

PROGRESS REPORT ON LIFE HISTORY  
STUDIES OF DALL'S PORPOISE IN  
THE NORTHWESTERN PACIFIC, 1978-1979

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Under the mandate of the International North Pacific Fisheries Convention as renegotiated in 1978, a study of the life history of Dall's porpoise in the northwestern North Pacific was begun at The National Marine Mammal Laboratory (National Marine Fisheries Service), Seattle, Washington. These studies were undertaken as part of the research program designed to assess the impact of the Japanese salmon fisheries on marine mammal populations. This report describes the preliminary results of analyses on data and samples collected during the 1978 and 1979 fishing seasons.

The data and samples used in these studies were collected by Japanese nationals and U.S. scientists aboard Japanese high seas salmon motherships and Japanese salmon research vessels from marine mammals incidentally taken in the salmon gillnets. Biological samples were preserved by freezing or emplacing in 10% formalin and were transported to the NMML for analysis. The following information and samples were collected: date and location of capture, sex, length, weight, stomach, reproductive tract, teeth and jaw section, parasites and fetus, if present. Complete photographic records were maintained.

In 1979, liver, blubber and adrenal gland samples

were also collected. A sample of adult Dall's porpoise were frozen aboard each mothership and shipped to the NMML for dissection. The following tissues were removed from these animals, examined and weighed: kidney, liver, heart, lung, pancreas, spleen, adrenal glands, thymus, stomach, intestine, and reproductive tract. Blubber and muscle were also collected. The skeletal material is presently being cleaned and prepared for morphometric studies of possible stock differences. This skeletal collection will be housed at the NMML as part of the marine mammal research reference collection.

#### Incidental Take Studies

A total of 611 Dall's porpoise was collected in 1979. The mean length of these animals was 169 cm, with a range of 90 to 218 cm. For 352 porpoise collected and measured in 1978, the average length was 171 cm with a range of 90 to 210 cm (Figures 1 and 2).

No animals of 105 to 130 cm length were taken in either 1978 or 1979. There are several possible explanations for why this size animal is not captured: they may be more susceptible to dropping out of the nets during the retrieval process; they may not inhabit

Figure 1.-- Lengths of all Dall's Porpoise Incidentally Taken in Japanese Salmon Gillnets, aboard Research Vessels and in the High Seas Mothership Fishery. 1979.

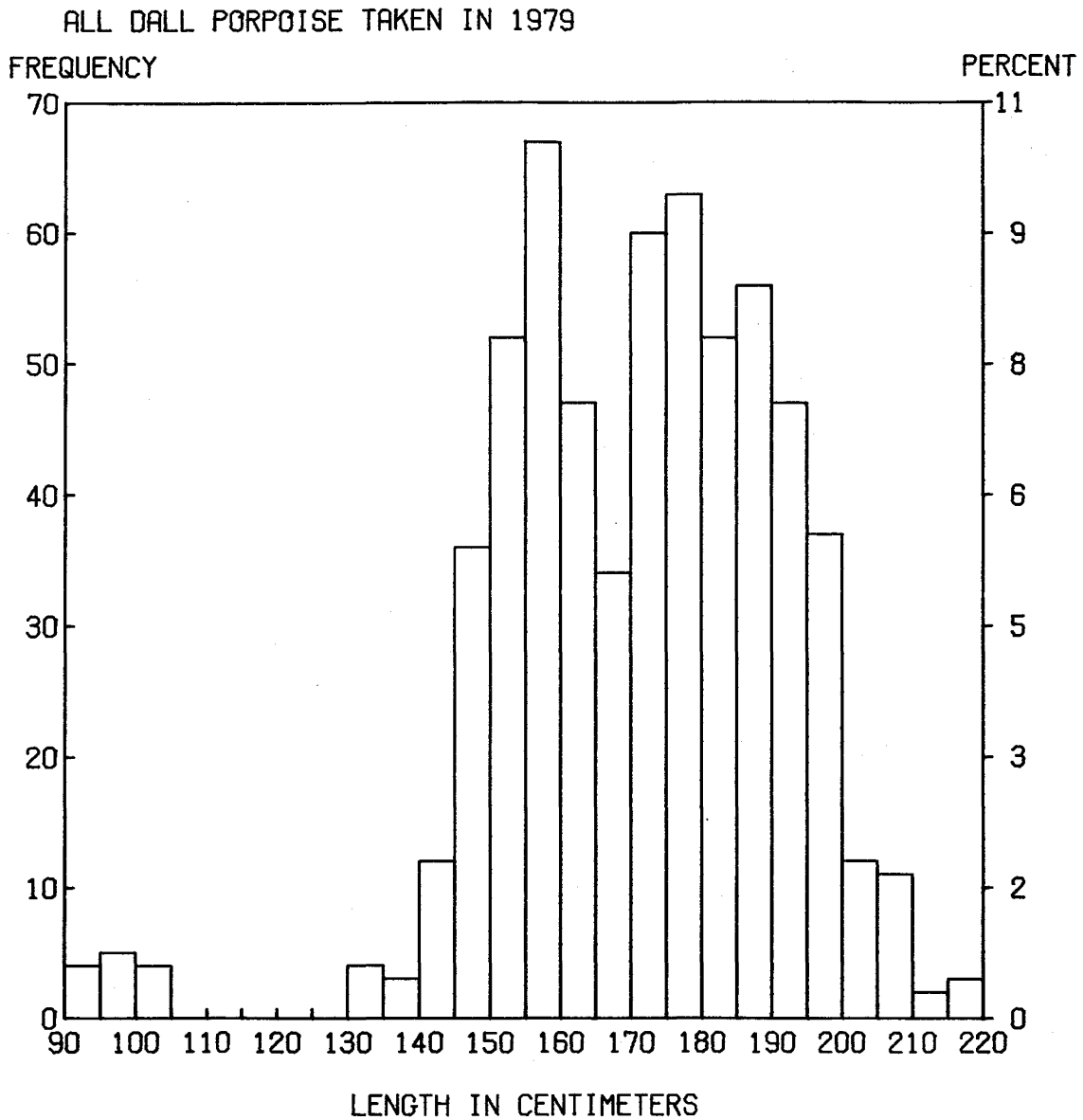
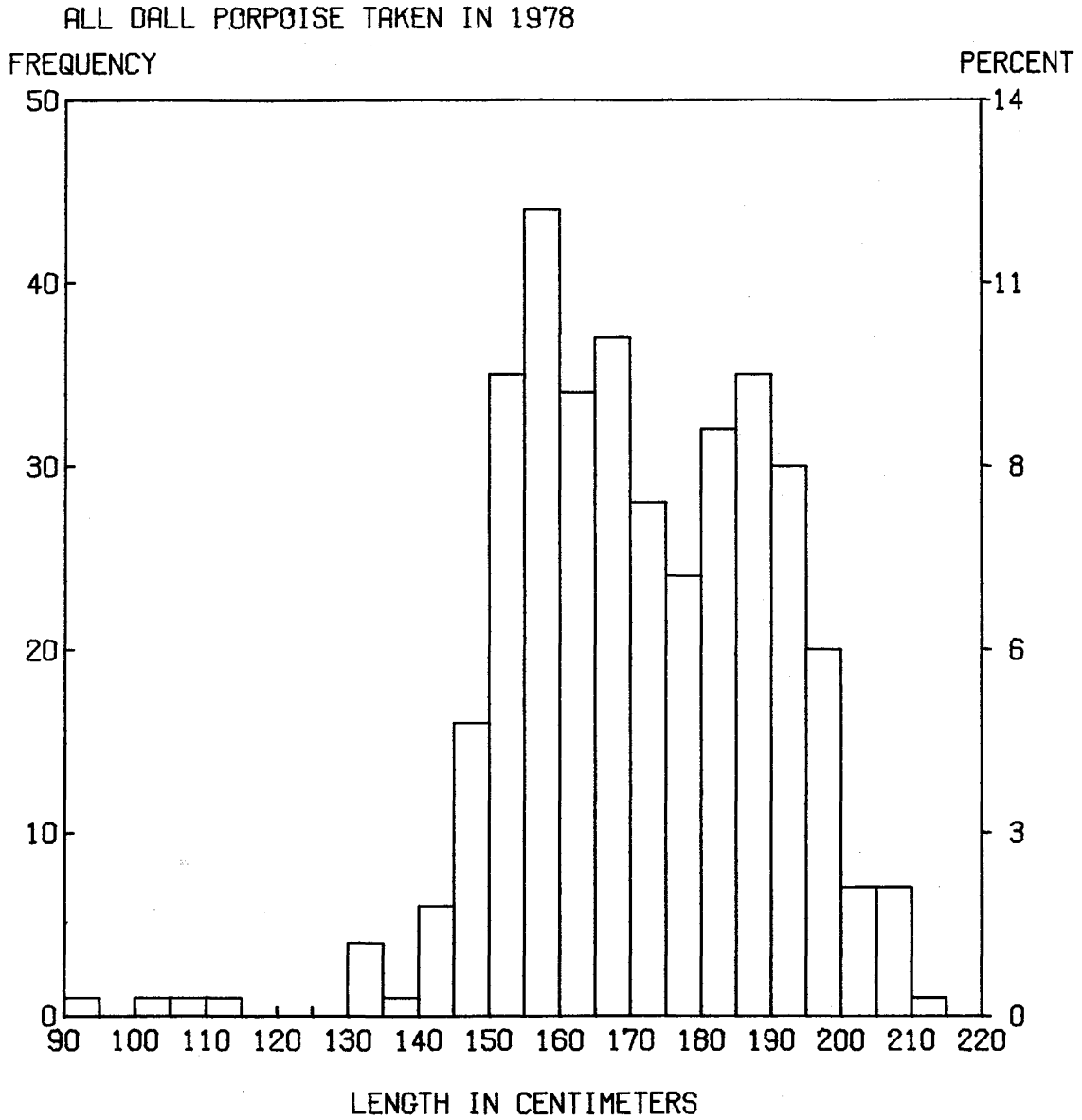


Figure 2.-- Lengths of all Dall's Porpoise Incidentally Taken in Japanese Salmon Gillnets, aboard Research Vessels and in the High Seas Mothership Fishery. 1978.



the fishing area during this season; their behavior, for example, feeding habits, may preclude their entanglement, or this size individual may not be present in the population at this time of year. Studies planned for 1980 on the fishing grounds may provide information on the factors involved in the size bias of the catch.

The location of each Dall's porpoise taken in 1978 during the time period when U.S. marine mammal biologists were aboard was plotted. There appeared to be some segregation of the population by size and sex, with pregnant females occurring in the southeast portion of the area fished during this time interval (Figures 3-6)

### Reproductive Biology

A total of 390 female Dall's porpoises were collected aboard Japanese motherships and research vessels in 1979. The average length was 170 cm, with a range of 130 to 218 cm. The smallest sexually mature female was 157 cm, slightly smaller than the smallest mature female taken in 1978 (166 cm). The average size at sexual maturity was 182 cm. Figures 7, 8 and 9 show the lengths of all females taken and of all mature and immature females, respectively. In 1978, the mean size

Figure 3.--Locations of the Capture of All Female Dall's Porpoise Incidentally Taken in Gillnets of the Japanese High Seas Salmon Fishery. 1978.

□ = Females

▣ = Pregnant or Lactating Females

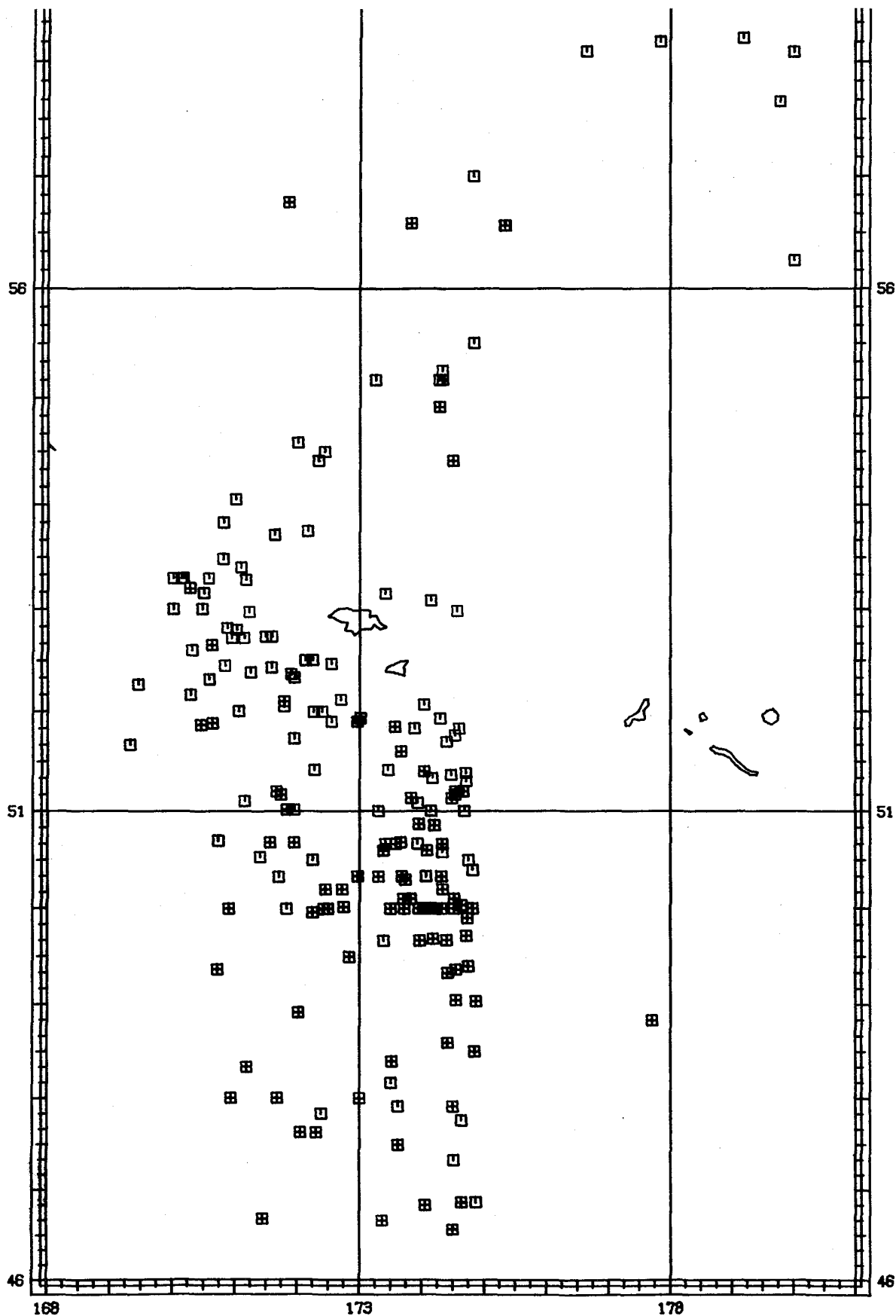


Figure 4.-- Locations of the Capture of All Male Dall's Porpoise Incidentally Taken in Gillnets of the Japanese High Seas Salmon Fishery. 1978.

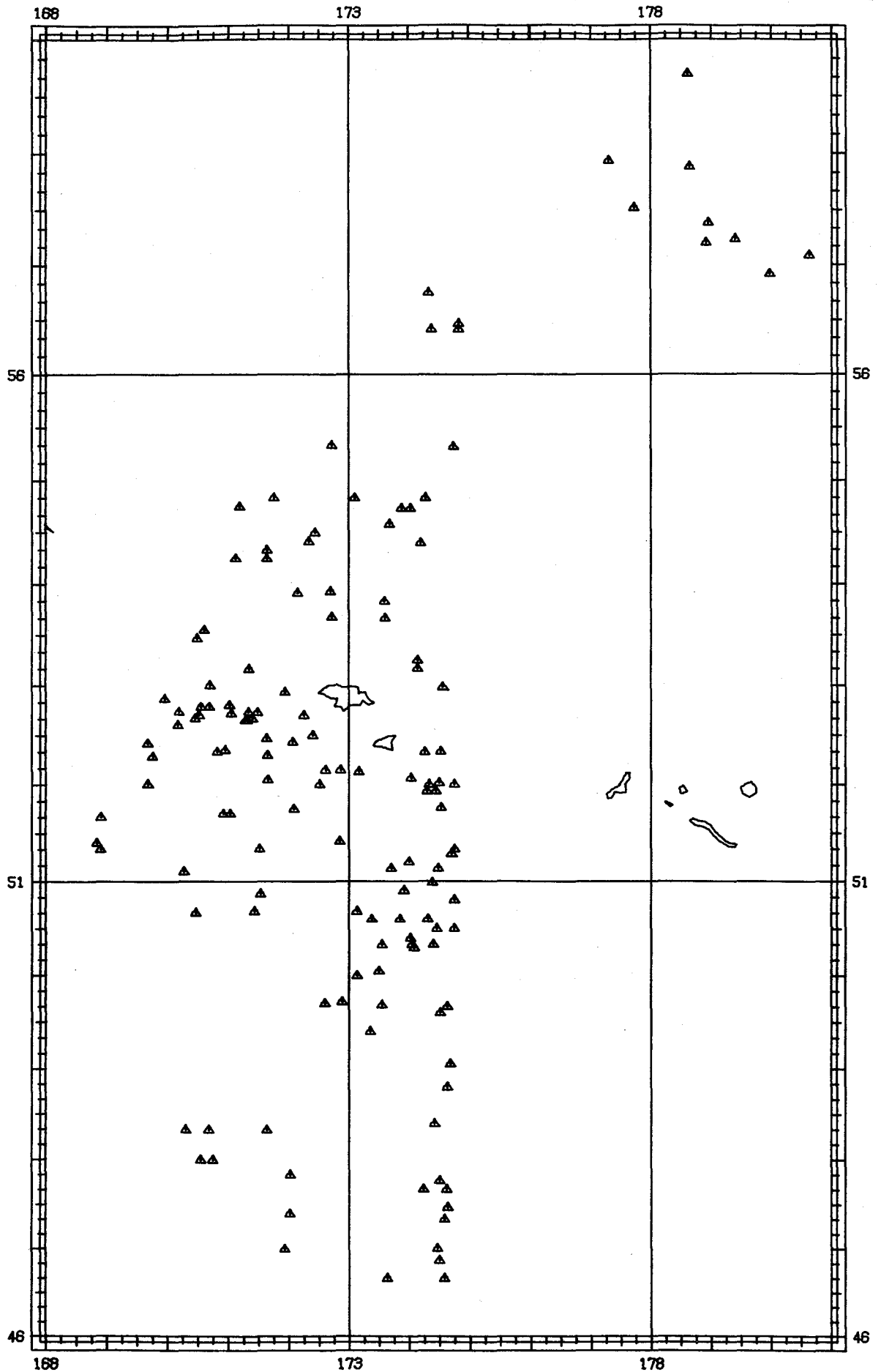




Figure 5.--Locations of the Capture of All Female Dall's Porpoises Incidentally Taken in Gillnets of the Japanese High Seas Salmon Fishery. 1979.

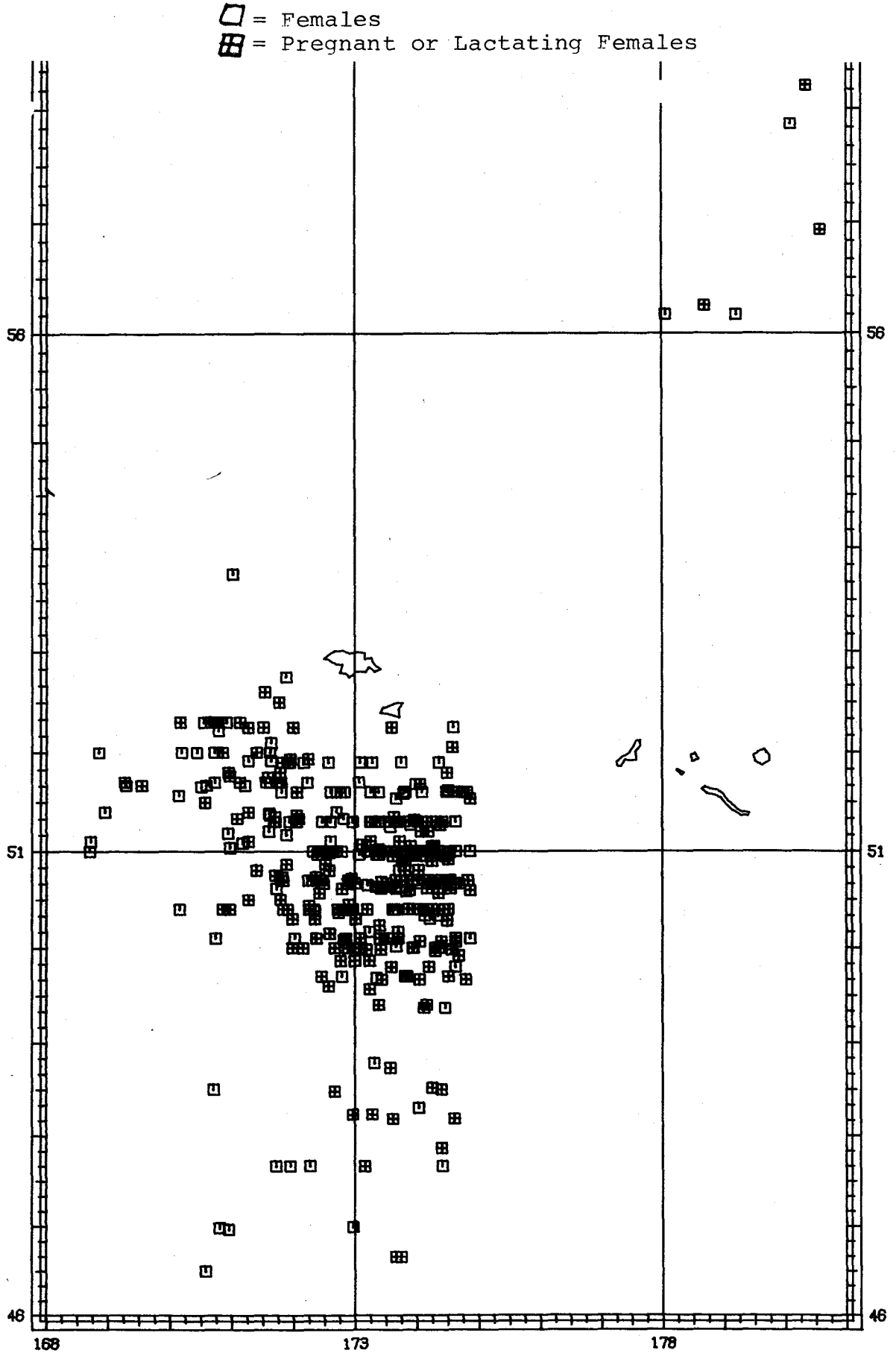


Figure 6.-- Locations of the Capture of All Male Dall's Porpoises Incidentally Taken in the Gillnets of the Japanese High Seas Salmon Fishery. 1979.

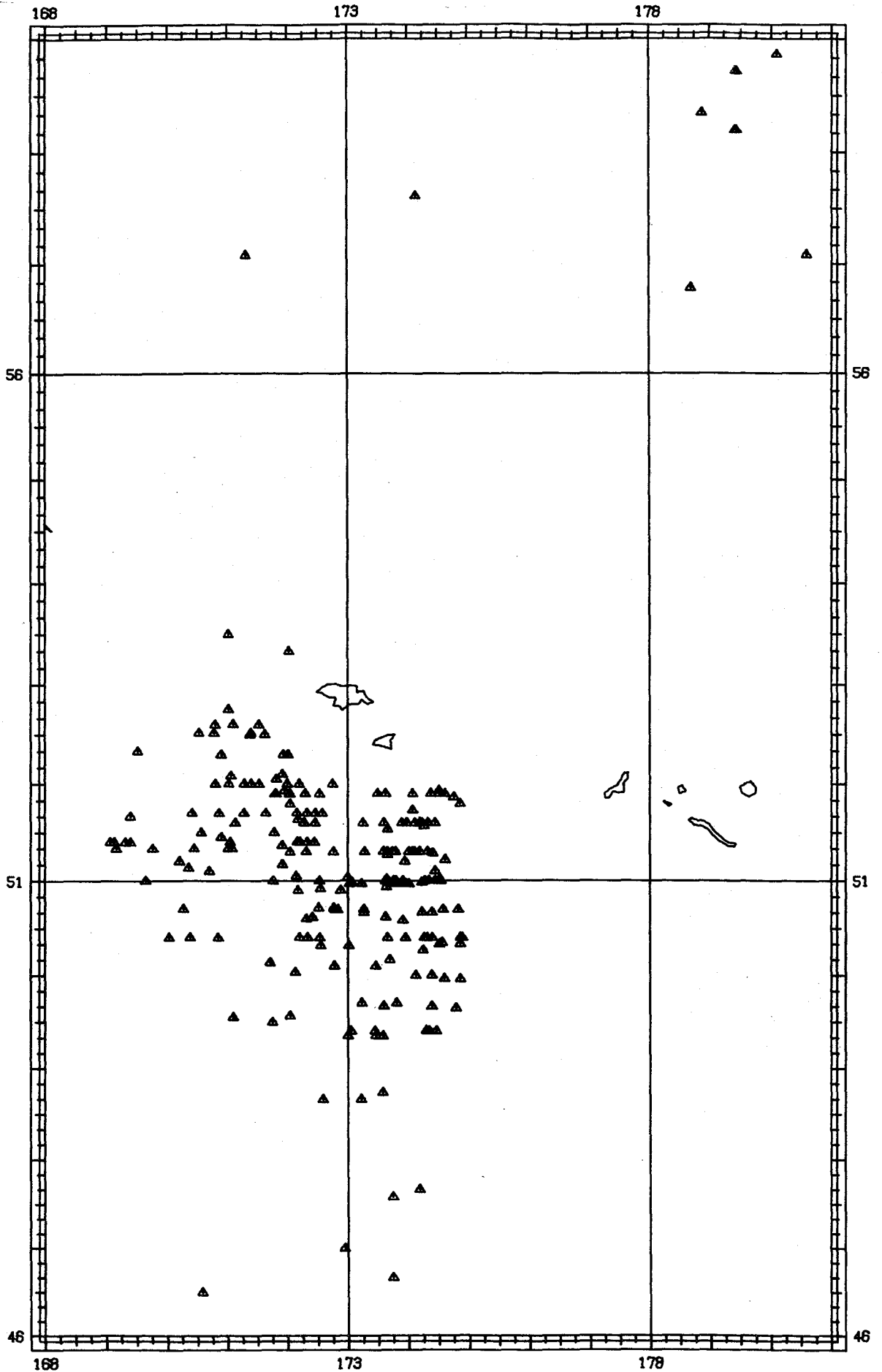


Figure 7.-- Lengths of All Female Dall's Porpoises  
Incidentally Taken in Gillnets of the Japanese  
High Seas Salmon Fishery. 1979.

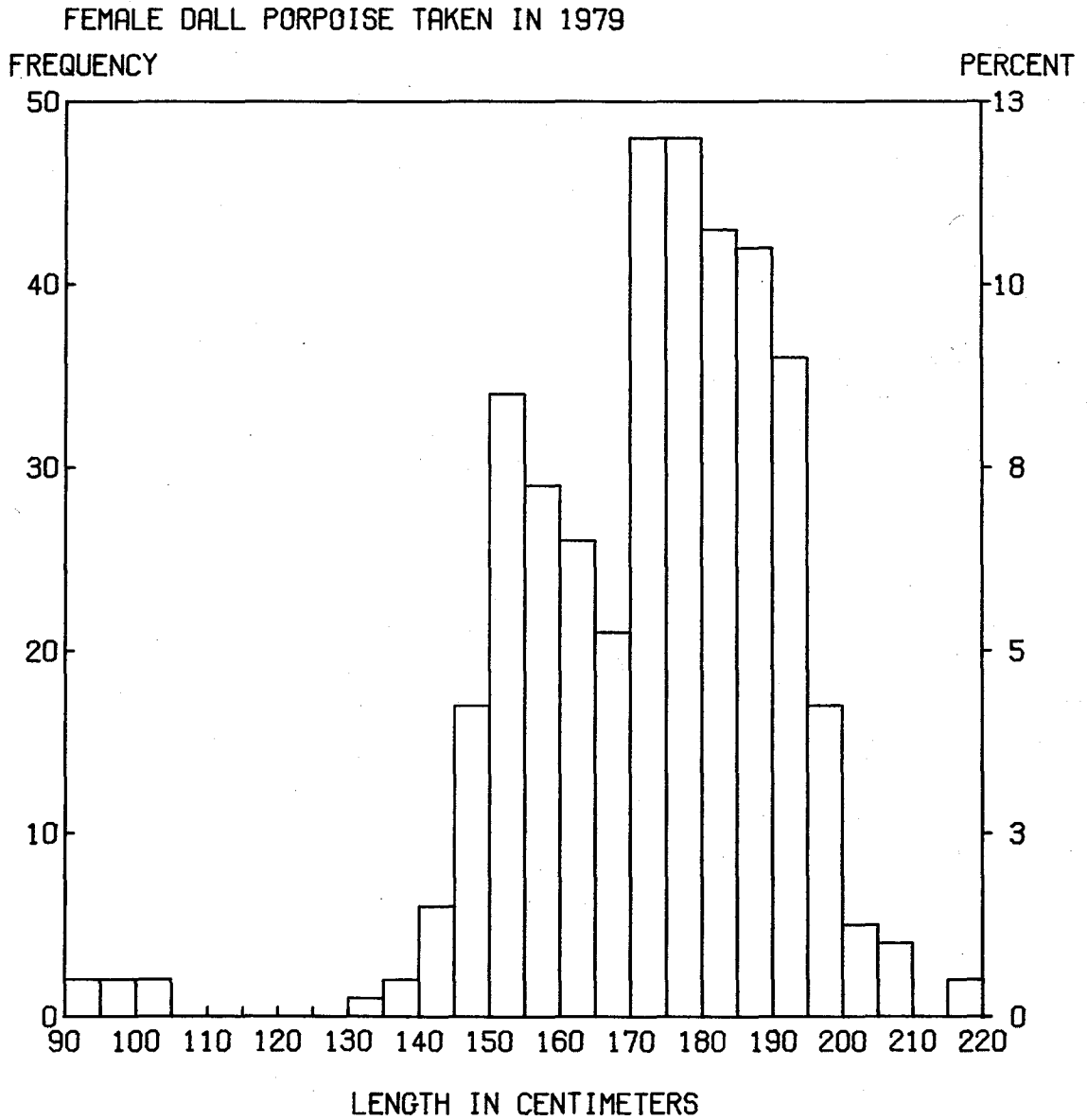


Figure 8.-- Lengths of All Mature Female Dall's Porpoises  
Incidentally Taken in the Gillnets of the Japanese  
High Seas Salmon Fishery. 1979.

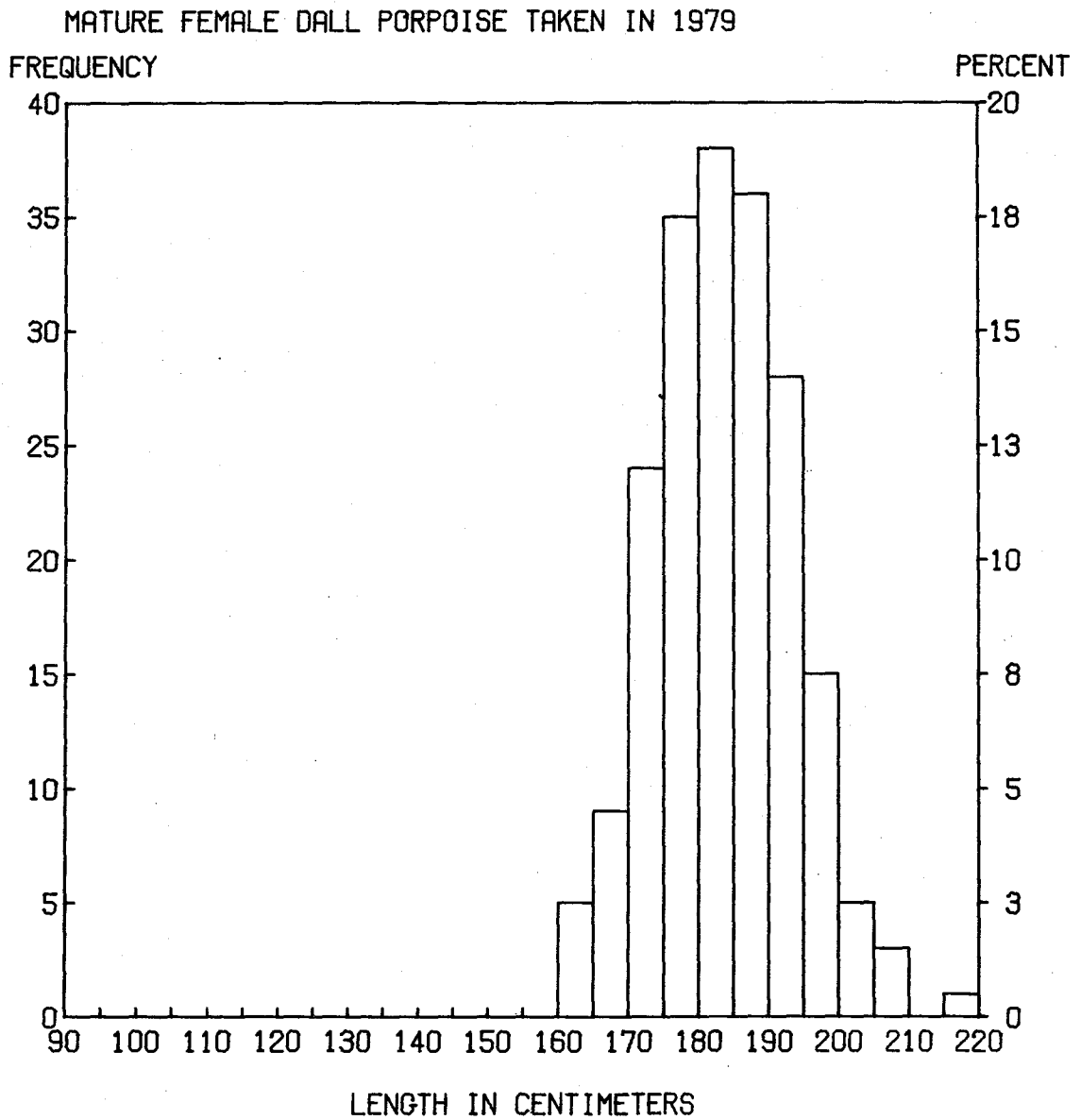
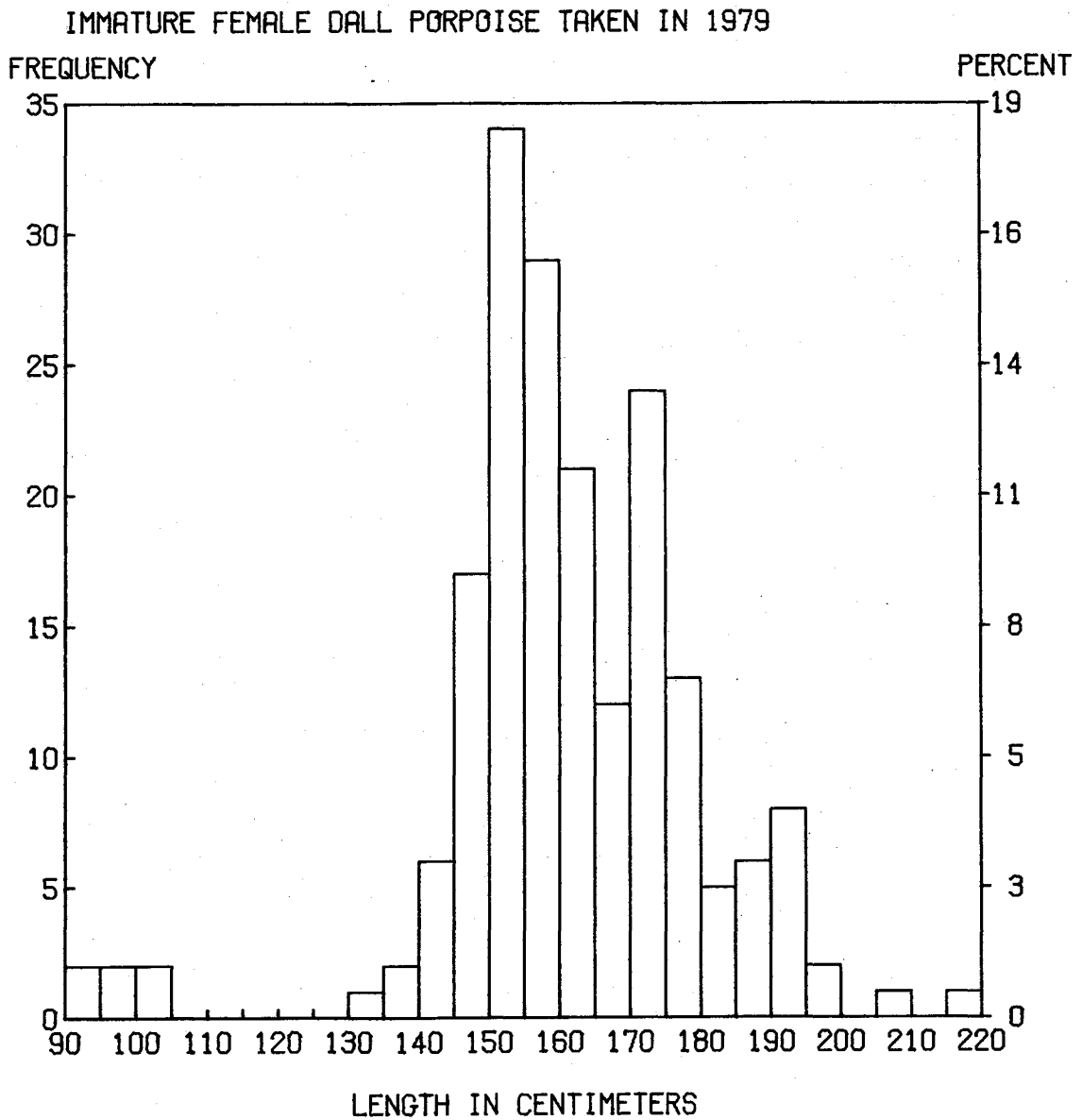


Figure 9.--Lengths of All Immature Female Dall's Porpoises  
Incidentally Taken in Gillnets of the Japanese  
High Seas Salmon Fishery. 1979.



of females was 172 cm, with a range of 90 to 209 cm (Figures 10-12). Figures 13 and 14 show length-weight relationships.

Females comprised 63% (385) of the total take in 1979. Approximately 60% (210) of the females were sexually mature. Of these, 39% (152) were pregnant and 27% (105) were lactating. Of the animals taken in 1978, 61% (195) were female, of which 46% (90) were sexually mature. Of the sexually mature females, 63% (57) were pregnant and 20% (18) were lactating.

With the exception of the frozen carcasses, all ovaries collected have been examined and weighed. Corpora lutea and albicantia counts and measurements have been incorporated into the life history computerized data base. Figures 15 and 16 shows the relationship between the number of corpora per female and individual length for 1979 and 1978.

A total of 116 fetuses (sex ratio of 1:1) were collected in 1979. The fetuses were frozen, and shipped to the NMML. These animals will be examined for the following: coloration pattern development, organ weights, morphometrics, and skeletal development. Similar studies were conducted on 37 fetuses collected in 1978.

A total of 247 male Dall's porpoise were collected in 1979. Their mean size is 187cm, with a range of

Figure 10.--Lengths of All Female Dall's Porpoises  
Incidentally Taken in Gillnets of the Japanese  
High Seas Salmon Fishery. 1978.

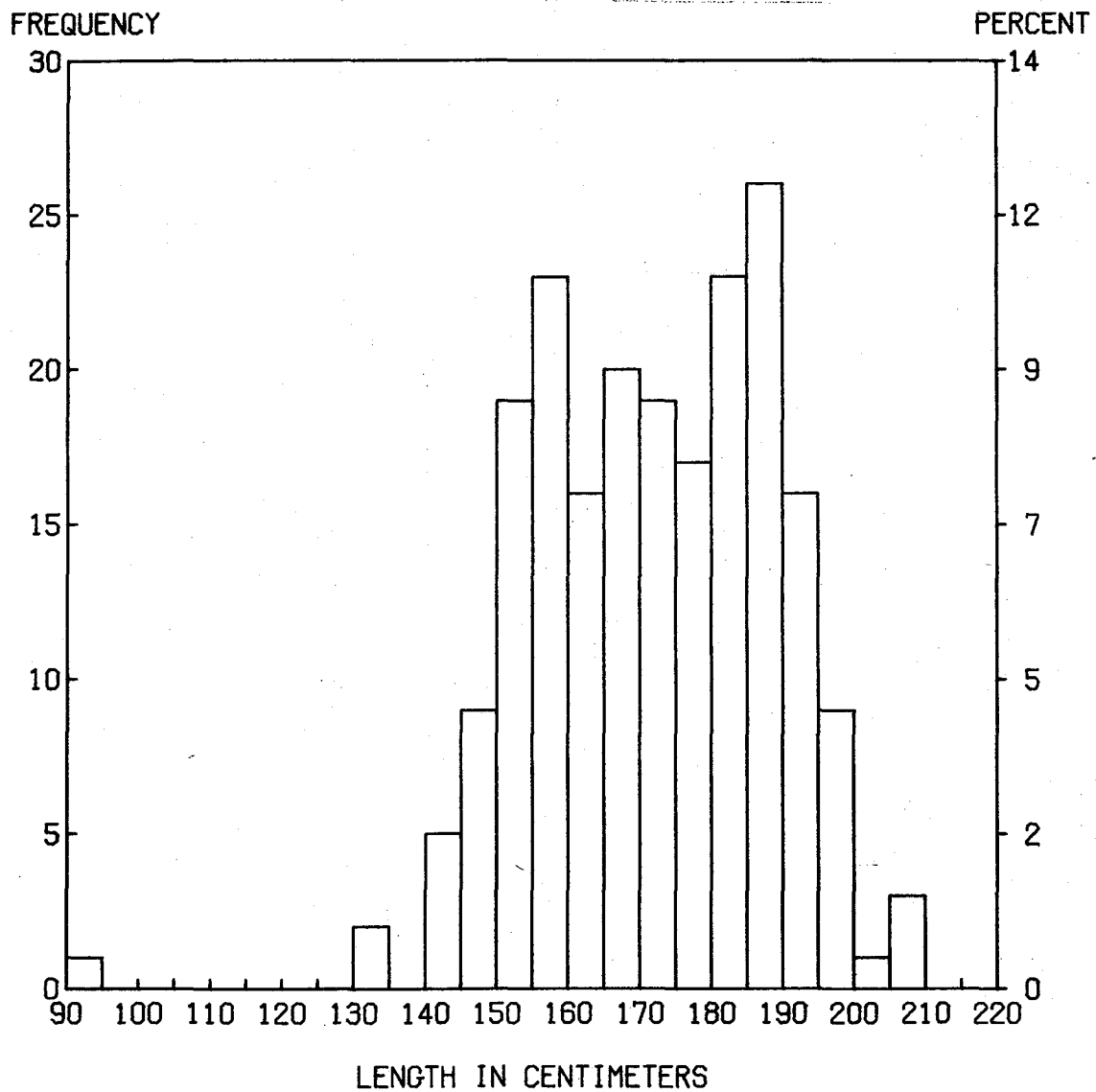


Figure 11.--Lengths of All Mature Female Dall's Porpoises Incidentally Taken in the Gillnets of the Japanese High Seas Salmon Fishery. 1978.

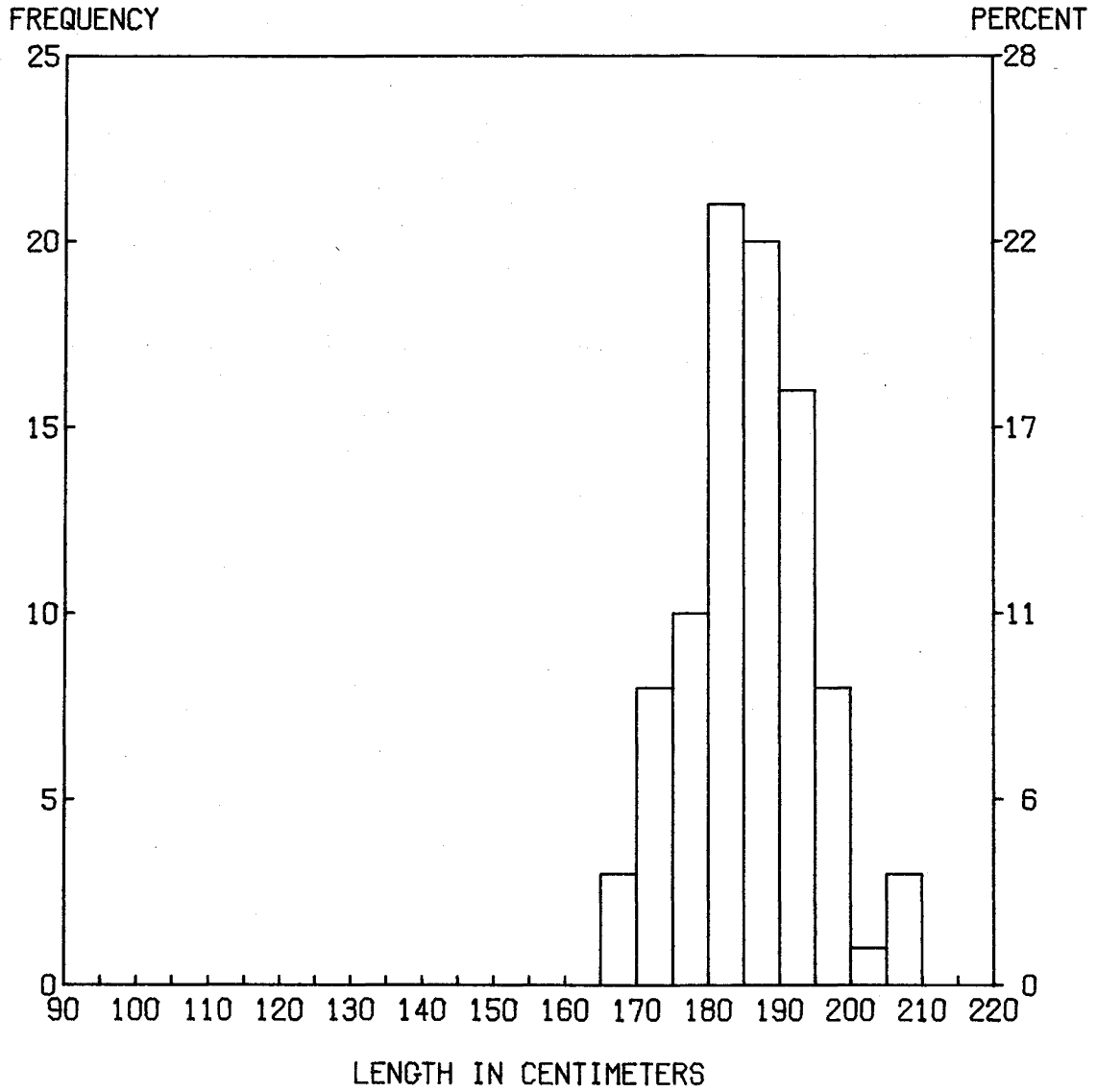




Figure 12.--Lengths of All Immature Female Dall's Porpoises  
Incidentally Taken in the Japanese High Seas  
Salmon Fishery. 1978.

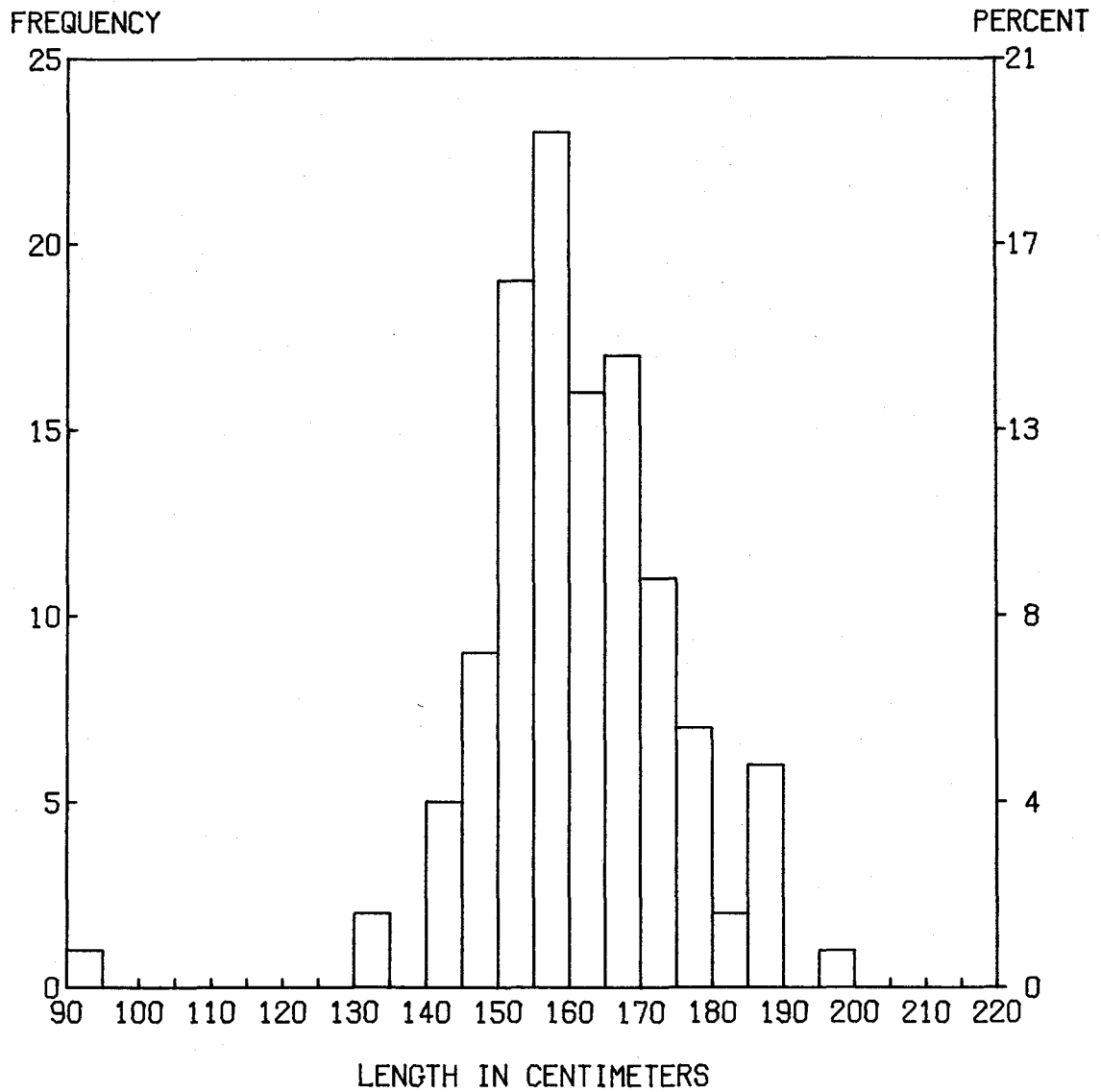
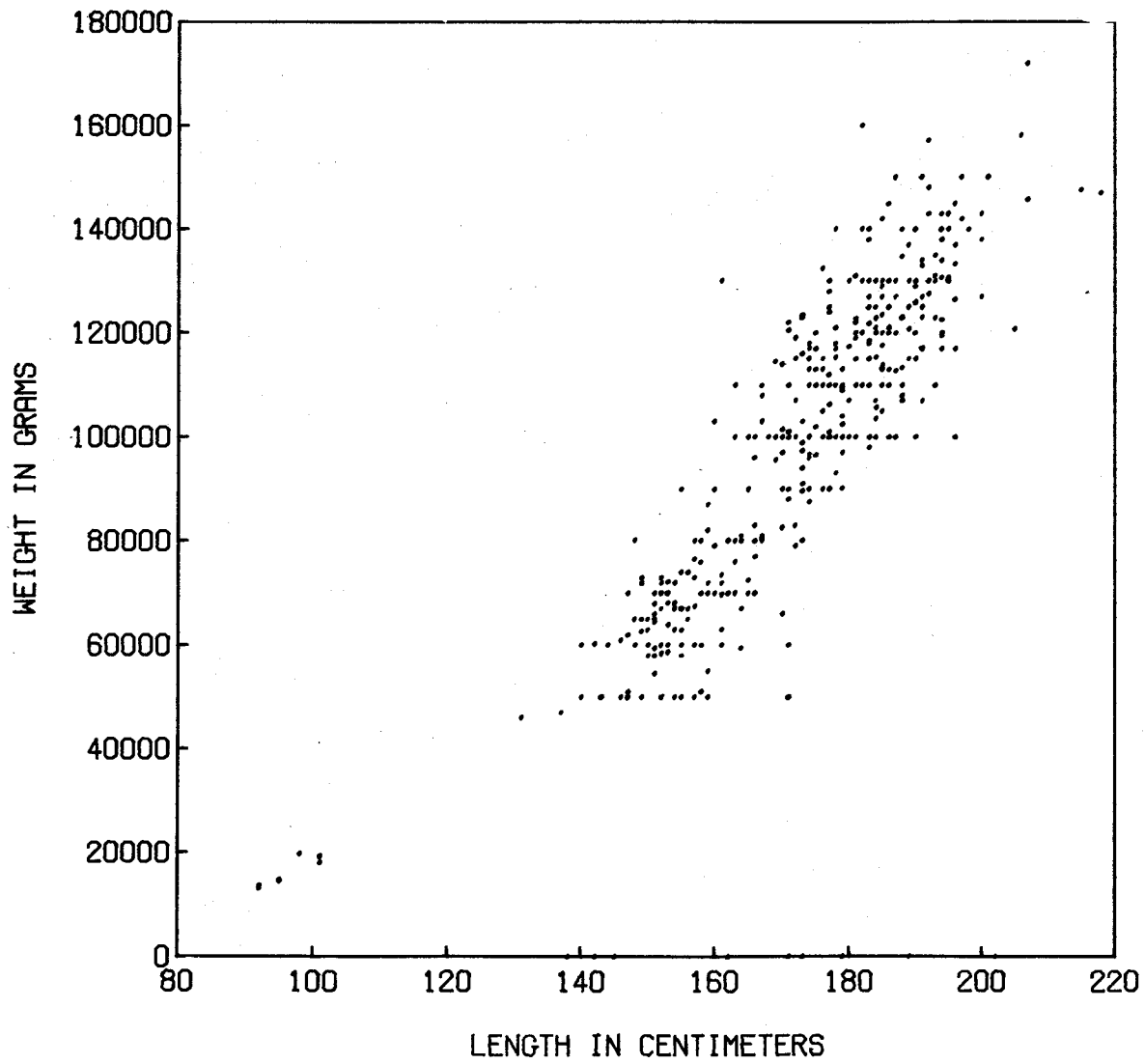
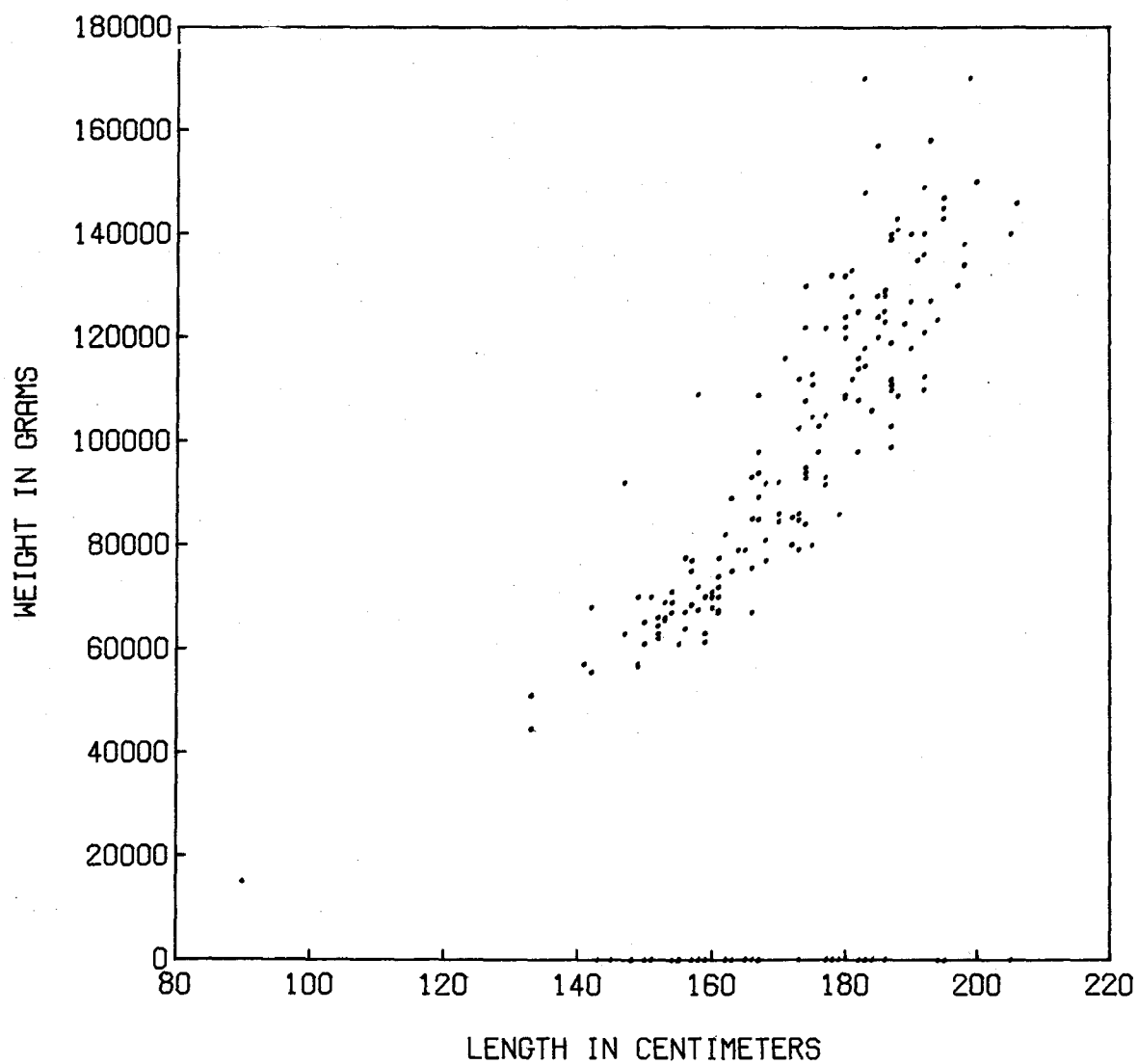


Figure 13.--Weight-length Relationships of All Female Dall's Porpoise. 1979.



LENGTH (172.4,18.31) VERSUS WEIGHT (97263,32944) 387 VALUES

Figure 14.--Weight-length Relationships of All Female Dall's Porpoises Incidentally Taken in the Japanese High Seas Salmon Fishery. 1978.



LENGTH (171.2,16.79) VERSUS WEIGHT (79678,48549) 209 VALUES

Figure 15.--Number of Corpora Present versus Length for All Female Dall's Porpoises Incidentally Taken in the Japanese High Seas Salmon Fishery. 1979.

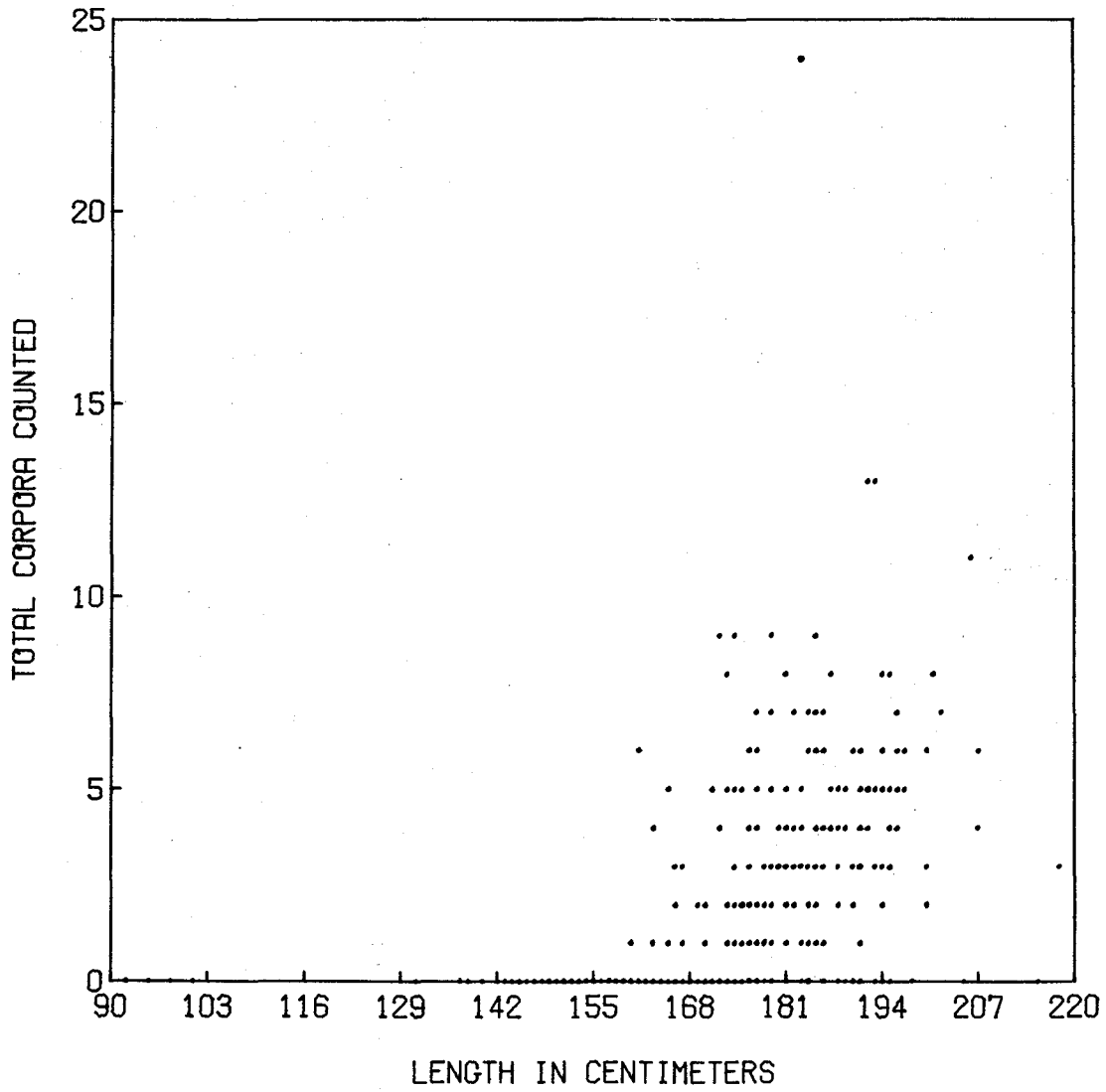
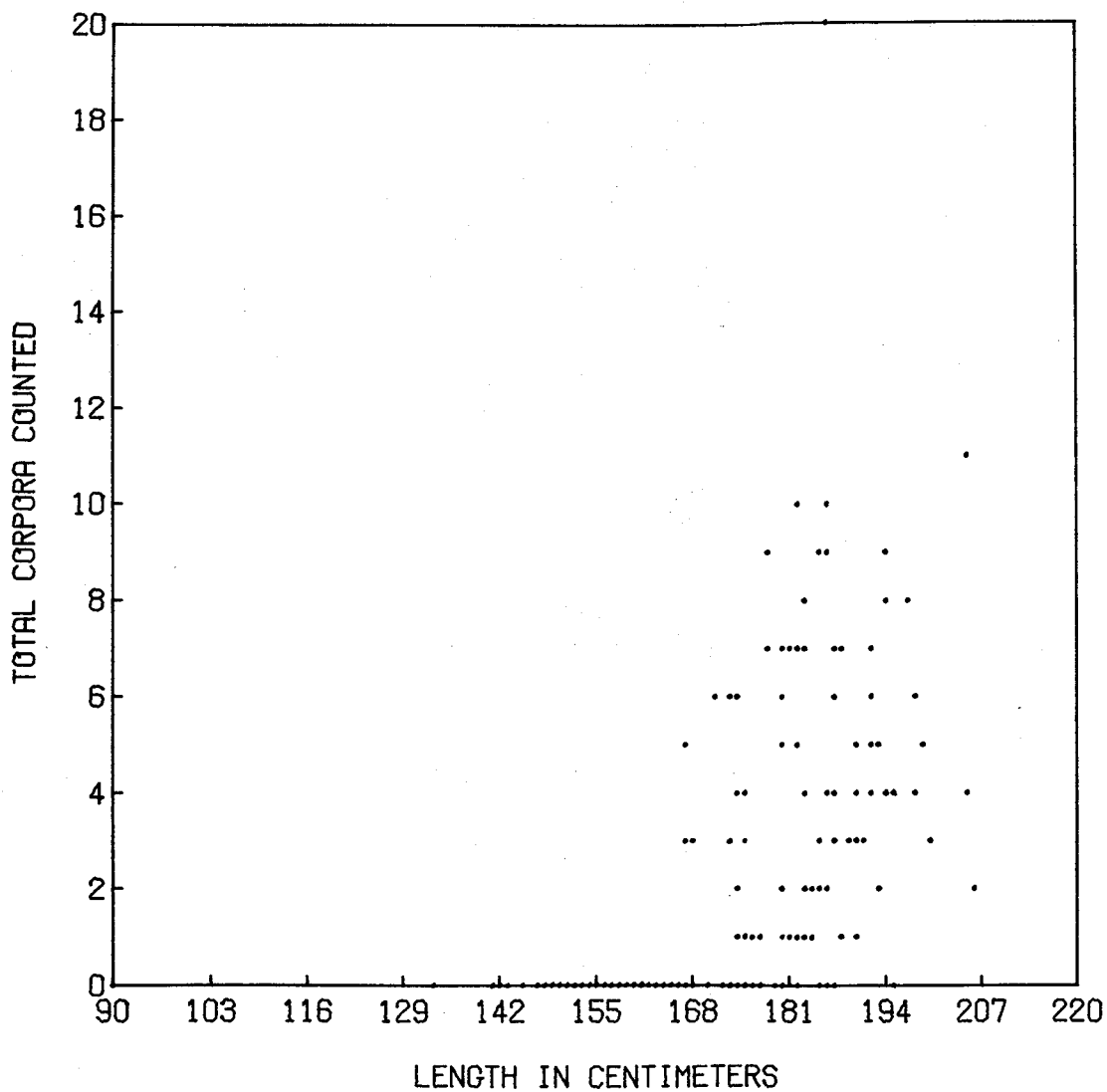


Figure 16.--Number of Corpora Present versus Total Length for All Female Dall's Porpoises Incidentally Taken in the Japanese High Seas Salmon Fishery. 1978.



91 to 218 cm (Figure 17). Approximately 32% (65) of 203 measured males were sexually mature, compared to 26% (41) in 1978. Sexual maturity was determined on the basis of testes weight increase, which occurs when the males are approximately 180 cm in length (Figures 18-19). Mean length in 1978 was 171 cm, with range of 100 to 211 cm (Figure 20).

All male testicular and epididymal tissues are being histologically prepared at the University of Puget Sound, Tacoma, WA. These preparations will be examined to determine the onset of sexual maturity and the stage in reproductive activity.

Figures 21 and 22 show the weight-length relationships for both years.

#### Age Determination

A critical aspect of the life history studies is the determination of the age of individual animals. Because of the small size of Dall's porpoise teeth, aging of individuals by this method has proven difficult. Although the procedure used in 1978 for preparing tooth sections appeared reliable, we recently found the technique resulted in inconsistencies. For example, some pregnant females appeared to have only one growth layer; that is, to be only one year old. The decalcification procedure is being modified and we are hopeful this will result in more accurate

Figure 17.--Lengths of All Male Dall's Porpoises  
Incidentally Taken in the Japanese High Seas  
Salmon Fishery. 1979.

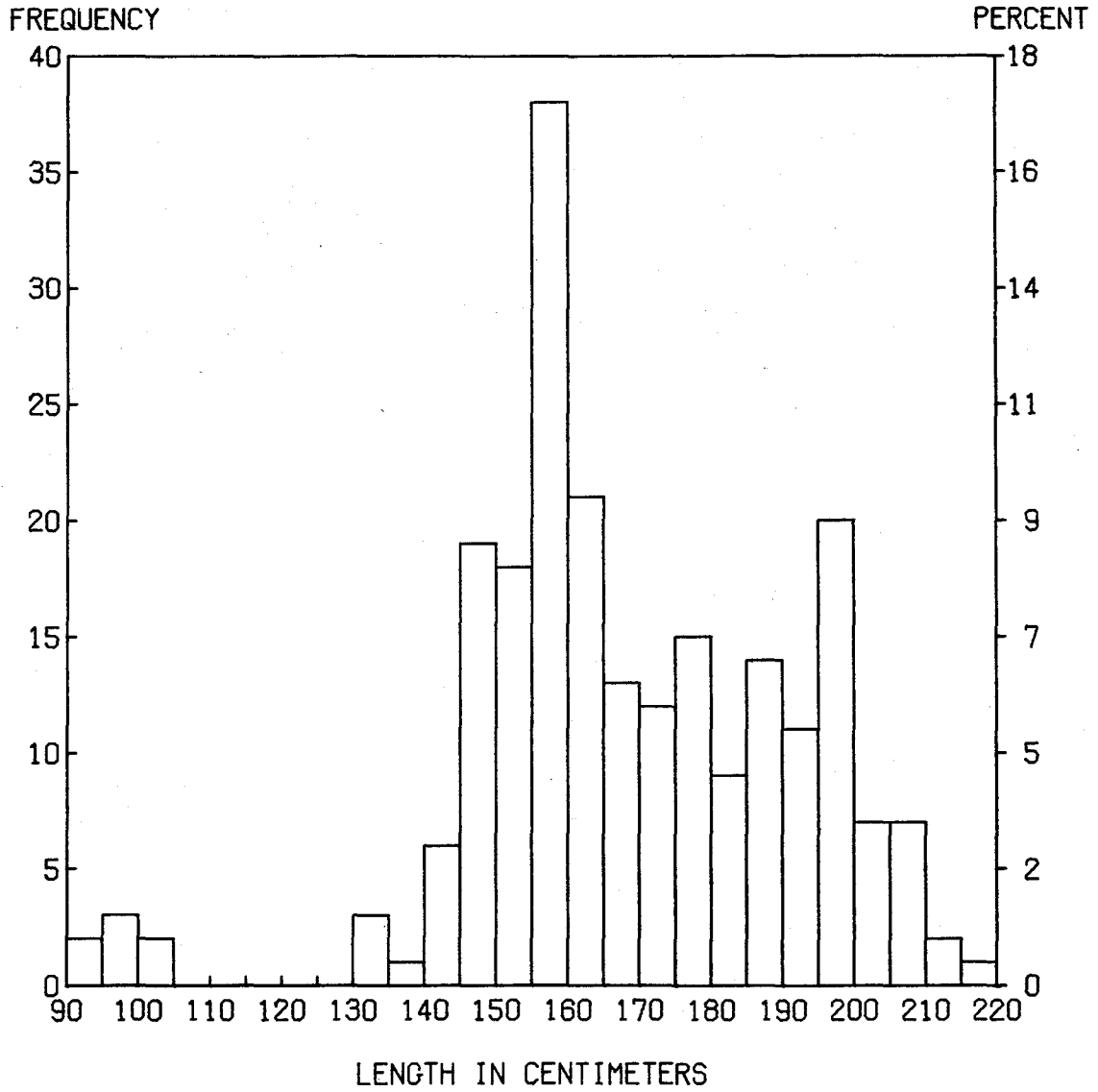


Figure 18.--Lengths versus Right Testis Weight for All Male Dall's Porpoises Incidentally Taken by the Japanese High Seas Salmon Fishery. 1979.

MALE DALL PORPOISE TAKEN IN 1979

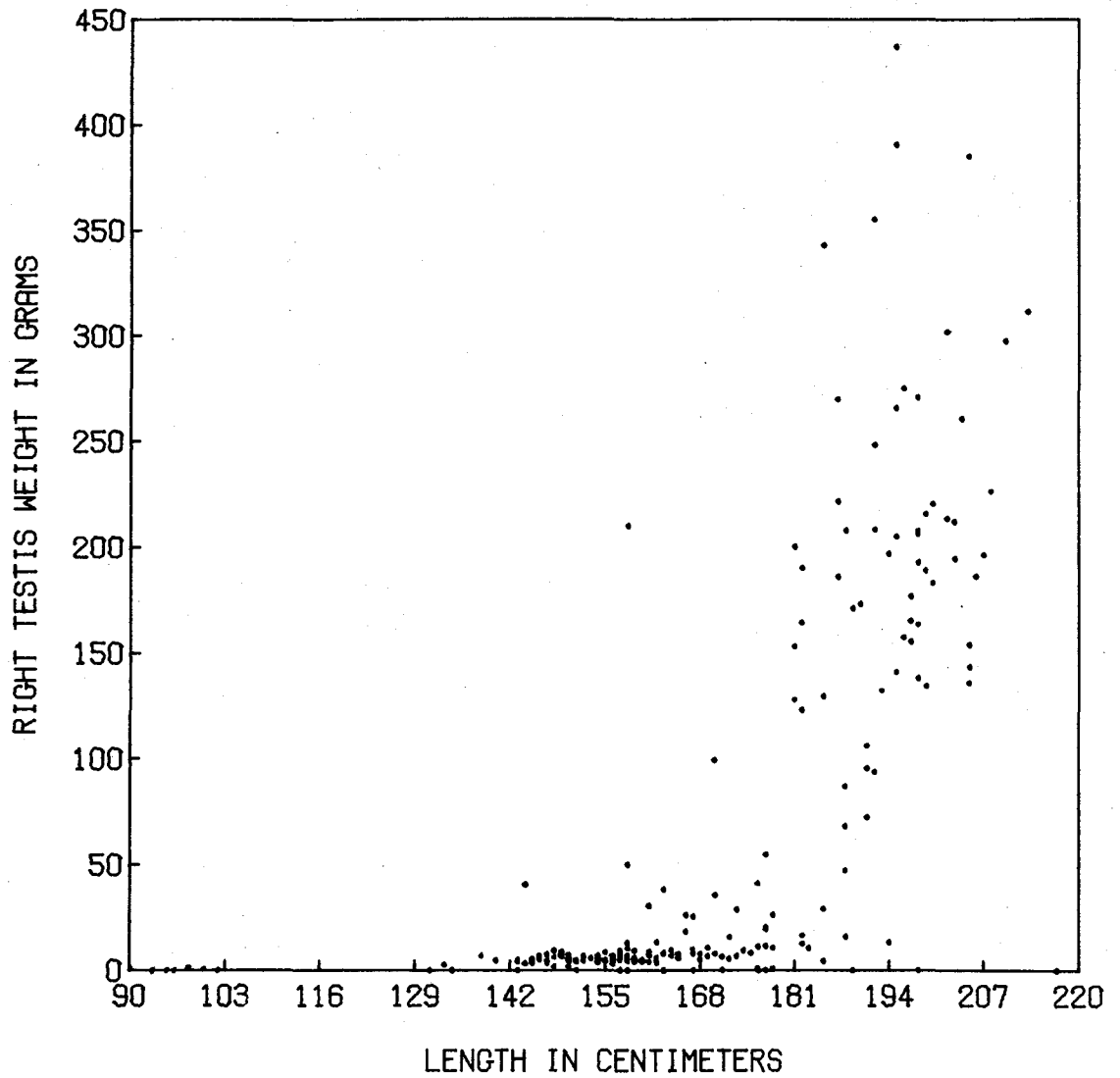




Figure 19.--Lengths versus Right Testis Weights for Male Dall's porpoises Taken in the Japanese High Seas Salmon Fishery. 1978.

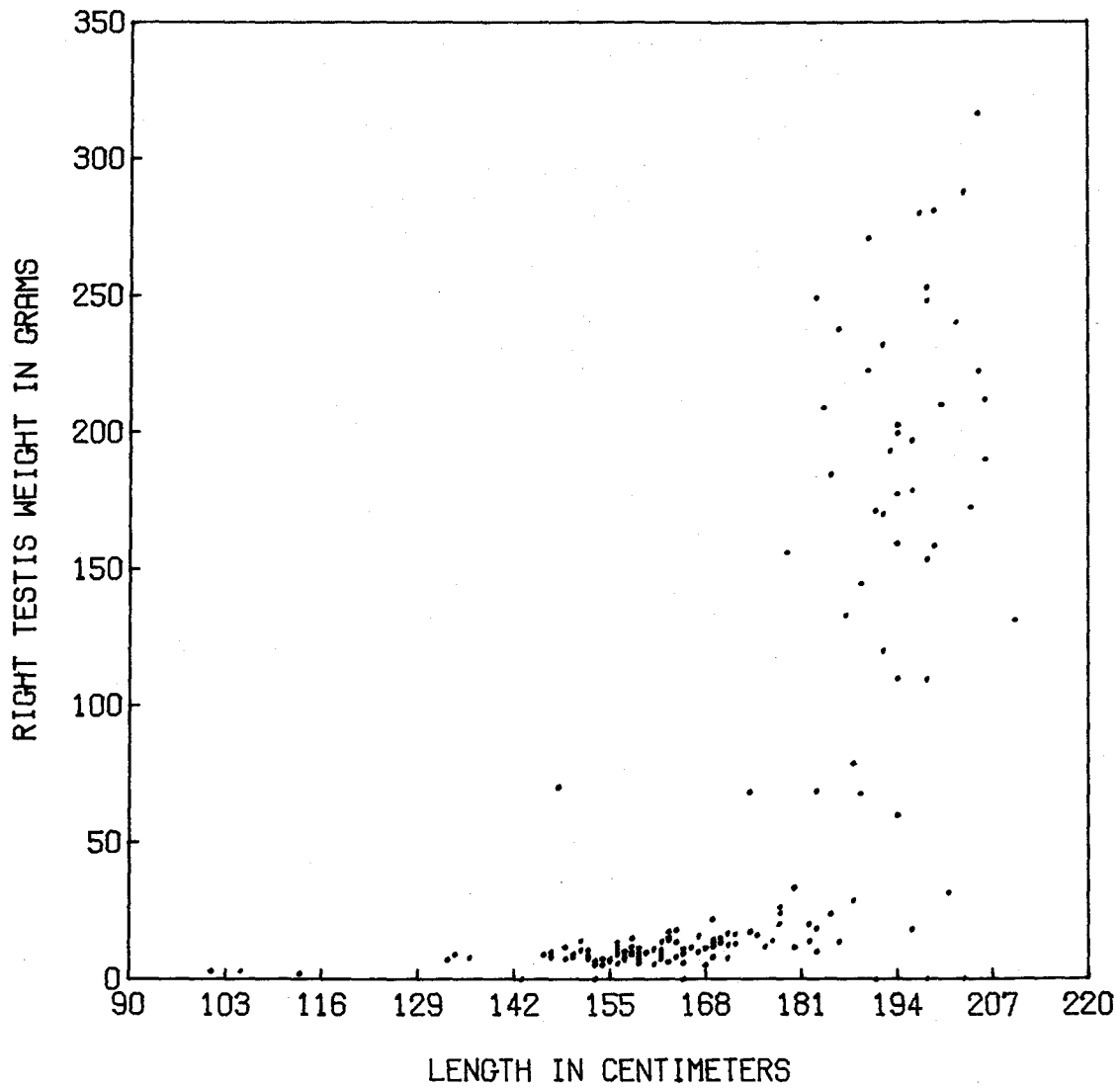


Figure 20.--Lengths of all Male Dall's Porpoises  
 Incidentally Taken in the Japanese High Seas  
 Salmon Fishery. 1978.

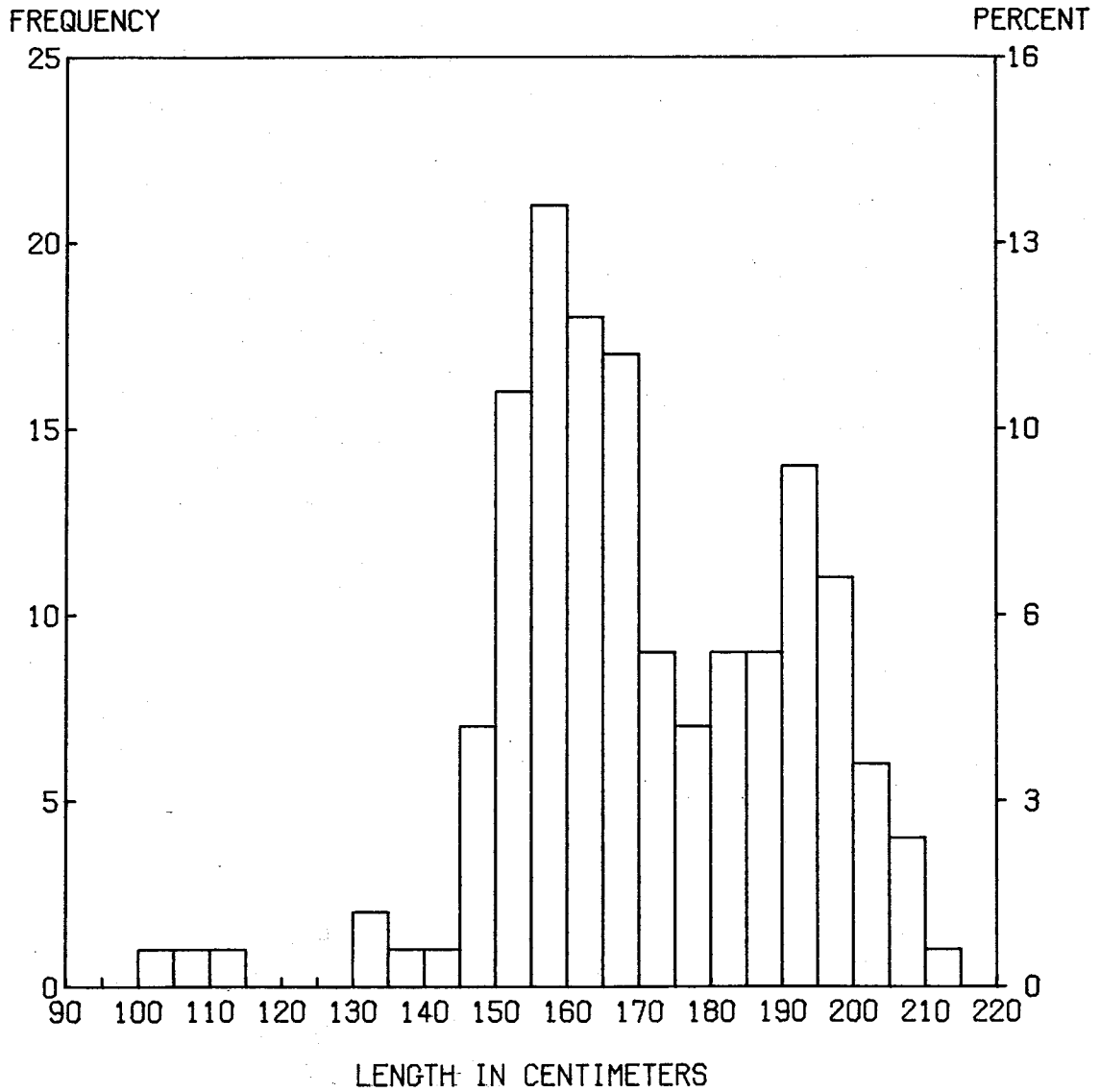
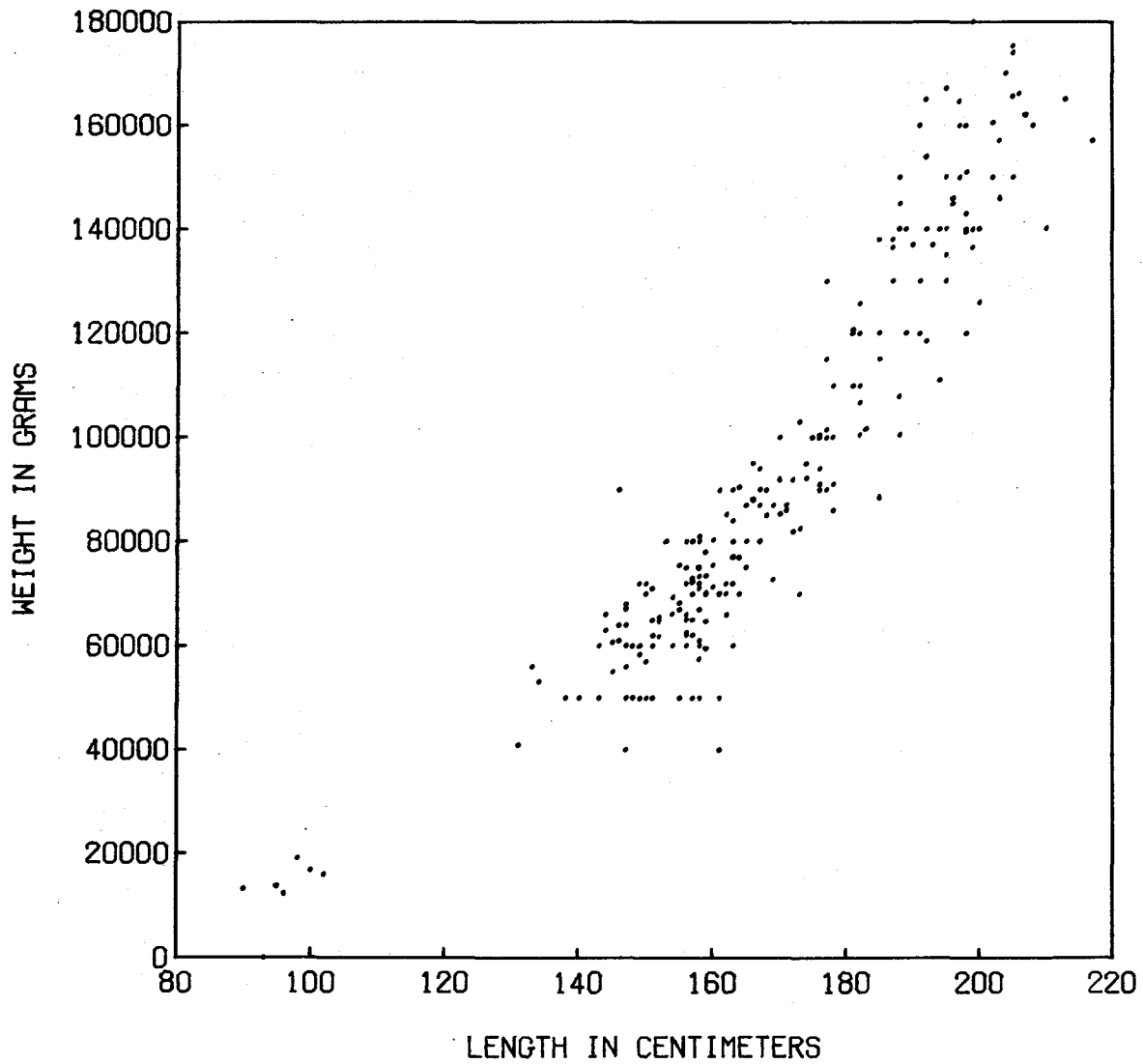
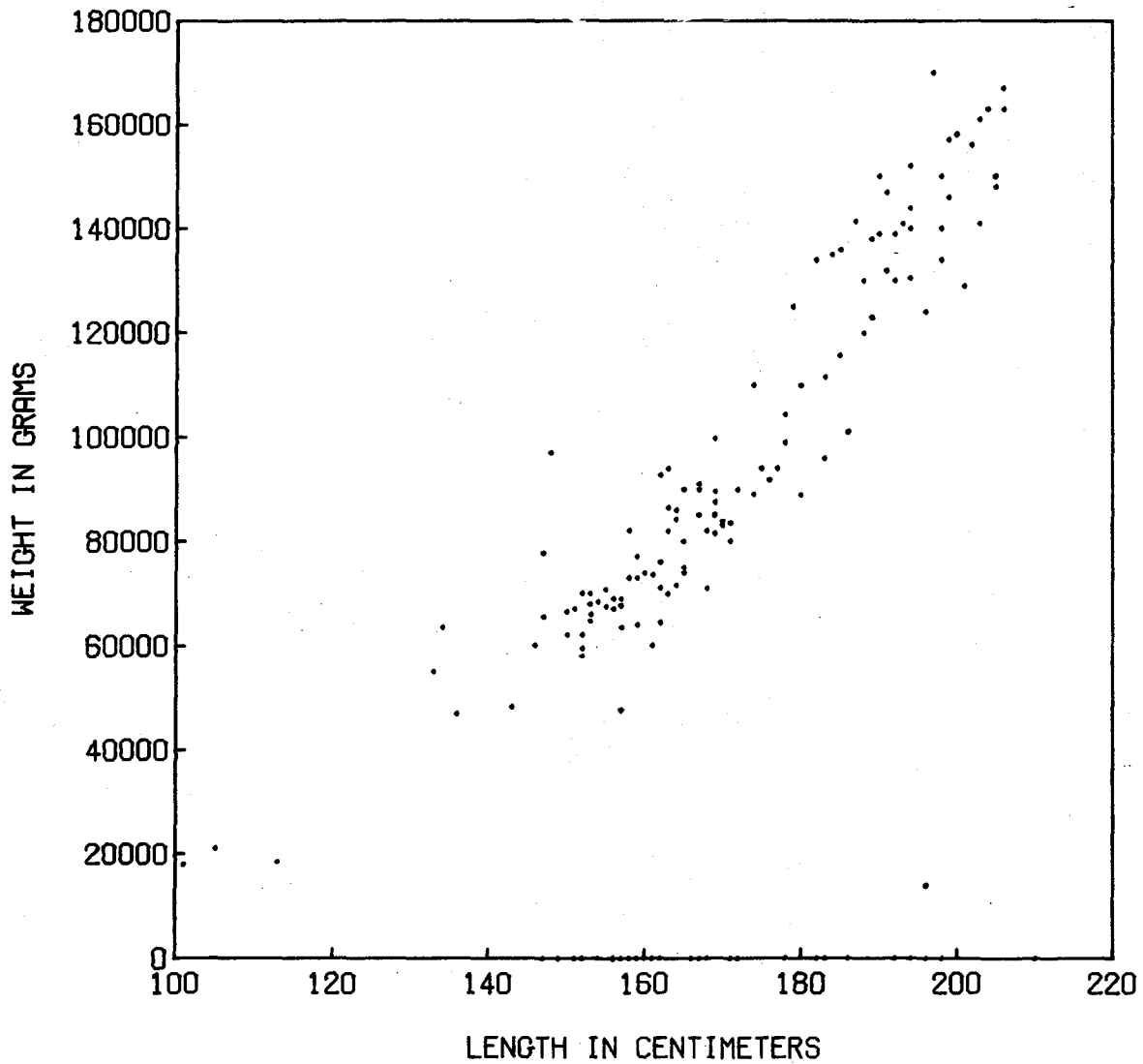


Figure 21.--Weight-length Relationship for all Male Dall's Porpoises Incidentally Taken in the Japanese High Seas Salmon Fishery. 1979.



LENGTH (168.1,23.08) VERSUS WEIGHT (92026,38013) 224 VALUES

Figure 22.--Weight-length Relationships for all Male Dall's Porpoises Incidentally Taken in the Japanese High Seas Salmon Fishery. 1978.



LENGTH (170.6,20.14) VERSUS WEIGHT (76229,50924) 156 VALUES

determination of the age of individuals.

Preliminary readings of teeth collected in 1978 revealed from 4 to 22 growth layers per tooth. Individuals having 1 to 3 growth layers did not appear to be represented in the the sample.

### Stock Identity Studies

Skeletal materials, blubber and liver samples have been collected for studies of stock identity and discreteness. Skeletal materials are being prepared for measurement. We plan to initiate the project during 1980. Studies using electrophoretic techniques were initiated by scientists at other institutions, using the liver samples to locate genetic differences which identify separate populations. Photographs of individuals are being studied to determine if reliable stock or age differences exist, based on coloration and body configurations.

### Food Habit Studies

In 1978, 226 stomachs were collected from Dall's porpoise incidentally taken in the northwestern Pacific Ocean and the Bering Sea. The contents of each of the

three stomach chambers was processed separately. Each was weighed and displacement volume was determined. The contents were then processed through a series of three sieves (5.6 mm, 1.0 mm, and 0.355 mm mesh size). Fish otoliths, or ear bones, and cephalopod statoliths were segregated from other prey components and retrieved (Treacy and Crawford, in prep). (Otoliths were used to identify and enumerate fish prey items.) Remaining prey items were rough-sorted by taxonomic groups.

Table 1 lists the fish prey items identified in stomachs collected in 1978. A total of 32 species were found, involving 26 genera and 16 families. Of these, 26 species had not been reported previously as prey items of Dall's porpoise. The majority are small, bathypelagic species which migrate to surface waters nocturnally. The most numerous single prey item was Protomyctophum tomponi (42,858 otoliths). In terms of numbers, squid are second to fish in abundance in these stomachs.

A total of 491 stomachs were collected from Dall's porpoise in 1979. A subsample of 276 collected aboard two motherships is presently being analyzed for comparison with the 1978 sample. A subsample of 86 stomachs was selected from the 276 for preliminary

Table 1.--Species of fish identified from 196 Dall's porpoise stomachs from animals incidentally taken by the Mothership Salmon Fishery in the northwestern Pacific, 1978.

Species	$\bar{x}$ length	No. otoliths	% total
MYCTOPHIDAE (Percent total No. otoliths 91.5)			
<u>Protomyctophum tompsoni</u>	7.0	42858	71.4
<u>Diaphus theta</u> <sup>1/</sup>	11.4	5343	8.9
<u>Stenobranchius spp.</u> <sup>1/</sup>	12.7	5394	8.9
<u>Lampanyctus regalis</u> <sup>1/</sup>	19.0	335	--
<u>Lampanyctus jordani</u> <sup>1/</sup>	--	1290	2.1
<u>Lampanyctus "achirus" type</u> <sup>1/</sup>	--	2	--
<u>Tarletonbeania spp.</u>	12.7	18	--
<u>Tarletonbeania crenularis</u>	12.7	5	--
<u>Tarletonbeania taylori</u>	--	2	--
Unknown Myctophids	--	103	--
		55350	
BATHYLAGIDAE (Percent total no. otoliths 3.4)			
<u>Bathylagus milleri</u> <sup>1/</sup>	16.5	146	--
<u>Bathylagus pacificus</u> <sup>1/</sup>	25.0	287	--
<u>Bathylagus ochotensis</u> <sup>1/</sup>	12.1	62	--
Unidentified <sup>1/</sup>	--	1565	--
		2060	
AMMODYTIDAE (Percent total no. otoliths 3.6)			
<u>Ammodytes hexapterus</u> <sup>1/</sup>	20.6	2164	--
STICHAEIDAE (Percent total no. otoliths 0.04)			
Unidentified Stichaeoids <sup>1/</sup>	15.0	23	--
MORIDAE			
Unidentified Morids	66.0	2	--
ARGENTINIDAE (Percent total no. otoliths 0.04)			
<u>Nansenja candida</u> <sup>1/</sup>	22.2	24	--
SCOPEIOSAURIDAE (Percent total no. otoliths 0.3)			
<u>Scopelosaurus harryi</u> <sup>1/</sup>	21.6	176	--
MELAMPHAEIDAE (Percent total no. otoliths 0.47)			
<u>Melamphaes lugubris</u> <sup>1/</sup>	8.9	274	--
<u>Poromitra crassiceps</u> <sup>1/</sup>	12.7	13	--
		287	

Table 1.--continued.

Species	$\bar{x}$ length	No. otoliths	% total
OPISTHOPROCTIDAE (Percent total no. otoliths 0.08)			
<u>Macropinna microstoma</u> <sup>1/</sup>	4.4	45	--
<u>Dolichopteryx spp.</u> <sup>1/</sup>	15.0	2	--
		<u>47</u>	
PARALEPIDIDAE (Percent total no. otoliths 0.04)			
<u>Notolepis rissoi rissoi</u> <sup>1/</sup>	23.5	9	--
<u>Lestidiops ringens</u> <sup>1/</sup>	20.9	13	--
		<u>22</u>	
COTTIDAE			
Unidentified Cottids <sup>1/</sup>	Juvenile	10	--
CLUPEIDAE* (Percent total no. otoliths 0.08)			
<u>Clupea harengus pallasii</u>	25.0	50	--
*From one standing specimen in Puget Sound, Washington			
ENGRAULIDAE*			
<u>Engraulis mordax</u>	17.8	5	--
*From one standing specimen in Puget Sound, Washington			
GADIDAE (Percent total no. otoliths 0.25)			
<u>Theragra chalcogramma</u> <sup>1/</sup>	91.0	150	--
SCOPELARCHIDAE			
<u>Benthabella dentata</u> <sup>1/</sup>	35.5	6	--
HEXAGRAMMIDAE			
<u>Pleurogrammus monopterygius</u> <sup>1/</sup>	--	2	--

<sup>1/</sup> Species not previously reported as prey of Dall's porpoise

<sup>2/</sup> Mean size of individuals for each species and taken from J.L. Hart, Pacific Fishes of Canada, Fisheries Research Board of Canada, Bulletin 180, 1973 (740 pages).



identification and enumeration. This sample was selected for direct comparison with 1978 samples and represents animals taken during the same time interval, in the same area, and of similar sex ratio, size and reproductive condition. Examination of this sample indicates that prey were more numerous in the stomachs in 1979, however the prey species are similar in both years (compare Tables 1 and 2).

A reference collection of identified otoliths has been assembled at the NMML. These will be used for subsequent identifications of prey species.

The stomachs of 9 newborn Dall's porpoise (length of 90 to 101 cm) were examined at sea. Each contained milk but no solid food.

Northern fur seal, salmon, squid, and seabird stomachs were collected in 1979 for food habit comparisons. Neuston and plankton samples were collected aboard the dedicated research vessel and are being analyzed for comparison with stomach contents of other organism. The food habit studies will provide an understanding of the spatial distribution of Dall's porpoise.

Table 2.--Species of fish identified from 86 Dall's porpoise stomachs from animals incidentally taken by the Japanese mothership salmon fishery in the northwestern Pacific, 1979.

Species	No. otoliths	% total
<u>Protomyctophum tomponi</u>	39020	88
<u>Stenobranchius</u> sp.	1642	4
<u>Diaphus theta</u>	1979	4
<u>Lampanyctus jordani</u>	825	2
<u>Lampanyctus regalus</u>	50	-
<u>Lampanyctus "archirus" type</u>	1	-
<u>Tarletonbeania</u> sp.	4	-
<u>Scopelosaurus harryi</u>	21	-
<u>Lestidiops ringens</u>	10	-
<u>Bathylagus miller</u>	107	0.2
<u>Bathylagus pacificus</u>	39	-
<u>Bathylagus</u> sp.	167	0.4
<u>Pleurogrammus monopterigiis</u>	209	0.5
<u>Nansenia candida</u>	153	0.4
<u>Macropinna microstoma</u>	27	-
<u>Melamphaes</u> sp.	112	0.2
<u>Poromitra</u> sp.	18	-
<u>Stichaeidae</u>	4	-
<u>Stomiatoid</u>	3	-
<u>Ceratospelus</u> sp.	2	-
Total	44,393	