachs appeared empty when they were butchered on the ice. On several occasions in the USSR zone when some of the hunting boats did not carry scientists, age, sex and reproductive information from carcasses was collected after hunting boats returned to the ship. Tissue samples from livers, kidneys and blubber for contaminant analysis were taken opportunistically.

All tissues, stomach and intestinal contents were frozen on the ship. Teeth and claws were boiled to remove remaining tissue and stored in paper packets. Bearded and ribbon seal ages were

estimated on the ship based on counts of annuli in the claws from the front and rear flippers. Canine teeth of largha seals were returned to NMML for future sectioning and age determination. Ice seal samples were imported under Permit to Import Marine mammals and Endangered Species Number 578, to NMML, Seattle.

When seals were processed on the ice, they were measured, skinned, and samples were taken; empty stomachs, intestines and some internal organs were then discarded. Gall bladders were kept by the crew. The skins and carcasses were stored in the hold and on the deck of hunting boats until they were delivered to the ship. One hunting boat could hold 12 to 17 bearded seals or 20 to 25 ribbon, ringed or largha seals before it was necessary to return to the ship. Filling a boat could take 4 - 16 hours. Once on the ship, all blubber was removed from the skins which were then stored in salt for processing on land. All other body parts were ground, quick-frozen and packaged for animal feed.

Hunting observations. USSR and US biologists often accompanied hunting crews in the small (7m) harvest vessels or "fangsbots." Crews generally consisted of a motorist, a deck hand, a hunter/captain, and a biologist or fisheries inspector. When seals were being hunted, one to seven boats would leave the ship when seals were sighted, often returning after dark. Only one boat hunted walruses, sometimes returning to the ZRS Zaslonovo during the day for meals or to move to a new hunting location.

A single observers' records from a boat on one day, regardless of returns to the ship, was considered an "observer - hunting day." Hunting was observed with 10 x 40 binoculars and recorded in field notes. Hunting data included: species, zone (USA/USSR), substrate (target animal on ice or in water), number of animals stalked (attempt made to come within shooting range), number not shot at (animals which left ice or dove before being shot at), number shot at and missed (observed bullet ricochet in water or on ice), number struck and lost (observed hit or blood present on ice or in water), number shot at with unknown consequence (no positive identification of blood or ricochet), and number killed and retrieved.

Marine mammal observations. A watch for marine mammals was maintained by at least one scientist on the bridge during many of the daylight hours when the ship was underway, especially when working in ice. Watches were kept less frequently when the ship transited through open water (e.g.. from Kamchatka to St. Matthew Island). Data recorded were: date, weather, position, time, ice, water depth, number and species of animal and, occasionally, behavioral notes.

RESULTS AND DISCUSSION

The results reported here are preliminary because most data and samples have not yet been analyzed. The majority of the analysis is planned for completion and reporting by the end of 1992, in cooperation with various USSR and US colleagues.

Walruses. Walruses were collected 30 March - 18 May in 4 main areas: southwest of Nunivak Island (Nunivak, N=130, 13 males, 117 females), along the USSR Koryak coast from Cape Navarin to Cape Olyutorsky (Koryak, N=186, all males), southeast of St. Lawrence Island (SLI, N=60, 36 males, 24 females), and in northern Anadyr Gulf (Anadyr, N=130, 6 Males, 124 females, Table 1). Of the 506 walruses taken, 265 (53%) were females and 241 (47%) were males.
All samples taken are stored at USFWS - Fairbanks, USFWS - Anchorage, TINRO - Magadan, or have been sent to various collaborators for analysis.

The majority of the calves were born in late April and early May. Of the 47 fetuses examined, 31 (66%) were females, 14 (30%) were males, and the gender was unknown for 2 (4%). Most (N=41) were taken 30 March - 6 April, near Nunivak. We returned 9 May from the Koryak coast (where only males were seen) to St. Lawrence Island (where females were found) and saw several placentas on the ice, as well as many newborn calves, many with the umbilicus still attached. Only 6 fetuses were taken after that date. The reproductive tracts have not yet been analyzed to determine the ratio of early births to' late abortions. Of the 247 females examined, 128 were lactating. Three milk samples were collected and frozen.

The heaviest male was 1468 kg and 381 cm long. The heaviest female was 1053.5 kg and 342 cm long. The smallest animals were fetuses (body weights averaged 52.6 kg, range 24.5 - 76.5 kg, N = 47). The combined weight of all walruses harvested and weighed, including fetuses, was 436,398.5 kg. Sternal blubber depths were very similar to those from spring 1981 (Sease 1984, Table 2).

Preliminary assessment of reproductive condition is summarized in Table 3. Sperm was present in 13 of 191 males checked for presence or absence of sperm; testes were weighed for 109 animals. Testes samples were collected for microscopic examination. Female reproductive tracts have not yet been analyzed.

The technique of painting animals taken together on the same ice floe with the same color resulted in 110 groups being marked. This information will be especially useful in interpretation of genetic and contaminant data. Contaminant samples were collected from 220 animals (Table 4). Muscle tissue for DNA analysis was collected from all animals but 5 fetuses.

A total of 2417 walruses in 154 groups were classified as to sex and age (Table 5) although sources of variance and bias have not yet been analyzed. Near St. Lawrence Island, the groups were largest (average group size = 23.7 walruses), with many adult females and newborn calves (calves/adult female = 73.2). In contrast, in Anadyr Gulf the average group size was 16.7 walruses, mostly composed of adult females and older young with very few calves (calves/adult female = 12.1). Near Nunivak Island, average group size was 4.7 with 37.9 calves/adult female. Hunters did not select females with newborn calves in the St. Lawrence Island area, and the difference between the take in this area (4 calves taken in harvest of 60 walruses (7%)) and the composition observed (407 calves classified in a total of 1302 animals classified (31%)) reflects this bias.

Overall, 205 (41%) of the 506 stomachs examined were not empty (Table 6), although 12 contained only milk, 7 had nematodes only, and 16 contained only rocks or gravel. Males taken near the Koryak coast had the largest amount of stomach contents by volume (average = 7527 ml, maximum 26,355 ml, Table 6). Prey from walruses taken at Nunivak and Koryak were different from each other and from those taken the northern Bering Sea (Table 7).

Near Nunivak, most animals ate *Echiurus echiurus*, and the bivalves *Spisula polynema*, *Serripes Qroenlandicus*, and tellinids, probably *Tellina lutea*. One stomach contained strips of seal skin and blubber; the species of seal was not determined. In the Koryak area, more bivalves of the genus Mya, were eaten as well as *Serripes groenlandicus*, and holothurians (*Cucumaria* sp.). Two stomachs contained sandlance (*Ammodytes hexapterus*). Stomachs from animals from Anadyr Gulf had similar prey items and sizes to those from St. Lawrence Island, (e.g.. gastropods and very small tellinids), and a similar percentage of animals had stomach contents (St. Lawrence Island = 27%, Anadyr = 30%), but the average volume was much less (68 ml and 1508 ml, respectively). Stomach contents from 17 animals were sampled for contaminants analysis of 5 main prey items: Echiurus, Mya_, Spisula, Serripes and tellinids.

Walruses that were darted with etorphine in April and May to allow attachment of radio-transmitters were more variable in their reaction to the drug than walruses darted at other times of year (Hills et al. in prep). Of the 18 animals for which darting was attempted, 3 were fitted with a PTT only, 1 received a VHF radio only, both a PTT and a VHF radio were deployed on 4 others. For 3 walruses the drug was not effective, 2 animals were either wrong sex or impossible to put the transmitter on, 2 shots were missed, 1 walrus died, and 2 animals left the ice before the drug took effect and were lost to sight (their fate is unknown). Of the 4 walruses with both PTT and VHF, one probably died shortly after immobilization; it was not resighted after it left the ice, and no signals have been heard from the PTT since the transmitter was deployed. Counting both unknown animals as deaths, 2 of the 4 deaths occurred in USSR waters, and 2 in US waters. Seven darts shattered when fired, perhaps due to cold.

Data for walruses with PTTs is summarized in Table 8. Raw locations received from the PTTs through 31 August are shown in Figs. 5-10. Only PTT 8434 transmitted after 31 August and it ceased regular transmissions on 9 September. Some locations shown are probably not accurate (e.g.. positions on land); the data have not yet been analyzed for location quality. Positions for August and September are not yet available from ARGOS. Daily PTT locations were plotted relative to ice cover and showed that the walruses stayed close to the southern margin of the ice.

Bearded Seals Of the 182 bearded seals taken, information was collected from 133 animals in the US zone (1 was butchered before data could be collected), and 48 in the USSR zone. Hunting occurred in four main areas: Bristol Bay (N=9), Cape Navarin (N=9), Anadyr Gulf (N=39) and southeast of St. Lawrence Island (N=125). A total of 132 females (73%) and 49 males (27%) was taken. Bearded seals were separated into categories of pup, sub-adult (males 1-6 yrs, females 1-5 yrs) and adult (Burns 1986) based upon counts of annuli in the claws and length and weight measurements for seals whose claws were not collected or have not yet been analyzed (Table 9). A sub-sample of 45 seals were weighed, 11 of which had only the dorsal zoological length (DZL) taken due to the onset of rigor. The heaviest male was 307 kg and 240 cm DZL. The heaviest female was 375 kg and 244 cm (DZL). Length, weight, girth and blubber measurements are summarized for adult bearded seals in Table 10.

Reproductive tracts were collected from 106 females and a small number of males were examined for spermatogenesis. Analysis of reproductive material is not yet complete.

Undigested prey remains were found in 84 stomachs and trace remains were collected from 11 others. Stomachs from 5 pups contained milk. Fifty-four large intestines were taken from animals with empty stomachs and 19 from animals with stomach contents to examine the relationship between food remains in the stomach and large intestine.

Liver, kidney and blubber tissue samples were collected for contaminants analysis from a range of bearded seals in each hunting area (Table 11). Muscle tissue was obtained from 169 animals. A detailed series of measurements of blubber depth, and girth were taken from five bearded seals to study the relationship between girth, blubber depth and total fat volume (Gale 1987). Lower jaws were collected from 19 bearded seals. All samples are at NMML, Seattle or USFWS, Anchorage.

Larqha and Ribbon Seals Information was collected from a total of 57 largha and 65 ribbon seals during 3 days of hunting in Karaginsky Bay and 1 day in Kamchatka Bay. An additional ribbon seal was taken near Cape Navarin. The sex composition of the ribbon seals was 31 male, 34 female and 1 unknown. The largha sample consisted of 26 females and 30 males. Age composition data is not available at this time.

Morphometrics, reproductive tracts from females, stomach contents and tissue samples were collected for 46 ribbon seals and 44 largha seals by scientists working in the hunting boats. Female reproductive tracts (when intact after butchering) and tooth and claw samples were taken from an additional 19 ribbon and 13 largha seal carcasses brought to the ship. Rear claws were collected for age analysis from 56 ribbon seals and upper canine samples were taken for 47 largha seals. Female reproductive tracts were taken from 17 largha and 16 ribbon seals. Prey remains were collected from 16 largha and 16 ribbon seal stomachs. Liver, kidney and blubber tissue samples were collected for contaminant analysis (Table 11). All samples are at NMML, Seattle or USFWS, Anchorage.

Hunting Observations. A total of 37 observer-hunting days were spent in the fangsbots by the scientific crew (Table 12). Hunting was observed for a few additional days near Nunivak Island, but data have not yet been exchanged. The number of days observed, by species, (Table 13) differs from the total observer days because, on several occasions, multiple species were taken on the same day.

The number of animals struck-and-lost (Table 14) should be viewed as conservative estimates because we included only those cases where there was a direct observation of wounding or some positive evidence of a hit (e.g.. blood on ice or water). It is possible that some of the animals in the "unknown" category were also struck and lost. Although we do not know that hunters did not alter their hunting strategy when observers were present, after working with hunters almost daily for two months and seeing the range of hunting skill and success, we think that our presence had little or no effect on techniques or hunting success. The relatively low number of animals struck and lost are likely attributable to several factors including: our conservative criteria, experienced hunters, close approach to facilitate extreme selectivity, a general avoidance of hunting walruses in the water, and being prepared to capture wounded animals in the water (e.g.. harpoons with floats readily available and used). The effect of these factors is also seen in the difference in loss rates for seals hunted in the water or on the ice (Table 14).

Marine mammal observations., observations were recorded for 29 days, 15 April- 16 May. Log books were kept in both Russian and English and have not yet been compiled.

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Table 1. Summary of number and ages of walruses taken in Bering Sea, March-May 1991, on the USSR-US pinniped research cruise on the ZRS Zaslonovo.

Area	Date	Total	Males	Females	Fetus			Calf		1 Yr		2 Yrs		3 Yrs		4-5 Yrs		6-9 Yrs		10-15 Yrs		16-25 Yrs		>26 Yrs		Unknown		# groups marked
					M	F	U	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
Nunivak	03/30	21	2	19	1	3												1	4		8	1	5		1		1	4
	03/31	7	2	5	1	1				1											2		2	1	1			2
	04/01	1	0	1																	1							0
	04/02	8	1	7	1		1						1	1							5		1					3
	04/03	26	2	24	1	6		1										1	2		9		10		3			4
	04/04	20	2	18	2	4	1							2					4		2		9		3			4
	04/05	22	2	20	2	5				1									4		10	1	5		1			5
	04/06	25	2	23	3	9														1	7	1	11		4		1	4
Koryak	04/12	15	15	0																2		5		7		1		3
	04/14	40	40	0														4		8		16		12				6
	04/15	10	10	0																2		4		4				2
	04/17	8	8	0																3		3		2				2
	04/19	34	34	0																9		18		7				7
	04/20	12	12	0																5		5		2				4
	04/21	18	18	0																5		8		5				4
	04/22	17	17	0														1		2		8		6				5
	04/23	11	11	0																4		5		2				3
	04/24	14	14	0														1		5		6		2				5
	04/25	7	7	0														1		2		3		1				2
SLI	05/09	31	23	8				1	1									5	1	7	3			1	1	1		7
	05/10	7	2	5												1			2	1	1		1		1			1
Anadyr	05/12	2	0	2																	2							1
	05/13	47	1	46	1				1		1			1	1		3		10		9		15		6			10
	05/14	23	1	22	1	1			1								1		4		4	1	6		6			4
	05/15	58	4	54	1	2			3			1	1	1		1	4		7		11	1	21		5		2	12
SLI	05/17	16	7	9				1							1	1		1	1	2	3	2	3		1			4
	05/18	6	4	2				1											2	1		2						2
TOTALS	27	506	241	265	14	31	2	4	6	2	1	1	2	5	2	3	8	15	41	59	77	98	91	52	33	2	4	110

Table 2. Blubber measurements (mm) of walruses taken from the USSR-US pinniped cruise on the ZRS Zaslonovo, April-May 1991, Bering Sea and from the USSR-US pinniped cruise on the ZRS Zvyagino, February-March 1981, Bering Sea (Sease 1984).

	Dorsal Blubber Thickness (60% Total Len)		Sternal Blubber Thickness	
	ZRS Zaslonovo		ZRS Zaslonovo	ZRS Zvvagino
		MALES		
Mean	33.7		32.5	32.60
Std. Dev.	10.7		10.1	7.70
Range	8-69		12-64	15-54
Number	176		204	85
Mean	40.1	FEMALES	36.1	39.61
Std. Dev.	9.1		9.7	8.98
Range	21-66		10-64	24-68
Number	139		249	87

Table 3. Preliminary reproductive codes of walruses harvested during the USSR-US pinniped cruise on the ZRS Zaslonovo, AprilMay 1991, Bering Sea.

Age Group	Males	Females
Calf	8	7
Juvenile	7	11
“Teenager” sperm absent	63	
“Teenager” sperm present	7	
Adult (sperm absent)	112	
Adult (sperm present)	6	
Adult		240*
Status Undetermined	38	7
Totals	241	265

* Female reproductive tracts have not yet been analyzed in detail.

Table 4. Walrus tissues sampled for contaminants analysis on the USSR-US pinniped cruise on the ZRS Zaslonovo, April-May 1991, Bering Sea.

		Tissues to be Analyzed			
Region of collection	Class	Kidney	Liver	Blubber	Vibrissae
Nunivak Island	M	10	10	-	2
	F	67	68	3	7
	fetal	17	17	1	1
Koryak coast	M	49	48	7	4
St. Lawrence Island	M	10	9	7	-
	F	11	10	10	1
Anadyr Gulf	M	5	5	5	5
	F	43	43	14	13
	fetal	8	8	3	3
TOTAL		220	218	50	36

Table 5. Summary of sex and age composition data and preliminary recruitment calculations for walruses seen during the USSR-US pinniped research cruise on the ZRS Zaslonovo_, April-May 1991, Bering Sea.

AREA	Total Groups	Total Walruses	MEAN #/ GRP	CALVES/100 AD FEMALES	CALVES	ADULT FEMALES
Nunivak	29	136	4.7	37.9	22	10
Koryak	18	110	6.1	0	0	0
Anadyr	52	869	16.7	12.1	66	544
St. Lawrence Island	55	1302	23.7	73.2	407	556
Totals	154	2417	15.7	44.6	495	1110

Table 6. Summary of stomach contents of walruses taken in the Bering Sea, March-May 1991, on the USSR-US pinniped research cruise on the ZRS Zaslonovo.

Area	Total Walruses Taken	Stomachs w/ Contents (% of Total)	Samples (M/V)*	Average Volume	Number of Subsamples	Milk Only	Parasites Only**	Sediments Only
Nunivak	130	39 (30%)	6/13	1197		4	1	2
Koryak	186	111 (60%)	14/5	7527	48	0	5	4
SE St. Lawrence	60	16 (27%)	0/1	1508		4		
Anadyr	130	39 (30%)	0/0	68		3	1	10
Total	506	205 (41%)	20/19	4508	48	12	7	16

* M = samples taken for analysis of contaminants in stomach contents V = voucher specimen taken
** Minimum number, presence of parasites not always noted

Table 7. Percent occurrence of prey types in stomachs of walruses taken on the USSR-US pinniped research cruise on the ZRS Zaslonovo, April-May 1991, Bering Sea.

Area	Stomachs w/ contents (% of total)	Fish	Seal	Anemone	Polychaetes	Echiurus	Priapulus	Gastropods	Siliqua	Spisula	Serripes	Tellinids	Mya Turncata	Mya Aremaria	Mya III	Mya sp.	Crustaceans	Cucumaria	Tunicate	Unidentified Fragments (ml)	Sediments
Nunivak	39 (30%)		1 3%		28 72%	15 38%		25 64%	3 8%	16 41%	16 41%	18 46%	9 23%	1 3%			15 38%	2 5%	7 18%	23 59%	17 44%
Koryak	111 (60%)	2 2%		2 2%	17 15%		5 5%	14 13%		2 2%	52 47%	1 1%	52 47%	20 18%	47 42%	5 5%	20 18%	52 47%	4 4%	65 59%	28 25%
SE St. Lawrence	16 (27%)					1 2%	1 2%	12 20%			4 7%	1 2%		1 2%			5 8%		1 2%	3 5%	4 7%
Anadyr	39 (30%)						5 13%	16 41%			2 5%	7 18%					3 8%		1 3%	4 10%	22 56%
Total	205 (41%)	2 1%	1 1%	2 1%	45 22%	16 8%	11 5%	67 33%	3 1%	18 9%	74 36%	27 13%	61 30%	22 11%	47 23%	5 2%	43 23%	54 26%	13 6%	95 46%	71 35%

Table 8. PTT number, deployment date, last transmission date, estimated age, and presence of calf for female walruses radio-tagged in the Bering Sea, April-May 1991.

PTT	Est. Age	Calf? (age)	Deployment Date	Last trans-mission	Total Days
8424	30	no	8 April	9 August	124
8430	25	no	10 May	7 June	29
8432	18	yes (newborn)	12 May	25 June	45
8434	18	yes (newborn)	10 May	9 Sept	123
8438	15	no	9 May	9 June	32
8439	17	yes (1 yr.)	8 April	20 August	135

Table 9. Preliminary assessment of ages of bearded seals taken on the USSR-US pinniped cruise on the ZRS Zaslonovo, April-May 1991, Bering Sea.

Age Class	Male	Female
Pup	3	11
Sub-Adult*	24	10
Adult	22	111
Totals	49	132

* males 1-6 years old, females 1-5 years old

Table 10. Summary of morphometric data from adult bearded seals taken during the USSR-US pinniped cruise, on the ZRS Zaslonovo, in April-May 1991, in the Bering Sea.

	Number	Average	Minimum	Maximum	St. Dev.
Dorsal Zoological Length					
Male	16	231.5	216	250	9.1
Female	105	233.9	177	288	12.9
Dorsal Standard Length					
Male	14	216.6	205	240	11
Female	92	214.5	164	278	12.9
Weight					
Male	4	275.1	256	307	22.6
Female	20	278.1	204.5	375	52.8
Axial Girth					
Male	14	157.9	145	175	8.9
Female	100	148.8	120	185	8.9
Maximum Girth					
Male	14	169.1	161	196	7.7
Female	100	166.7	126	200	12
Sternal Blubber Thickness					
Male	15	5	3.5	6.5	0.8
Female	93	4.5	1.6	7.7	1.1

Table 11. Summary of kidney, liver and blubber samples from ice seals taken during the USSR-US pinniped research cruise, on the ZRS Zaslonovo, in April-May 1991, in the Bering Sea.

Region of Collection	Bearded Seal	Largha Seal	Ribbon Seal
S.W. Nunivak Island			
Male	3		1
Female	7*		
Cape Navarin			
Male	3**		
Female	6**		
Karagin Gulf			
Male		4	5
Female		2***	4
Kamchatka Gulf			
Male		1	1
Female			1
Anadyr Gulf			
Male	5**		
Female	13**		
S.E. St. Lawrence Island			
Male	19		
Female	6		
Totals	62	7	12

Table 12. Summary hunting observations on the USSR-US pinniped cruise on the ZRS Zaslonovo, April-May 1991, Bering Sea.

Species	Zone	Substrate	Stalked	Not Shot At	Missed	Shot at and: Struck/Lost	Unk.	Taken
Or[1]	USA	Ice	253	228	7	2	0	16
Or	USSR	Ice	267	198	0	4	3	61
Eb[2]	USA	Ice	184	31	16	21	11	105
Eb	USA	Water	21	9	3	3	1	5
Eb	USSR	Ice	70	12	4	6	7	41
Eb	USSR	Water	18	10	1	1	3	3
P13	USSR	Ice	98	26	19	6	6	41
Pt	USSR	Water	8	2	3	1	1	1
Pf[4]	USSR	Ice	63	8	1	5	3	46
Pf	USSR	Water	1	0	0	0	0	1
Ph[5]	USSR	Ice	2	1	0	0	0	1
P?[6]	USSR	Ice	10	6	1	0	0	3
P?	USSR	Water	5	2	3	0	0	0

or = walrus
Eb = bearded seal
P1 = largha seal
Pf = ribbon seal
Ph = ringed seal (Phoca hispida)
P? = unidentified phocid

Table 13. Number of observer-days of hunting observations on the *USSR-US* pinniped cruise on the ZRS Zaslonovo, April-May 1991, Bering Sea.

Species	Observer Days	
	USSR	*USA*
Walrus	6	2
Bearded Seal	12	8
Other Phocids	15	-
Totals	33	10

Table 14. Minimal estimates of struck-and-lost rates for hunting during the USSR-US pinniped cruise on the ZRS Zaslonovo, April

May 1991, Bering Sea. of animals struck and lost on:

Species	ICE	WATER
Walrus	6.4	-
Bearded Seal	12.7	20.0
Other Phocids	8.3	10.0

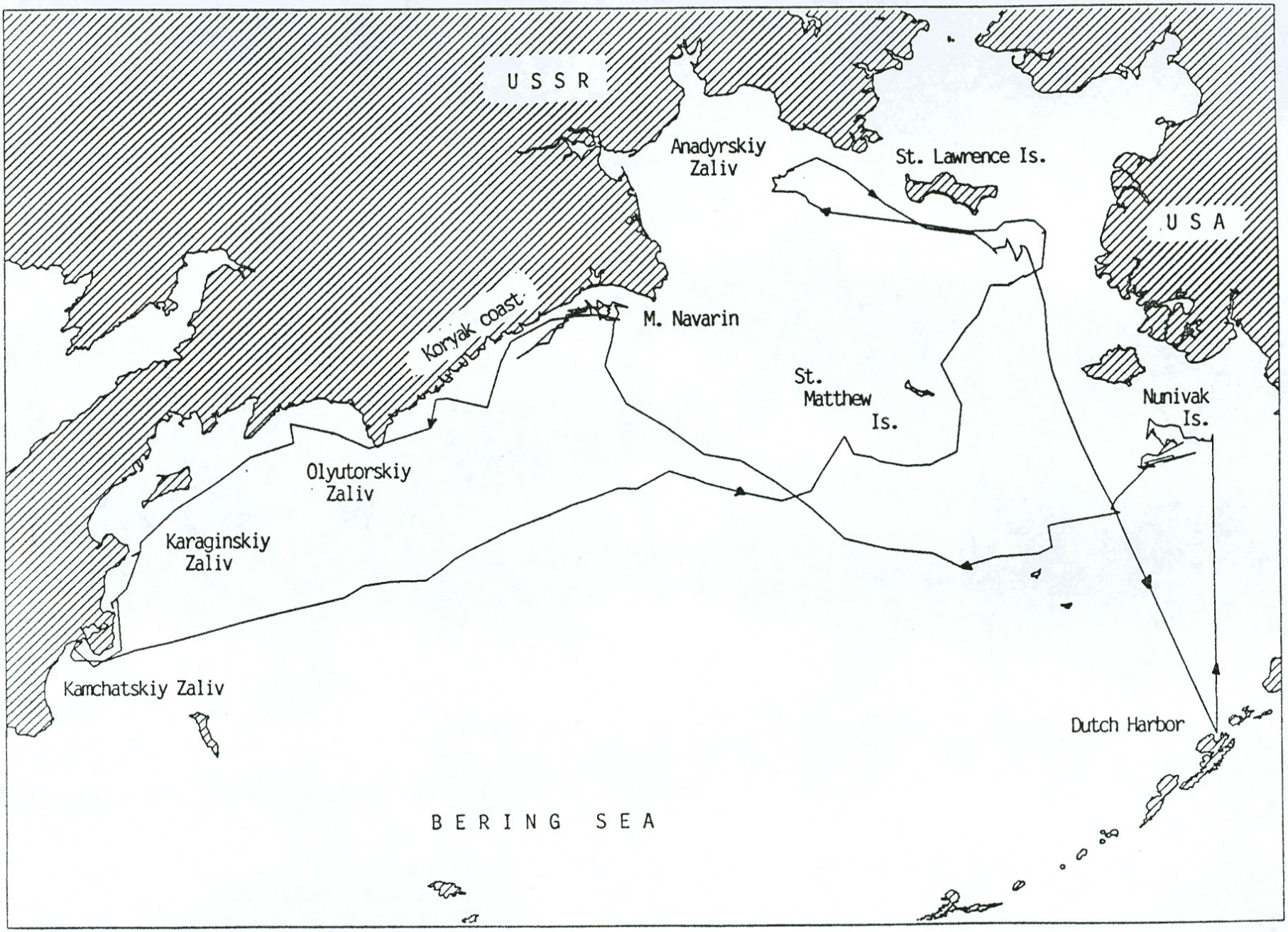
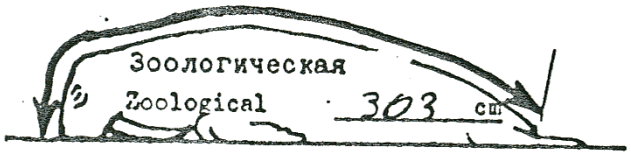


Figure 1. Cruise track of ZRS Zaslonovo in the Bering Sea, March 28 - May 21, 1991.

Последовательный №
Sequential No. 3

Метка № Tag No:____ Дата: Date: 7/30 A M Пол: М Ж Sex: M (F) Оценичный возраст: Estimated age: 10-15 13. Зубный возраст: Tooth age:____

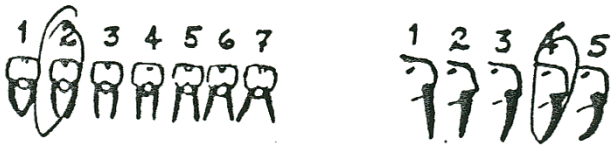
Место: Location: 59°40.7 C N 164°13.3 З W Вес тела: Body Weight: 613.0 кг kg



группа цвет
Group Color taken alone.

Клыки Tusks: Длина Length: 46.0 cm Перелом Fractured: П Л R L none Нов.-Стар.-Количество New - Old - Amount ____ cm

Форма Form:



Морда: Ширина Snout: Width____ Глуба Depth____ Кол. клыка покрыва по губе: впер. бок. Amt. Tusk Covered by lip: Ant____ Lat____

Толщина сала на груде Thickness of blubber, sternal: 2.6 Линька: процент меха линяли: Molt: percent hair shed: 16

Образци Samples: Крови Blood Молоко Milk Сала Blubber Сердце Heart Печень Liver Желудок Stomach Contaminants Kidney

Uterine Horns
Ovaries

Tissue Contaminants:

Органы Размножения-Самец: Вес семенников без эпидидимисов
Reproductive Organs - Male: Weight of testes w/o epididymides: ____ g

Самок: Плаценталные шрами: Ширина Цвет Female: Placental Scars: R Width: ___ cm Color: ____; L Ширина Width: ___ cm Цвет Color: ____

Яичники: Диаметр сам. болш. фолл. Желтая тела Рубцев
Ovaries: R Diam. largest follicle ___ mm; Corp. luteum ___ mm; C. albicantia ____

L Diam. largest follicle ___ mm; Corp. luteum ___ mm; C. albicantia ____

Эмбрион: Fetus: Пол Sex: M F Вес Weight: ___ kg

Длина Length: Нос-хвостовая Nose-tail ___ cm

Макушко-кресцовая Crown-rump: ___ cm

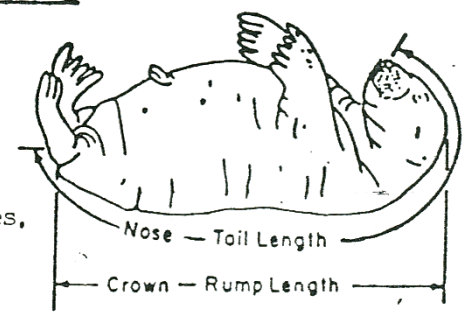


Figure 2. Data sheet used for walruses.

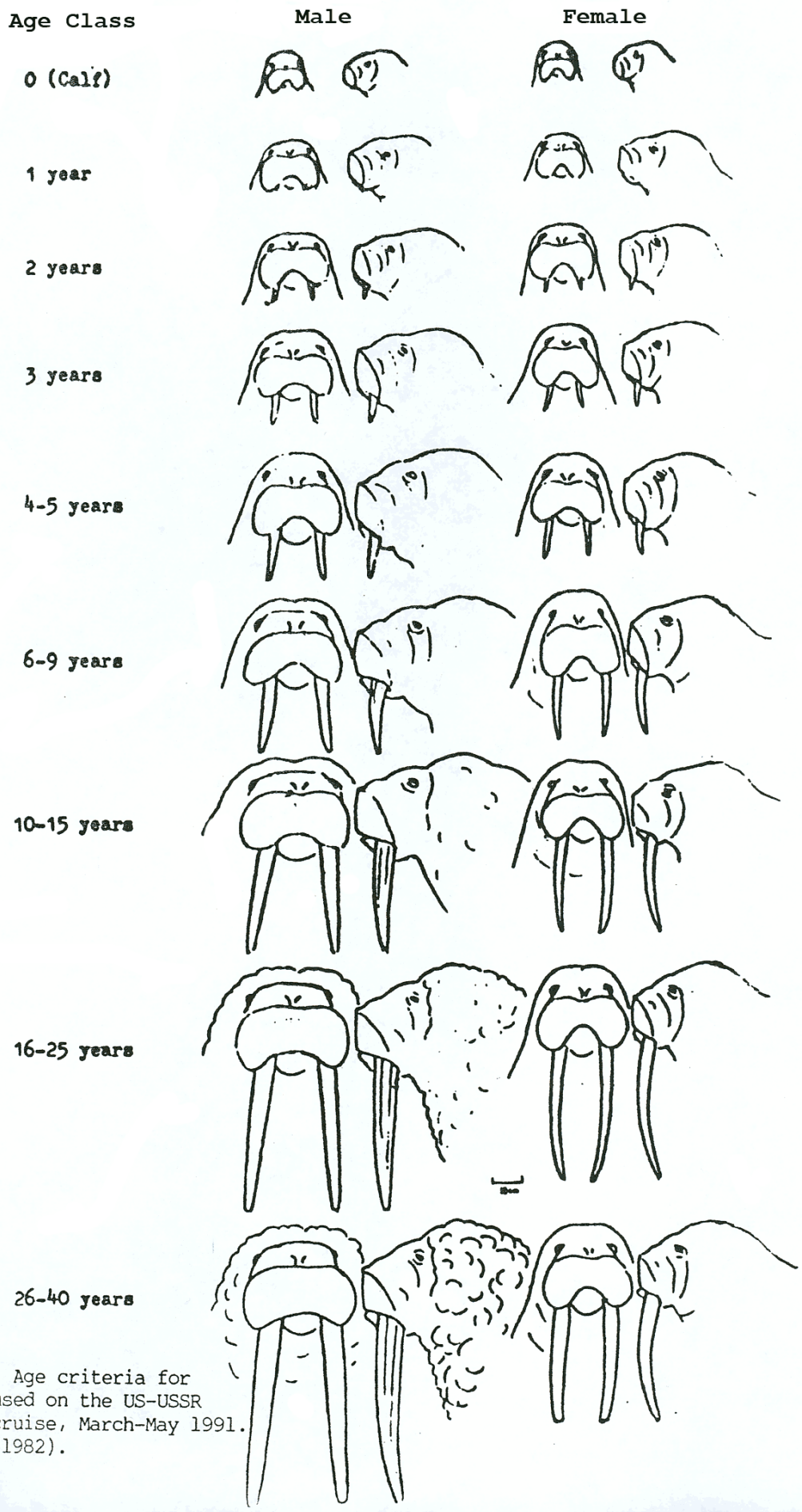


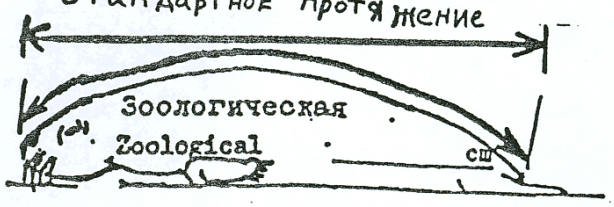
Figure 3. Age criteria for walruses used on the US-USSR pinniped cruise, March-May 1991. (from Fay 1982).

Sequential No. _____

Метка № Дата: С О Пол: М Ж Оценичный возраст: Зубный возраст:
Tag No:_____ Date:___S O Sex: M F Estimated age:_____ Tooth age:_____

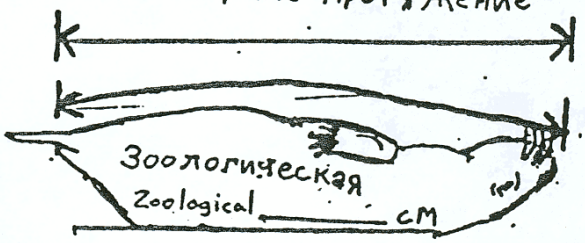
Место: С З Вес тела: кг
Location:_____ N W Body Weight:_____ kg

STANDARD LENGTH _____ CM
СТАНДАРТНОЕ ПРОТЯЖЕНИЕ



СПИНА
BACK

STANDARD LENGTH _____ CM
СТАНДАРТНОЕ ПРОТЯЖЕНИЕ



ГРУДЬ
CHEST

FRONT FLIPPER
ПЕРЕДНИЙ ЛАСТ _____ cm

REAR FLIPPER
ЗАДНИЙ ЛАСТ _____ cm

MAXIMAL GIRTH
МАКСИМАЛЬНЫЙ ОБХВАТ _____ cm

Толщина сала на груде
Thickness of blubber, sternal:_____

Линька: процент меха линяли:
Molt: percent hair shed:_____

Образцы Крови Молоко Сала Сердце Печень Желудок Коготь Зуб
Samples: Blood. Milk Blubber Heart Liver Stomach Contaminants Claw Tooth

Tissue Contaminants:

Органы Размножения-Самец: Вес семенников без эпидидимисов
Reproductive Organs - Male: Weight of testes w/o epididymides:_____ g

Самок: Плацентальные шрамы: Ширина Цвет. Ширина Цвет.
Female: Placental Scars: R Width:___cm Color:_____; L Width:___cm Color:_____

Яичники: Диаметр сам. болш. фолл. Желтая тела Рубцев
Ovaries: R Diam. largest follicle___mm; Corp. luteum___mm; C. albicantia_____

L Diam. largest follicle___mm; Corp. luteum___mm; C. albicantia_____

Эмбрион: Пол Вес
Fetus: Sex: M F Weight:___kg

Длина Нос-хвостовая
Length: Nose-tail___cm

Макушко-крестцовая
Crown-rump:___cm

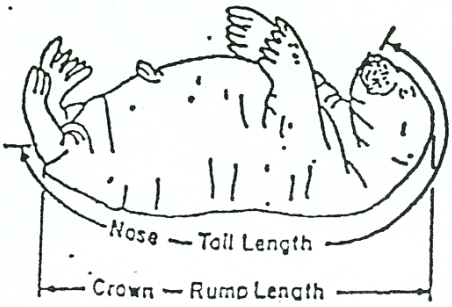


Figure 4. Data sheet used for Bearded seals.

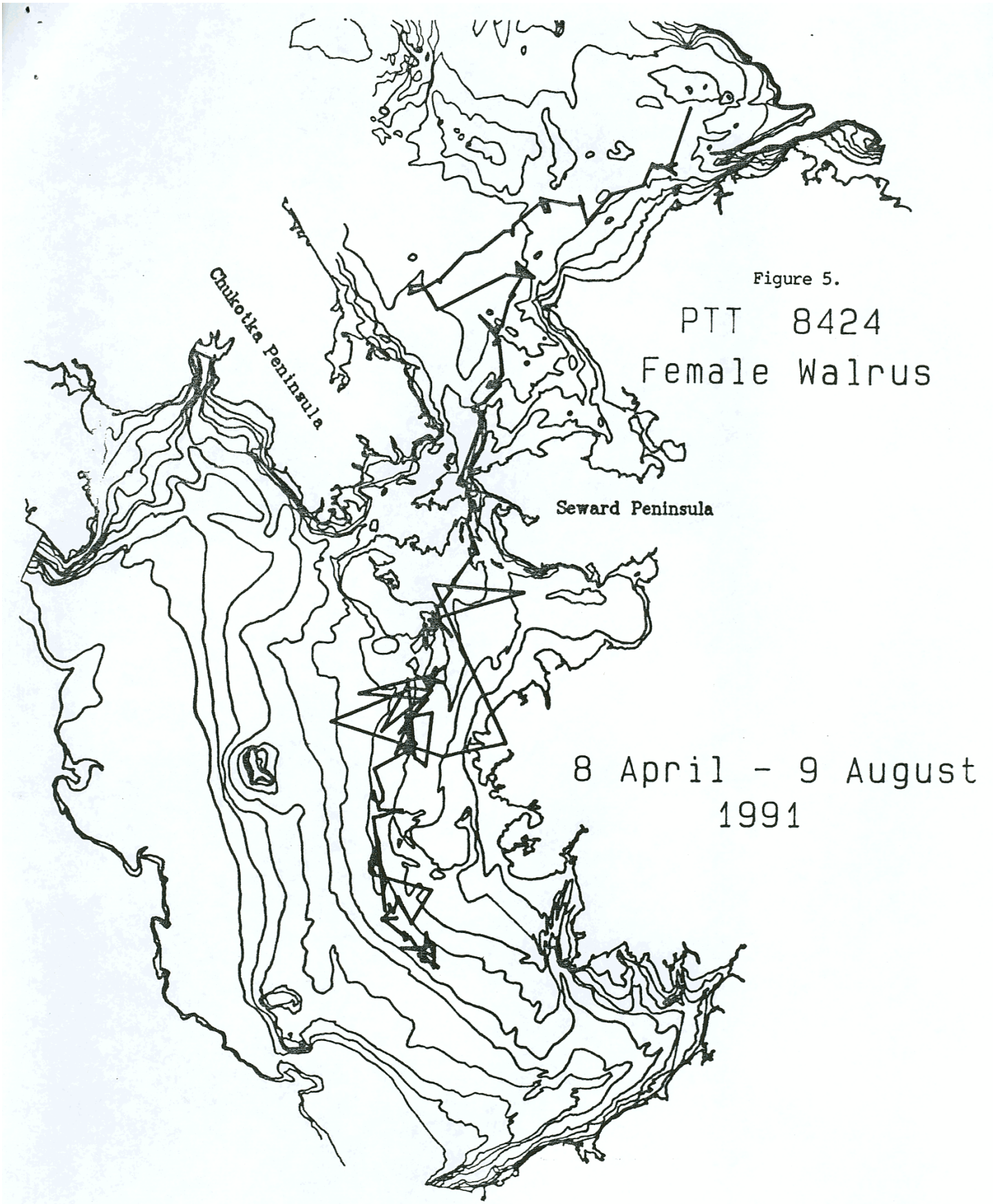

Chukotka Peninsula
Seward Peninsula
PTT 8424
Female Walrus
8 April - 9 August
1991

Figure 5.

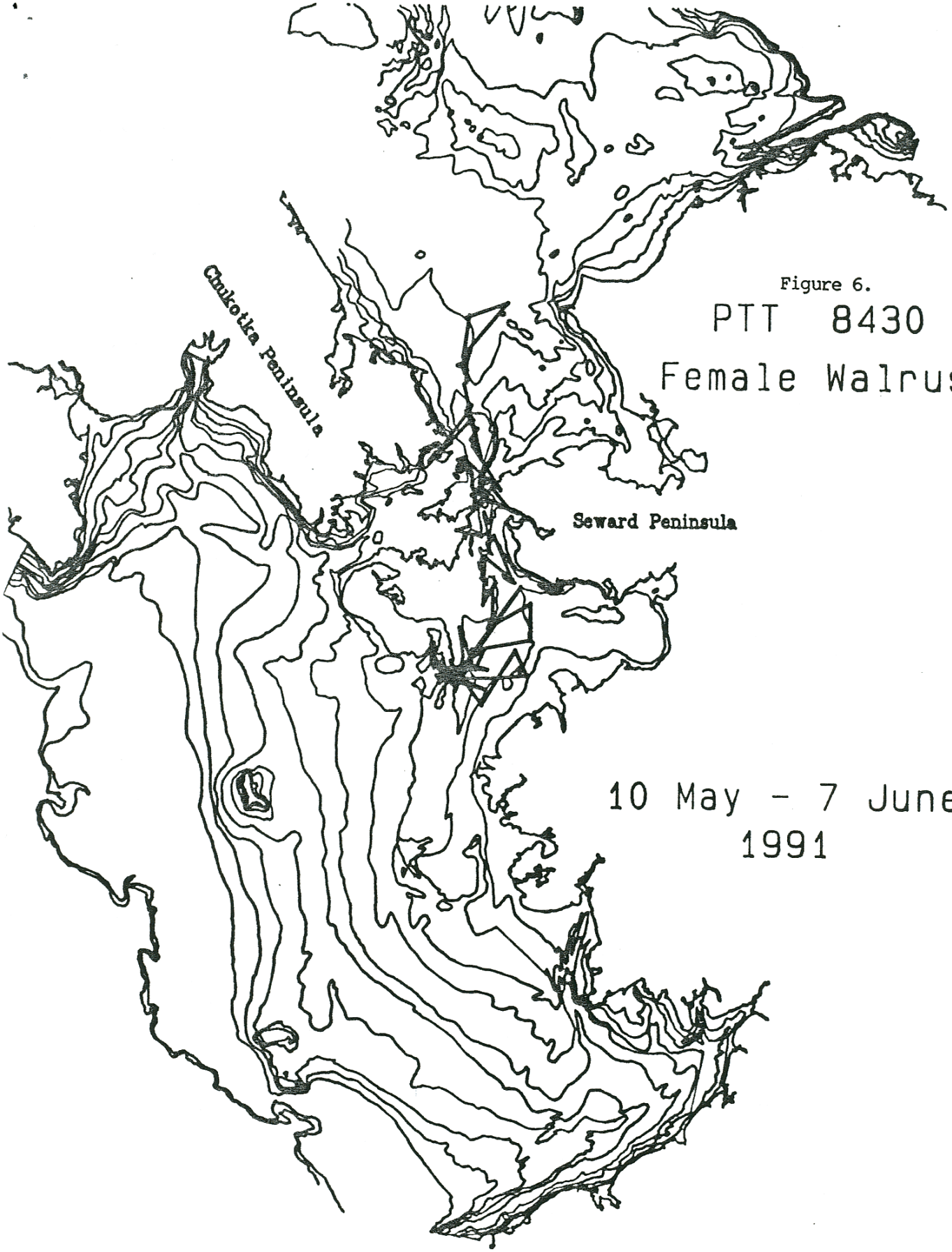


Figure 6.

PTT 8430

Female Walrus

10 May - 7 June

1991

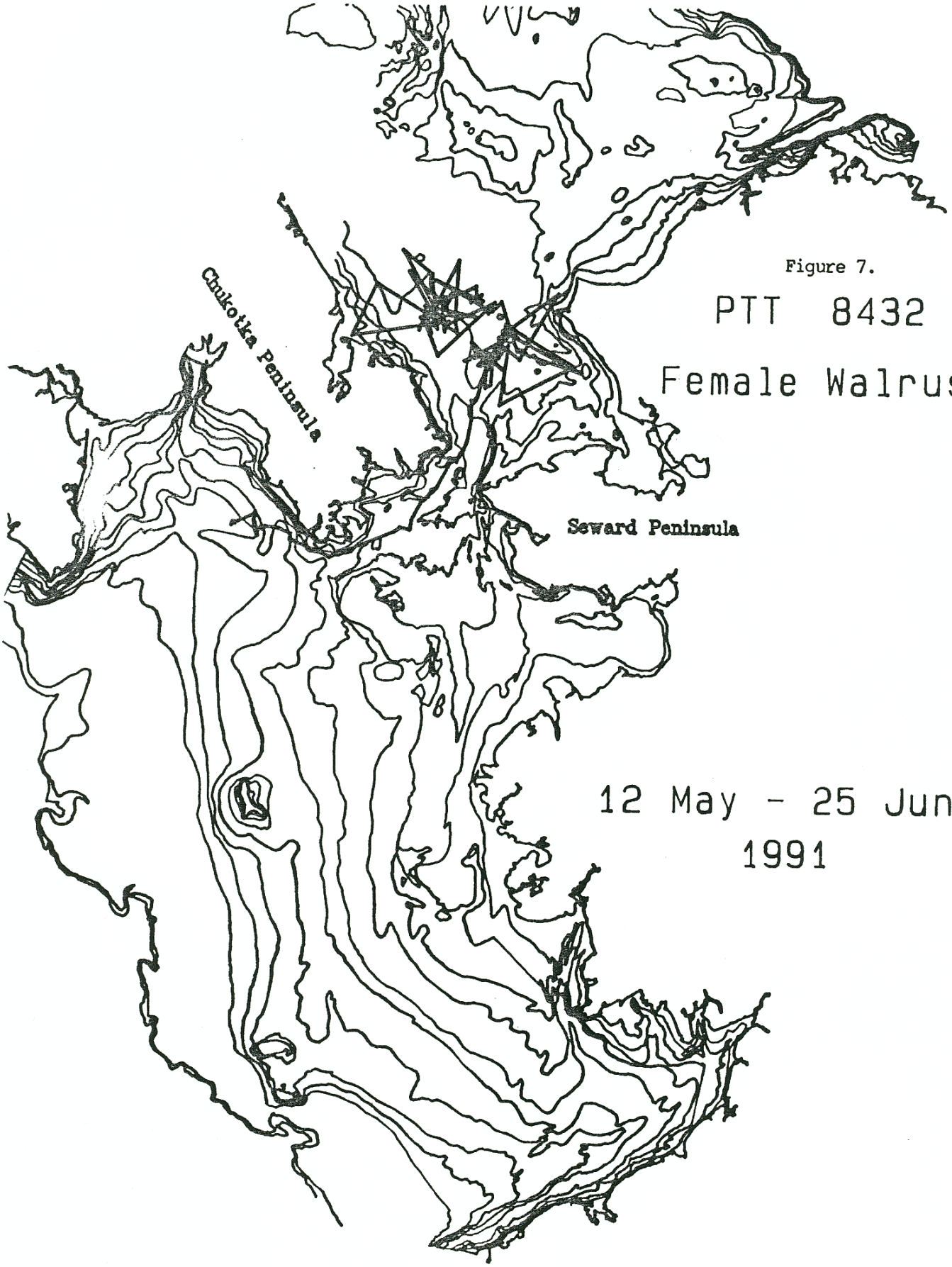


Figure 7.

PTT 8432

Female Walrus

12 May - 25 June

1991

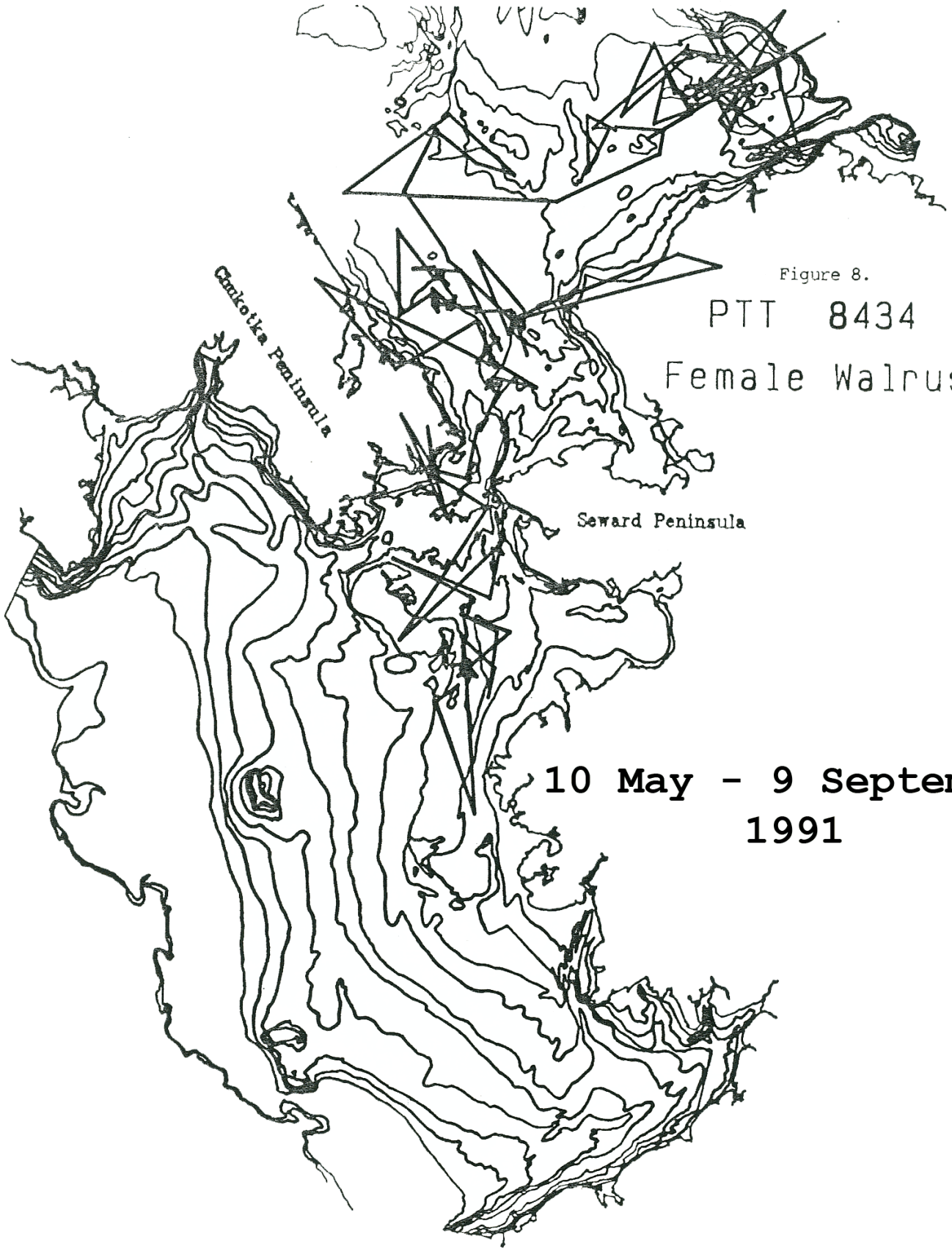


Figure 8.

PTT 8434

Female Walrus

10 May - 9 September 1991

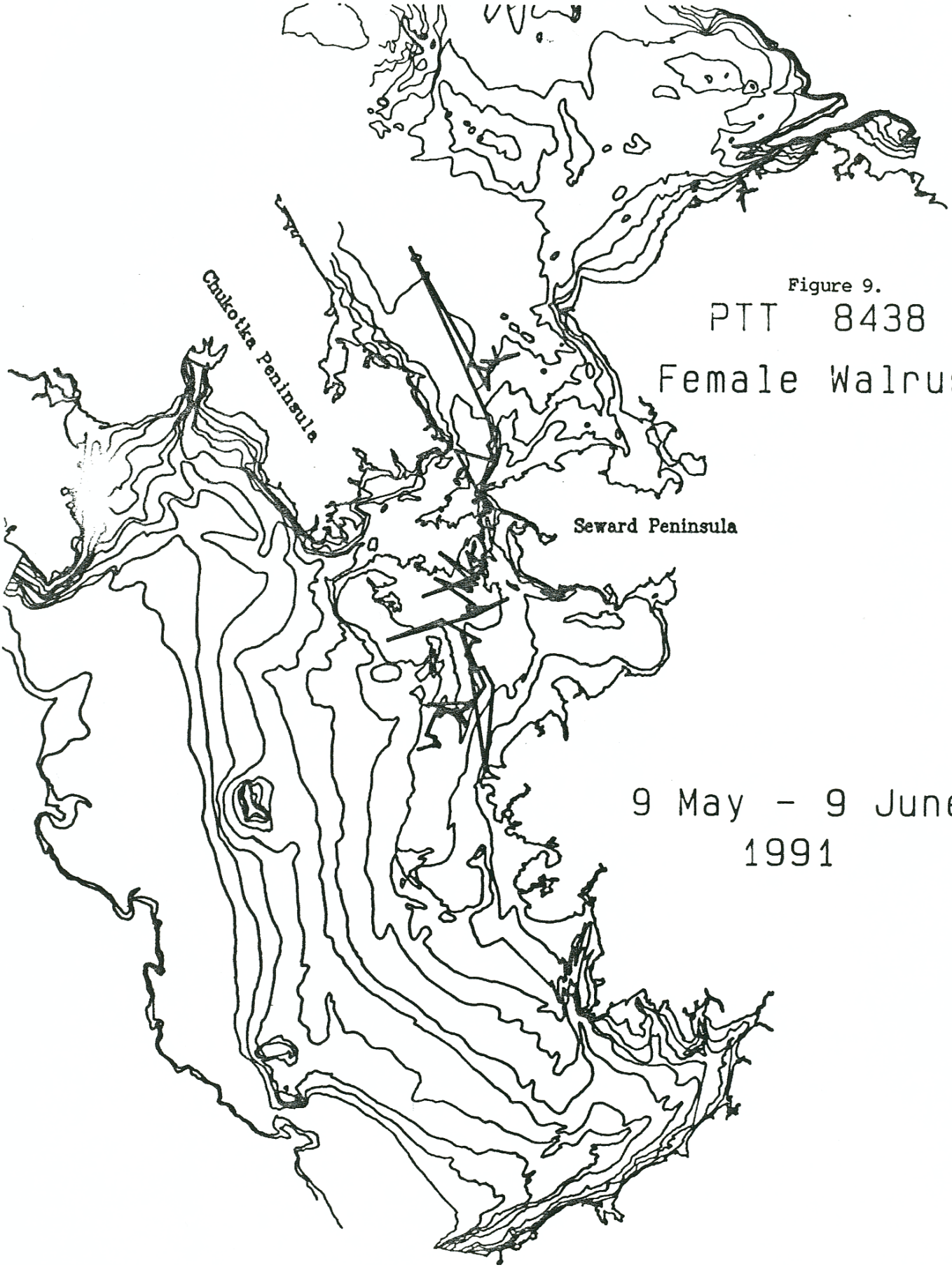


Figure 9.

PTT 8438

Female Walrus

9 May - 9 June

1991

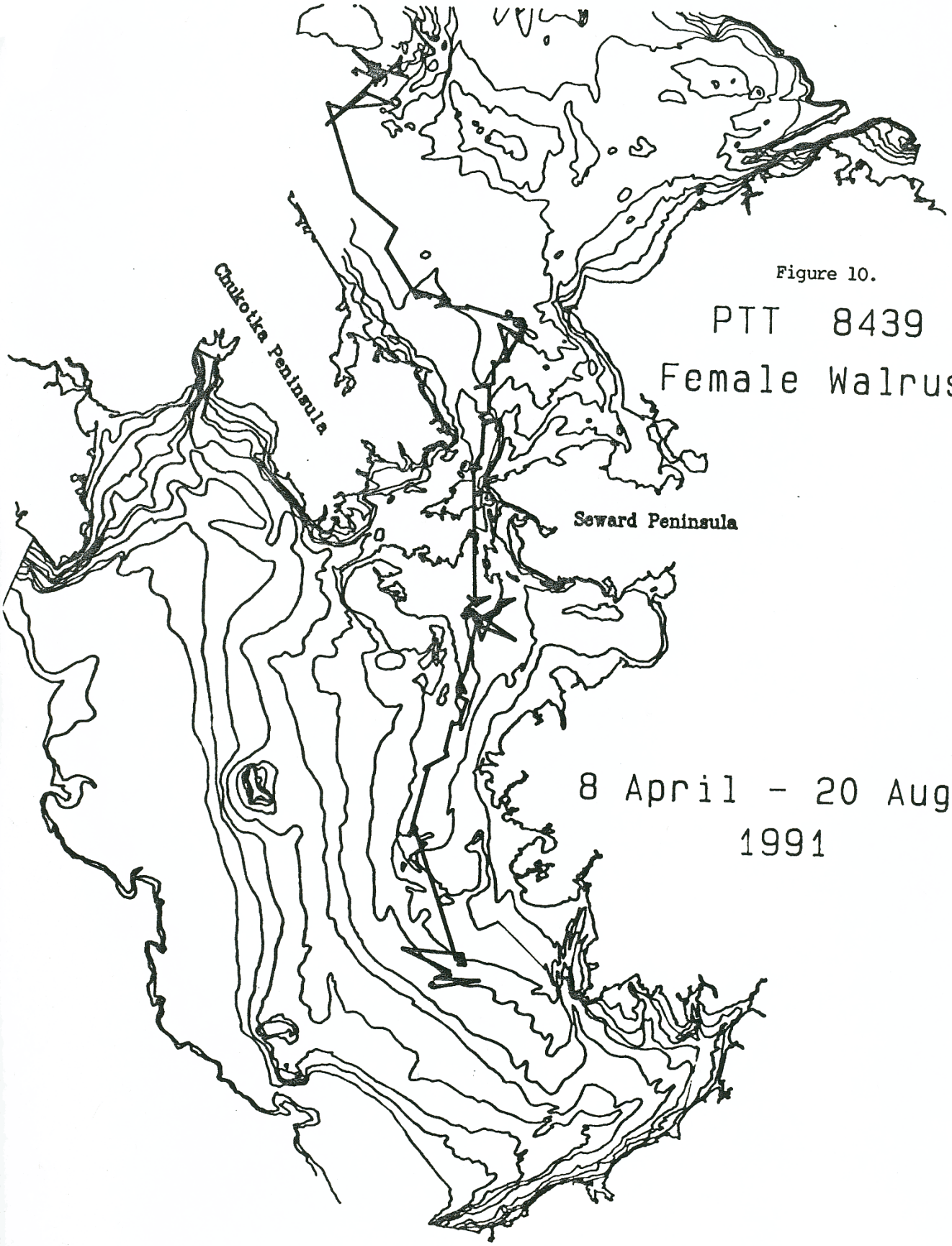


Figure 10.

PTT 8439

Female Walrus

8 April - 20 August

1991