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Canadian High Seas Research Cruise to the Eastern North Pacific Ocean, July 5-23, 1992

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by

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Canadian scientists on the R.V. *W.E. Ricker* conducted a surface gillnet survey of the eastern North Pacific from July 5-23, 1992 to determine how El Niño affects epipelagic species distributions. Summaries are presented of the Pacific salmon (*Oncorhynchus spp.*), Pacific pomfret (*Brama japonica*), neon flying squid (*Ommastrephes bartrami*), albacore tuna (*Thunnus alalunga*), and shark catches; the biological data collected on these species; the zooplankton sampling; and the marine mammal and seabird observations. The detailed biological database collected on the Pacific salmon caught is included. The abundance of Pacific salmon species appeared to be related to sea surface temperature, and the upper thermal limit to their distributions lay between 13.0°C and 14.0°C.

RÉSUMÉ

Morris, J. F. T., D. W. Welch, W. Shaw, and D. Wellingham. 1993. Canadian high seas research cruise to the eastern North Pacific Ocean, July 5-23, 1992. Can. Data Rep. Fish. Aquat. Sci. 903: 55 p.

À bord du navire de recherche *W.E. Ricker*, des scientifiques canadiens ont effectué du 5 au 23 juillet 1992 un relevé au filet maillant dans les eaux superficielles du Pacifique nord-est; ce relevé devait permettre de déterminer de quelle façon El Niño affecte la distribution des espèces épipélagiques. Nous présentons des sommaires des prises de saumons du Pacifique (*Oncorhynchus spp.*), de castagnole mince (*Brama japonica*), d'encornet volant (*Ommastrephes bartrami*), de germon (*Thunnus alalunga*) et de requins; les données biologiques recueillies sur ces espèces; l'échantillonnage du zooplancton; enfin, les observations de mammifères marins et d'oiseaux de mer. Le rapport contient les données biologiques recueillies sur les saumons du Pacifique capturés. L'abondance des diverses espèces de saumons semble liée à la température des eaux superficielles, et la limite thermique supérieure de leur distribution se situe entre 13.0°C et 14.0°C.

1. INTRODUCTION

Canadian scientists on the R.V. *W.E. Ricker* conducted a surface gillnet survey in the eastern North Pacific from July 5-23, 1992. The overall objective was to determine the effects of the 1992 El Niño episode on the distributions of epipelagic species and zooplankton biomass in the eastern North Pacific. The specific objectives were to 1) establish the physical and biological factors defining the southern limit to the summer distribution of Pacific salmon (*Oncorhynchus spp.*); 2) to determine the summer distribution of neon flying squid (*Ommastrephes bartrami*) and Pacific pomfret (*Brama japonica*) along 145°W; 3) to determine zooplankton abundance and distribution; 4) to determine marine mammal and seabird distributions; and 5) to delineate the physical oceanography in the eastern North Pacific associated with the El Niño episode.

This report summarizes the surface gillnet and longline catches, the biological data collected on epipelagic species, the zooplankton sampling, and the marine mammal and seabird observations.

2. METHODS

2.1 CRUISE TRACK AND FISHING STATIONS

Figure 1 shows the cruise track along with the CTD, XBT, bongo net, surface gillnet, and surface longline stations completed by the R.V. *W.E. Ricker*.

The cruise was made up of the following tracks: an outbound leg along a northeastern course to the first gillnet station at 51° 36.9'N, 142° 59.5'W; a south-bound transect along 145°W where 5 gillnet sets were completed; a north-bound transect along 145°W where 2 gillnet sets were completed; an emergency run to a position within 200 miles of Cape St. James on the Queen Charlottes Islands to evacuate a critically ill crewman by helicopter; a south-bound transect along 138°W where 2 gillnet sets were completed; and an inbound leg along an eastern course to Cape Scott on the north tip of Vancouver Island. In total, 10 gillnet sets, 2 longline sets, 44 CTD casts, 44 XBT casts, and 20 zooplankton bongo tows, were completed.

2.2 FISHING GEAR AND PROTOCOL

2.2.1. Surface gillnet

The surface gillnet was made up of twenty-five 50 X 10 m tans of 115 mm stretched mesh monofilament for a total length of 1.25 km. The gillnet was normally set in the evening between 1900 hrs and 2200 hrs Pacific Daylight Time, and retrieved the next morning after 0800 hrs. However, during set #8, we hauled the surface gillnet early at 0642 hrs in response to the medical emergency.

2.2.2 Longline

The floating longline was set twice to capture live salmon for an experiment to assess their daily food ration. It was set at 0500 hrs and was retrieved by 0800 hrs. A total of 6 and 21 hachi were used at stations #1 and #2, respectively. There were approximately 50 size #1 hooks on 1 m leaders of 30 lbs test monofilament to each hachi. Salted anchovies were used as bait.

2.3 BIOLOGICAL SAMPLING PROTOCOL

Pacific salmon were sampled as follows: fork lengths, body weights, gonad weights, and liver weights were measured; stomachs were frozen intact for future analysis; scales and otoliths were collected from all species except pink salmon (*O. gorbuscha*); chum salmon (*O. keta*) tissue samples were collected and stored frozen for electrophoretic analysis to determine continent of origin; and muscle tissues from all species were collected and stored frozen for ^{13}C-^{15}N isotope analysis to determine relative trophic levels.

Neon flying squid were sampled as follows: dorsal mantle lengths and nidamental gland lengths were measured; stomachs were preserved intact in 10% formalin for future analysis; tissue samples were collected and stored frozen for electrophoretic analysis; blood samples were collected from six specimens for a pilot DNA-based genetic stock identification project; and some specimens were frozen whole for subsequent parasitological analysis.

Pacific pomfret were sampled as follows: fork lengths were measured; tissues samples were collected and stored frozen for electrophoretic analysis; stomachs were preserved intact in 10% formalin for future analysis; and dorsal, ventral, and pectoral

fins, otoliths, and scales were collected for age determination from specimens less than 30 cm and greater than 49 cm.

Shark species were sampled as follows: notch, fork, and total lengths were measured; stomach fullness was estimated; and prey items in stomachs were identified.

Albacore tuna (*Thunnus alalunga*) were sampled as follows: fork lengths were measured; heads and entrails were collected and stored frozen for parasitological analysis; and anal fins were collected for age determination.

Pelagic armourhead (*Pentaceros richardsoni*) were measured for fork length.

2.4 MARINE MAMMAL AND SEABIRD SIGHTING METHODS

Mr. Greg Morgan, National Marine Mammal Laboratory (NOAA) in Seattle, Washington, conducted the marine mammal sighting. A series of one hour transects were conducted when the ship was in transit and visibility exceeded 2 km. Sightings made on these transects are referred to as "on effort". Sightings made at other times are referred to as "off effort".

Mr. Mike Force, Canadian Wildlife Service, Environment Canada, Vancouver, B.C., conducted the seabird sighting. A series of ten minute transects were conducted when the ship was in transit and visibility exceeded 2 km. Seabirds that were within approximately 400 m of the ship were recorded as transect sightings. Sightings were also conducted at "off effort" times.

2.5 ZOOPLANKTON SAMPLING PROTOCOL

Bongo casts for zooplankton were conducted at Cooperative Plankton Research Program (COPRA) stations in coastal waters off British Columbia, at each fishing station, and every night along the inbound and outbound legs of the cruise route. All bongo casts were oblique tows to a maximum of 700 m, and followed the protocol described in the COPRA sampling manual (Shaw 1990).

The zooplankton sample from one of the twin bongo nets was preserved in 7% formalin for future analysis to determine species composition. The zooplankton sample from the other net was sorted into three size fractions by successively sieving it through 2.0 mm, 850 μm, and 180 μm Nitex screens. The size fractions were

stored frozen for future biochemical analysis to determine protein, lipid, and carbohydrate contents.

2.6 PHYSICAL OCEANOGRAPHIC SAMPLING

Physical oceanographic data from the cruise included a series of CTD (conductivity, temperature, depth) casts to 1000 metres and a continuous log of sea surface temperatures and salinities along the cruise track from the SAIL system. The CTD and SAIL datasets can be accessed by contacting Robin Brown, Oceanographic Data Management, Institute of Ocean Sciences (IOS), P.O. Box 6000, 9860 West Saanich Road, Sidney, B.C., Canada, V8L 4B2. The CTD dataset is identified by the cruise number "OP92-17" and the SAIL dataset by the vessel name "*W.E. Ricker*", year "1992", and start date "day of year, 188".

XBT (expendable bathythermograph) casts for the Department of National Defence were conducted every four hours when the ship was in transit.

2.7 BIOLOGICAL AND CHEMICAL OCEANOGRAPHIC SAMPLING

Sea surface chlorophyll, particulate organic carbon and nitrogen, phosphate, nitrate, and silicate samples were collected at each CTD station. Chlorophyll samples were collected on Micro Filtration Systems GF75 filters from 200 ml of sea water. Particulate organic carbon and nitrogen samples were collected on pre-combusted Micro Filtration Systems GF75 filters from 500 ml of sea water. Approximately 10 ml of seawater was collected in glass culture tubes for future nitrate and phosphate determinations, and in plastic culture tubes for future silicate determinations. All samples were stored frozen.

3. DATA

3.1 PACIFIC SALMON CATCHES AND BIOLOGICAL DATA

Table 1 presents the surface gillnet catches of salmon at each station. A total of 426 Pacific salmon were caught by surface gillnet; 50.5% were pink salmon, 25.8% were sockeye salmon

(*O. nerka*), 11.0% were chum salmon, 9.2% were coho salmon (*O. kisutch*), and 3.5% were steelhead trout (*O. mykiss*). No chinook salmon (*O. tshawytscha*) were caught.

The distribution of Pacific salmon (Figures 2-6) appeared to be dependent on sea surface temperature. Pink, chum, coho, and sockeye salmon, and steelhead trout were caught at the one station on the outbound leg and at the three most northerly stations along 145°W at or below 12.1°C. They were also caught at the two stations along 138°W, where the sea surface temperatures were 12.7°C and 13.3°C, respectively. No salmon were caught at stations #5 and #6 at the southern extreme of the 145°W transect, or at the two stations along 142° 30′W, where sea surface temperatures ranged from 13.3°C to 14.0°C.

Table 2 presents longline salmon catches for two stations. Fifteen pink salmon, 3 sockeye salmon, and 1 steelhead trout were caught at station #2, where the sea surface temperature was 12.7°C; no salmon were caught at station #1 at the southern extreme of the 145°W transect, where the sea surface temperature was 13.7°C.

Figures 9-13 show fork length distributions for Pacific salmon. Fork lengths for males, females, and sexes combined for all species were normally distributed. Male and female fork lengths did not differ significantly for any species. Pink salmon fork lengths had a mean of 490 mm and a standard deviation of 24 mm. Chum salmon fork lengths had a mean of 494 mm and a standard deviation of 56 mm. Coho salmon fork lengths had a mean of 584 mm and a standard deviation of 39 mm. Sockeye salmon fork lengths had a mean of 558 mm and a standard deviation of 28 mm. Steelhead trout fork lengths had a mean of 601 mm and a standard deviation of 44 mm.

Chum salmon were represented by three age classes: 68.9% were age 0.2 (fresh water years.ocean years) and 28.9% were age 0.3. One chum salmon was age 0.1. Coho salmon were represented by two age classes: 69% were age 1.1 and 31% were age 2.1. Sockeye salmon were represented by five age classes: the dominant age 1.2 (89.7%), age 1.3 (6.5%), age 0.2 (1.9%), age 2.1 (0.9%), and age 2.2 (0.9%). Steelhead trout were represented by two age classes: ten were age 1.1, one was 2.1, and one was 1.2.

Females dominated the pink and sockeye salmon catches; female to male ratios were 2.14:1 and 1.82:1, respectively.

Five sockeye salmon caught at surface gillnet station #9 and longline station #2 along the 138°W transect were marked by sea lice (*Lepeophtheirus salmonis*) lesions.

Table 3 presents the biological data including fork lengths, body weights, gonad weights, liver weights, age, and sex for each Pacific salmon.

3.2 RECOVERY OF TAGGED SALMON

One male steelhead trout tagged with CWT "10-42-16" was caught at surface gillnet station #9. It measured 70.5 cm in fork length, weighed 3,876 g, and its gonads weighed 5.3 g. The U.S. Fish and Wildlife Service released 100,506 smolts of which 15,218 were tagged with CWT "10-42-16" into the Sawtooth River in Idaho on April 6, 1990.

3.3 PACIFIC POMFRET CATCHES AND BIOLOGICAL DATA

Seventy-one Pacific pomfret were caught on the cruise; 70 by surface gillnet (Table 1, Figure 7) and one by longline (Table 2). Pacific pomfret fork lengths ranged from 36 cm to 50 cm with a major mode at 40 cm and a minor mode at 46-49 cm (Figure 14). Of 69 sexed Pacific pomfret, 40 were female and 29 were male.

3.4 MISCELLANEOUS SPECIES CATCHES AND BIOLOGICAL DATA

Eleven sharks were caught by surface gillnet; 6 salmon shark (*Lamna ditropis*), 4 blue shark (*Prionace glauca*), and 1 dogfish (*Squalus acanthias*) (Table 1). Lengths and sex are provided in Table 4.

Three albacore tuna and two pelagic armourhead were caught by surface gillnet (Table 1). Fork lengths are provided in Table 4.

3.5 SQUID CATCHES AND BIOLOGICAL DATA

All except one of the 78 neon flying squid caught on the cruise were from gillnet station #7 at the southern extreme of the 142°W transect (Table 1, Figure 8), where the sea surface temperature was 14.0°C. Of 69 sexed neon flying squid, 66 were female and 3 were male. Female neon flying squid mantle lengths

ranged from 33 to 45 cm with a major mode at 37 cm and minor mode at 43 cm (Fig. 8). McKinnell et al. (1990) also observed this minor mode at 43 cm. The male mantle lengths were 31, 34, and 37 cm.

Three female boreal clubhook squid (*Onychoteuthis borealijaponica*) were caught along 145°W (Table 1). Their mantle lengths were 35, 35, and 37 cm, and their respective nidamental gland lengths were 8, 8, and 10 cm.

3.6 MARINE OBSERVER DATA

Tables 5 and 6 provide summaries of marine mammal and seabird sightings, respectively.

A ball-up of 5 to 10 tans of surface gillnet was sighted floating at 51°08.3'N, 145°04.5'W on July 11, 1992, and hauled aboard. No marine mammals or fish were entangled.

3.7 ZOOPLANKTON DATA

Table 7 provides a summary of the bongo tow operations.

4. DISCUSSION

In response to concern for the potential effect of global warming on the carrying capacity of the North Pacific for salmon production, a joint Canada-Japan scientific program was started to examine the physical factors defining the southern boundaries of Pacific salmon distributions. This *W.E. Ricker* cruise from July 5-23 to the eastern North Pacific was one in a series of nine offshore cruises during 1992. The 1992 research cruises were of particular interest because they afforded an opportunity to collect distributional data on Pacific salmon during an El Niño. Data collected during an El Niño year may serve as a model for the longer term effects of global warming on the distribution of Pacific salmon in the North Pacific. During an El Niño, warm subtropical surface waters move up along the California coast and into the eastern North Pacific. This current flow is reflected in a northward displacement of sea surface isotherms. Global warming is expected to result in a permanent northward displacement of the

mean position of ocean isotherms. Since sea surface temperature has been shown to be an important factor in delineating the southern boundary of Pacific salmon distributions (Welch et al. 1990), the consequences of both El Niños and global warming may be a constriction of geographic ranges and a coincident decrease in the carrying capacity of the North Pacific for salmon production.

On this *W.E. Ricker* cruise, we found that the upper thermal limits to the southern distributions of Pacific salmon appeared to lie between sea surface temperatures of 13.0°C and 14.0°C. Pink, chum, coho, sockeye salmon, and steelhead trout were only caught north of the 12.1°C isotherm along 145°W, and none were caught above 13.3°C any where along the cruise track.

These upper thermal limits were considerably higher than in previous years. On the joint USSR-Canada rope trawl survey in April and May, 1990 (Welch et al. 1990), salmon abundances rapidly declined between sea surface temperatures of 10°C and 11°C; and the upper thermal limits occurred at ca. 10.5°C for pink and chum salmon, at ca. 10.0°C for coho salmon, and at ca. 8.0°C for sockeye salmon. The surface gillnet and longline surveys in 1987, 1988, and 1990 by the *W.E. Ricker* (Lebrasseur et al. 1987; Lebrasseur et al. 1988; and McKinnell et al. 1990), showed similar sharp declines in abundance between 10.0°C and 11.0°C.

However, the important point to make is that these cruises demonstrate that the southern extent of salmon distributions is consistently some function of sea surface temperature. The yearly and seasonal fluctuations in the upper thermal limits to salmon distributions that are observed may be due to interactions between sea surface temperature and food availability (Welch 1990), seasonal warming of the surface waters above the thermocline, and differences in the distributional response to sea surface temperatures between immature and maturing salmon.

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REFERENCES

LeBrasseur, R., B. Riddell, and T. Gjernes. 1987. Ocean salmon studies in the Pacific Subarctic boundary area. 16 p. (Document submitted to the Annual Meeting of the International North Pacific Fisheries Commission, Vancouver, B.C., Canada, October, 1987). Dept. of Fisheries and Oceans, Biological Sciences Branch, Pacific Biological Station, Nanaimo, B.C. V9R 5K6.

LeBrasseur, R. J., N. B. Hargreaves, and T. Gjernes. 1988. Canadian mid-ocean salmon studies, *W.E. Ricker*, 1-June - 12 July, 1988. 19 p. (Document submitted to the annual meeting of the International North Pacific Fisheries Commission, Tokyo, Japan, October, 1988). Department of Fisheries and Oceans, Pacific Biological Station, Nanaimo, B.C., Canada V9R 5K6.

McKinnell, S.M., W. Shaw, and J. Ladell. 1990. The 1990 pelagic research cruise of the *W.E. Ricker*. 23p. (Document submitted to the Annual Meeting of the International North Pacific Fisheries Commission, Vancouver, British Columbia, Canada, November, 1990). Department of Fisheries and Oceans, Pacific Biological Station, Nanaimo, B.C., Canada V9R 5K6.

Nelson, B. 1979. Seabirds, their biology and ecology. 219 p. A & W Publishers, Inc. By arrangement with The Hamlyn Publishing Group Limited. Library of Congress Catalog Card Number: 78-65881. ISBN: 0-89479-042-0.

Shaw, W. 1990. Cooperative Plankton Research Program, Plankton - Guildline CTD-AMR STD-12 Sampling Manual. Department of Fisheries and Oceans, Biological Sciences Branch, Pacific Biological Station, Nanaimo, B.C., Canada. V9R 5K6.

Welch, D. W., T. W. Gjernes, O. A. Rassadnikov, and A. Korolov. 1990. Upper thermal limits on the late spring distribution of Pacific salmon (*Oncorhynchus spp.*) in the Northeast Pacific. 17 p. (Document submitted to the Annual Meeting of the International North Pacific Fisheries Commission, Vancouver, B.C., Canada, November, 1990).

Welch, D. W. 1992. Possible future high seas salmon research by the Pacific Biological Station. pages 37-42. *in* Ishida, Y., K. Nagasawa, D. W. Welch, K. M. Myers, and A. P. Shershnev [eds.] 1992. Proceedings of the International Workshop on Future Salmon Research in the North Pacific Ocean. Special Publication of the National Research Institute of Far Seas Fisheries 20: 79 p.

Table 1. Summary of surface gillnet catches on the W.E. Ricker cruise to the eastern North Pacific, July 5-23, 1992.

SET#	DATE	LOCATION	DIR°	SET TIME	HAUL TIME	TANS	MESH mm	WINDS km/hr	SST °C	SSS (ppt)	NUMBERS OF SALMON					NUMBERS OF OTHER SPECIES		
											PK	CM	CO	SO	ST	PF	FS	MISCELLANEOUS SP.
1	09/07/92	51 36.9 N 142 59.5 W	245	22:00-22:12	8:23-10:00	25	115	SW 28	11.164	32.284	60	4	24	25	1	2	0	1 SS
2	10/07/92	51 29.9 N 145 00.2 W	265	20:00-20:11	8:12- 9:43	25	115	SW 33	11.138	32.369	38	20	7	16	0	0	0	
3	11/07/92	50 00.0 N 145 00.3 W	270	20:51-21:01	8:35- 9:40	25	115	W 30	11.278	32.401	29	17	2	23	2	0	0	1 DF, 1 CHS
4	12/07/92	48 30.0 N 145 00.3 W	260	20:15-20:26	8:10- 9:17	25	115	SW 22	12.084	32.521	15	1	1	16	2	1	0	
5	13/07/92	47 00.1 N 145 00.0 W	262	20:05-20:16	8:15- 9:19	25	115	SW 13	13.275	32.722	0	0	0	0	0	11	0	2 SS, 1 BS, 2 CHS
6	14/07/92	46 00.0 N 145 00.0 W	270	20:03-20:16	8:12- 9:06	25	115	SW 26	13.733	32.776	0	0	0	0	0	17	0	1 PA
7	15/07/92	46 29.9 N 142 29.9 W	270	20:47-20:58	8:15- 9:43	25	115	NE 15	14.032	32.634	0	0	0	0	0	2	77	3 BS, 3 AT
8	16/07/92	48 20.6 N 142 29.9 W	180	21:08-21:19	6:42- 7:30	25	115	S 15	13.457	32.482	0	0	0	0	0	21	1	1 SS
9	18/07/92	51 24.9 N 137 56.6 W	50	21:13-21:35	8:31- 9:34	25	115	W 22	12.698	32.347	38	5	4	28	6	14	0	2 SS, 1 PA
10	19/07/92	50 41.6 N 138 00.1 W	330	19:07-19:17	8:23- 9:18	25	115	NW 15	13.290	32.358	35	0	1	2	4	2	0	
											215	47	39	110	15	70	78	

Table 2. Summary of longline catches on the W.E. Ricker cruise to the eastern North Pacific, July 5-23, 1992.

SET#	DATE	LOCATION	DIR°	SET TIME	HAUL TIME	HACHI	WINDS km/hr	SST °C	SSS (ppt)	NUMBERS OF SALMON					
										PK	CM	CO	SO	ST	PF
1	15/07/92	46 00.0 N 145 00.0 W	270	5:00- 5:15	5:30- 6:00	6	SW 26	13.733	32.776	0	0	0	0	0	0
2	20/07/92	51 27.7 N 137 53.8 W	235	5:04- 5:38	6:20- 7:43	21	SW 8	12.698	32.347	15	0	0	3	1	1
										15	0	0	3	1	1

Abbreviations:

PK, pink salmon; CM, chum salmon; SO, sockeye salmon; CO, coho salmon; ST, steelhead salmon;
PF, Pacific pomfret; FS, neon flying squid; CHS, boreal clubhook squid; SS, salmon shark; DF, spiny dogfish;
BS, blue shark; AT, albacore tuna; PA, pelagic armourhead.

Table 3. Biological data collected on Pacific salmon on the W.E. Ricker cruise to the eastern North Pacific, July 5-23, 1992.

SET#	SPECIES	FL(mm)	FISH WT g	AGE	SEX	GONAD WT g	LIVER WT g	COMMENTS
1	PINK	557	2298	0.1	M	10.1	48.8	
1	PINK	565	1449	0.1	F	115.2	55.0	
1	PINK	495	1339	0.1	F	86.0	45.8	
1	PINK	487	1474	0.1	M	39.8	37.9	
1	PINK	510	1630	0.1	F	81.8	52.5	
1	PINK	488	1622	0.1	F	87.8	58.7	
1	PINK	473	1347	0.1	M	69.0	28.7	
1	PINK	502	1489	0.1	F	60.5	53.6	
1	PINK	420	1102	0.1	M	55.5	30.0	
1	PINK	477	1292	0.1	F	97.5	40.5	
1	PINK	495	1774	0.1	F	101.3	54.6	
1	PINK	509	1656	0.1	F	109.7	42.8	
1	PINK	506	1640	0.1	F	88.4	34.5	
1	PINK	488	1373	0.1	M	14.4	23.0	
1	PINK	500	1430	0.1	F	64.9	47.2	
1	PINK	533	2237	0.1	M	66.8	49.0	
1	PINK	495	1734	0.1	F	93.3	50.5	
1	PINK	505	1680	0.1	F	132.4	52.5	
1	PINK	489	1598	0.1	M	71.3	44.3	
1	PINK	527	1939	0.1	M	18.4	48.2	
1	PINK	490	1534	0.1	F	70.3	57.2	
1	PINK	490	1610	0.1	F	110.9	58.7	
1	PINK	492	1597	0.1	F	132.7	56.6	
1	PINK	502	1691	0.1	M	26.1	41.7	
1	PINK	531	1829	0.1	F	91.6	65.8	
1	PINK	464	1310	0.1	F	10.4	38.5	
1	PINK	485	1344	0.1	F	73.8	44.3	
1	PINK	510	1884	0.1	F	124.9	68.1	
1	PINK	466	1292	0.1	F	72.7	51.5	
1	PINK	485	1423	0.1	M	15.7	42.1	
1	PINK	478	1351	0.1	F	70.2	48.6	
1	PINK	465	1300	0.1	F		45.7	
1	PINK	512	1551	0.1	F	64.9	52.7	
1	PINK	505	1930	0.1	F	55.0	56.6	
1	PINK	490	1557	0.1	F	87.2	57.5	
1	PINK	477	1312	0.1	M	12.2	32.5	
1	PINK	490	1446	0.1	F	67.1	49.5	
1	PINK	509	1770	0.1	F	100.0	66.7	
1	PINK	500	1574	0.1	F	80.3	53.2	
1	PINK	475	1303	0.1	F	77.6	47.9	
1	PINK	495	1473	0.1	M	25.3	29.9	
1	PINK	459	1267	0.1	M	18.6	25.0	
1	PINK	511	1729	0.1	M	56.4	56.8	
1	PINK	504	1589	0.1	F	104.9	59.8	
1	PINK	503	1438	0.1	F	90.4	54.7	
1	PINK	510	1678	0.1	M	12.0	42.3	
1	PINK	498	1536	0.1	F	78.3	45.0	

Table 3 (continued).

SET#	SPECIES	FL(mm)	FISH WT g	AGE	SEX	GONAD WT g	LIVER WT g	COMMENTS
1	PINK	507	1808	0.1	F	36.7	43.9	
1	PINK	550	2107	0.1	F	129.1	78.4	
1	PINK	465	1236	0.1	M	42.2	25.5	
1	PINK	500	1503	0.1	F	71.8	54.1	
1	PINK	489	1468	0.1	F	101.6	57.7	
1	PINK	500	1561	0.1	F	72.1	54.5	
1	PINK	517	1760	0.1	F	112.0	72.4	
1	PINK	504	1676	0.1	F	89.8	53.7	
1	PINK	517	1542	0.1	F	47.8	51.0	
1	PINK	524	1838	0.1	F	91.1	66.3	
1	PINK	522	1819	0.1	F	96.4	66.2	
1	PINK	524	1902	0.1	F	113.9	74.1	
1	CHUM	530	1837	0.3	M	5.6	46.9	
1	CHUM	480	1436	0.3	M	3.9	44.1	
1	CHUM	510	1407	X.X	M	8.8	35.5	
1	CHUM	462	1354	0.2	F	12.9	42.1	
1	COHO	587	2092	1.1	M	25.7	63.1	
1	COHO	570	2092	X.1	M	36.2	55.7	
1	COHO	570	2596	1.1	F	65.8	82.5	
1	COHO	565	2015	X.1	F	53.9	62.0	
1	COHO	645	3002	1.1	M	18.8	61.6	
1	COHO	610	2836	2.1	M	76.0	68.7	
1	COHO	630	3828	X.1	F	50.8	113.2	
1	COHO	606	3134	2.1	F	44.4	88.6	
1	COHO	530	1797	1.1	F	27.6	51.7	
1	COHO	594	2614	1.1	F	54.8	87.7	
1	COHO	535	1811	1.1	F	20.5	59.5	
1	COHO	544	2043	1.1	F	40.0	64.5	
1	COHO	590	2887	X.1	F	97.9	103.4	
1	COHO	585	3036	X.1	F	135.8	124.6	
1	COHO	506	1594	1.1	M	16.3	45.3	
1	COHO	627	3136	1.1	M	37.6	80.9	
1	COHO	548	2048	X.1	F	38.0	60.1	PARASITIC YELLOW WORMS ON KIDNEY
1	COHO	608	2799	X.1	F	58.6	96.3	
1	COHO	566	2460	1.1	F	83.5	85.7	
1	COHO	590	2426	1.1	F	67.1	70.3	
1	COHO	508	1528	1.1	M	19.3	48.3	
1	COHO	545	2151	2.1	M	49.0	60.4	
1	COHO	583	3278	1.1	M	38.1	73.0	
1	COHO	595	3002	2.1	F	87.9	110.2	
1	SOCKEYE	546	1978	X.X	M	19.6	40.8	
1	SOCKEYE	596	2692	1.2	F	47.4	77.0	
1	SOCKEYE	563	2188	1.2	M	40.9	69.8	
1	SOCKEYE	589	2759	1.2	F	65.5	79.1	
1	SOCKEYE	525	3080	1.3	F	61.8	90.7	
1	SOCKEYE	533	1891	2.1	F	30.3	51.4	
1	SOCKEYE	580	2366	1.2	M	13.2	58.1	

Table 3 (continued).

SET#	SPECIES	FL(mm)	FISH WT g	AGE	SEX	GONAD WT g	LIVER WT g	COMMENTS
1	SOCKEYE	537	1873	1.2	M	24.4	46.9	
1	SOCKEYE	580	2438	X.X	M	16.0	71.5	
1	SOCKEYE	565	2287	1.2	M	19.0	62.8	
1	SOCKEYE	459	1135	1.2	M	19.3	25.0	
1	SOCKEYE	547	2083	1.2	M	16.7	56.3	
1	SOCKEYE	527	2045	1.2	F	28.7	58.2	
1	SOCKEYE	555	2259	1.2	M	27.5	48.0	
1	SOCKEYE	589	2846	1.2	F	104.2	62.2	
1	SOCKEYE	536	2028	1.2	F	39.3	57.2	
1	SOCKEYE	545	1796	1.2	F	28.4	49.1	
1	SOCKEYE	581	2792	1.2	M	35.1	71.6	
1	SOCKEYE	533	1724	2.2	F	48.4	56.5	
1	SOCKEYE	538	2128	1.2	F	37.8	65.4	
1	SOCKEYE	523	1747	1.2	M	26.8	45.1	
1	SOCKEYE	560	1954	1.2	F	34.3	47.2	
1	SOCKEYE	583	2508	1.2	M	18.2	61.5	
1	SOCKEYE	572	2557	1.2	M		60.8	
1	SOCKEYE	554	2136	1.2	F	30.4	53.1	
1	STEELHEAD	594	2205	X.1	M	0.3	51.3	
2	PINK	477	1456	0.1	F	90.4	25.8	
2	PINK	497	1377	0.1	M	39.2	35.8	
2	PINK	489	1545	0.1	F	112.1	40.0	
2	PINK	500	1723	0.1	F	134.7	57.0	
2	PINK	503	1667	0.1	F	90.1	57.5	
2	PINK	505	1763	0.1	F	125.6	58.2	
2	PINK	500	1283	0.1	M	54.3	34.7	
2	PINK	483	1443	0.1	F	91.0	46.1	
2	PINK	542	1738	0.1	F	133.4	59.7	
2	PINK	508	1462	0.1	F	101.4	60.1	
2	PINK	416		0.1	F	90.9	46.5	MISSING PART OF HEAD
2	PINK	472	1358	0.1	M	41.7	40.1	
2	PINK	496	1329	0.1	F	44.2	35.2	
2	PINK	494	1460	0.1	F	89.8	47.0	
2	PINK	463	1265	0.1	M	54.1	54.5	
2	PINK	495	1666	0.1	F	66.9	52.3	
2	PINK	499	1546	0.1	F	140.8	51.2	
2	PINK	485	1463	0.1	F	74.4		
2	PINK	478	1290	0.1	M			
2	PINK	469	1141	0.1	F	62.4	38.6	
2	PINK	465	1445	0.1	F	108.4	54.5	
2	PINK	452	1156	0.1	M	49.7	30.7	
2	PINK	496	1757	0.1	F	98.3	46.1	
2	PINK	470	1256	0.1	M	56.9	37.6	
2	PINK	425	1823	0.1	F	157.5	59.6	
2	PINK	490	1673	0.1	F	107.1	54.2	
2	PINK	496	1487	0.1	F	70.1	34.7	
2	PINK	517	1848	0.1	M	34.9	37.6	

Table 3 (continued).

SET#	SPECIES	FL(mm)	FISH WT g	AGE	SEX	GONAD WT g	LIVER WT g	COMMENTS
2	PINK	489	1386	0.1	F	77.5	42.2	
2	PINK	518	1699	0.1	M	59.6	41.4	
2	PINK	476	1307	0.1	M	64.1	23.7	
2	PINK	445	1242	0.1	F	73.8	45.9	
2	PINK	492	1536	0.1	M	81.7	37.0	
2	PINK	487	1525	0.1	F	111.0	55.1	
2	PINK	525	2125	0.1	F	150.6	70.4	
2	PINK	504	1485	0.1	F	32.1	26.8	
2	PINK	489	1515	0.1	F	96.9	52.5	
2	PINK	495	1468	0.1	F	107.7	46.5	
2	CHUM	485	1435	0.2	F	7.8	39.5	
2	CHUM	520	1729	0.2	M	1.3	43.2	
2	CHUM	577	1441	0.3	F	11.7	35.5	
2	CHUM	457	1158	0.2	M	2.1	26.9	
2	CHUM	520	1884	0.3	F	17.6	48.1	
2	CHUM	495	1575	0.2	M	1.2	42.7	
2	CHUM	523	1682	0.2	M	3.4	41.4	
2	CHUM	394	740	0.2	F	4.8	18.8	
2	CHUM	492	1615	0.3	F	16.9	41.0	
2	CHUM	490	1428	0.2	F	9.8	34.5	
2	CHUM	566	1272	0.3	F	14.7	26.4	
2	CHUM	437	1020	0.2	M	1.8	35.9	
2	CHUM	510	1668	0.3	M	2.7	38.4	
2	CHUM	452	1190	0.2	M		26.6	IMMATURE GONADS
2	CHUM	365	558	0.1	M	0.5	17.1	
2	CHUM	510	1461	0.2	M	1.1	27.0	
2	CHUM	485	1043	0.2	F	7.3	21.7	
2	CHUM	551	2086	0.3	M	2.8	52.2	
2	CHUM	463	1310	X.X	M			
2	CHUM	626	1639	0.3	M	1.8	34.1	
2	COHO	512	1725	2.1	M	42.3	32.2	
2	COHO	582	2825	X.1	F	143.4	118.4	
2	COHO	543	2042	2.1	M	30.7	48.1	
2	COHO	574	2313	1.1	M	18.5	67.8	
2	COHO	630	3178	2.1	M	26.2	63.5	
2	COHO	560	2248	X.1	F	51.0	45.1	
2	COHO	581	2868	1.1	M	35.5	71.8	
2	SOCKEYE	558	1777	1.2	F	26.7	39.4	
2	SOCKEYE	587	2192	1.2	F	26.3	47.9	
2	SOCKEYE	542	1908	1.2	F	45.1	38.5	
2	SOCKEYE	575	2138	1.2	M	10.2	50.7	
2	SOCKEYE	581	2159	1.2	M	21.8	50.9	
2	SOCKEYE	607	2535	1.3	F	81.9	47.7	
2	SOCKEYE	571	2086	1.2	F	32.5	46.6	
2	SOCKEYE	565	1977	1.2	F	37.8	46.7	
2	SOCKEYE	599	2583	1.2	F	41.2	61.7	
2	SOCKEYE	579	2279	1.2	F	44.2	61.3	

Table 3 (continued).

SET#	SPECIES	FL(mm)	FISH WT g	AGE	SEX	GONAD WT g	LIVER WT g	COMMENTS
2	SOCKEYE	605	3144	1.2	F	45.1	83.1	
2	SOCKEYE	526	2211	1.2	F	35.3	48.7	
2	SOCKEYE	574	1802	1.2	F	30.6	46.4	
2	SOCKEYE	565	2035	1.2	F	37.2	61.7	
2	SOCKEYE	521	1715	1.2	F	20.9	37.1	
2	SOCKEYE	542	1948	1.2	M	14.6	48.8	
3	PINK	510	1884	0.1	F	93.2	72.7	
3	PINK	474	1514	0.1	F	102.5	45.2	
3	PINK	503	1636	0.1	F	70.3	54.5	
3	PINK	498	1614	0.1	F	119.0	53.9	
3	PINK	539	2210	0.1	F	100.7	63.7	
3	PINK	474	1307	0.1	F	43.9	48.1	
3	PINK	512	1709	0.1	F	126.9	55.3	
3	PINK	502		0.1	M	71.8	38.6	
3	PINK	473	1381	0.1	F	86.9	37.9	
3	PINK	508	1717	0.1	F			
3	PINK	466	1240	0.1	F			
3	PINK	504	1918	0.1	F			
3	PINK	485	1491	0.1	M			
3	PINK	514	1588	0.1	F			
3	PINK	499	1580	0.1	M			
3	PINK	516	1817	0.1	M	48.6	40.7	
3	PINK	532	1969	0.1	F	113.5	68.0	
3	PINK	510	1471	0.1	F	67.6	59.0	
3	PINK	510	1571	0.1	F	66.9	46.2	
3	PINK	478	1282	0.1	M	27.9	30.1	
3	PINK	508	1904	0.1	F	109.9	73.0	
3	PINK	497	1416	0.1	M	31.1	28.8	
3	PINK	499	1573	0.1	F	95.0	47.9	
3	PINK	534	2083	0.1	F	105.9	64.5	
3	PINK	510	1614	0.1	F	104.4	44.4	
3	PINK	454	1178	0.1	F	75.5	40.1	
3	PINK	495	1557	0.1	F	64.1	51.0	
3	PINK	495	1647	0.1	F	101.5	51.6	
3	PINK			0.1				
3	CHUM	523	1861	0.2	M	1.0	40.9	
3	CHUM	532	1792	0.3	F	13.6	41.2	
3	CHUM	470	1254	0.2	M	1.4	29.5	
3	CHUM	469	1275	0.2	M	1.5	32.2	
3	CHUM	392	757	0.2	F	6.1	18.8	
3	CHUM	516	1870	0.3	M	2.6	45.7	
3	CHUM	563	2198	0.3	F	19.7	18.6	
3	CHUM	463	1203	0.2	M	1.7	22.4	
3	CHUM	455	1255	0.2	M	2.6	27.8	
3	CHUM	470	1360	0.2	F	6.1	32.3	
3	CHUM	457	1210	0.2	M	2.0	27.9	
3	CHUM	459	1254	0.2	M	2.8	29.9	

Table 3 (continued).

SET#	SPECIES	FL(mm)	FISH WT g	AGE	SEX	GONAD WT g	LIVER WT g	COMMENTS
3	CHUM	502	1500	0.2	M	2.0	33.9	
3	CHUM	466	1335	0.2	F	10.8	23.4	
3	CHUM	436	1148	0.2	F	7.2	21.7	
3	CHUM	497	1734	0.2	M	1.0	44.5	
3	CHUM	468	1263	0.2	M	2.3	29.3	
3	COHO	644	3834	2.1	F	87.4	120.6	
3	COHO	595	3188	1.1	F	92.2	75.8	
3	SOCKEYE	561	2220	1.2	F	29.3	52.1	
3	SOCKEYE	520	1876	1.2	F	24.6	45.9	
3	SOCKEYE	533	1954	1.2	F	26.1	42.6	
3	SOCKEYE	558	2045	1.2	F	26.3	45.9	
3	SOCKEYE	538	1985	1.2	F	36.8	46.0	
3	SOCKEYE	553	2247	1.2	F	29.4	67.6	
3	SOCKEYE	540	2185	1.2	F	34.8	57.8	
3	SOCKEYE	482	1386	1.2	F	19.0	27.8	
3	SOCKEYE	539	2020	1.2	F	30.5	61.0	
3	SOCKEYE	533	1988	1.2	M	16.0	56.8	
3	SOCKEYE	594	2931	1.2	M	23.8	73.9	
3	SOCKEYE	567	2487	1.2	F	41.9	60.8	
3	SOCKEYE	509	1459	1.2	F	22.3	29.0	
3	SOCKEYE	569	2388	1.2	M	24.2	45.5	
3	SOCKEYE	545	2002	1.2	F	24.4	47.7	
3	SOCKEYE	548	2309	1.2	F	21.0	59.8	
3	SOCKEYE	565	2206	1.2	F	25.9	63.6	
3	SOCKEYE	581	2763	1.3	F	39.7	41.2	
3	SOCKEYE	582	2579	1.2	F	46.1	53.3	
3	SOCKEYE	546	1950	1.2	F	32.4		
3	SOCKEYE	513	1747	1.2	F	22.9	40.7	
3	SOCKEYE	547	2256	1.2	M	18.6	51.4	
3	SOCKEYE	512	1750	1.2	M	20.9	32.2	
3	STEELHEAD	581	2131	1.1	F	12.2	40.9	ADIPOSE CLIPPED, NO CWT
3	STEELHEAD	610	2336	1.1	F	34.0	39.0	ADIPOSE CLIPPED, NO CWT
4	PINK	520	1871	0.1	F	98.4	64.5	
4	PINK	483	1719	0.1	M	59.9	51.3	
4	PINK	455	1334	0.1	F	103.6	58.1	
4	PINK	485	1389	0.1	F	97.2	49.3	
4	PINK	470	1577	0.1	F	42.4	53.3	
4	PINK	498	1509	0.1	F	59.4	58.5	
4	PINK	490	1581	0.1	F	101.7	74.2	
4	PINK	491	1421	0.1	M	18.9	52.3	
4	PINK	493	1852	0.1	F	125.0	64.0	
4	PINK	495	1746	0.1	F	98.8	70.0	
4	PINK	481	1509	0.1	F	115.9	66.0	
4	PINK	493	1485	0.1	M	27.9	50.2	
4	PINK	490	1584	0.1	F	92.6	68.2	
4	PINK	502	1714	0.1	M	52.7	42.3	
4	PINK	490	1470	0.1	M	106.7	34.2	

Table 3 (continued).

SET#	SPECIES	FL(mm)	FISH WT g	AGE	SEX	GONAD WT g	LIVER WT g	COMMENTS
4	CHUM	455	1292	0.2	F	12.1	47.1	
4	COHO	601	2811	X.1	M	16.8	71.9	
4	SOCKEYE	578	2480	1.3	F	47.6	32.1	
4	SOCKEYE	572	2266	1.2	F	29.0	52.3	
4	SOCKEYE	542	1945	1.2	F	19.0	51.1	
4	SOCKEYE	581	2469	1.2	M	18.3	61.7	
4	SOCKEYE	549	2029	1.2	F	34.2	56.2	
4	SOCKEYE	560	2253	1.2	F	33.7	64.9	
4	SOCKEYE	551	2059	X.X	M	10.3	60.6	
4	SOCKEYE	559	2184	1.2	F	25.0	61.3	
4	SOCKEYE	529	1862	1.2	M	19.0	37.6	
4	SOCKEYE	595	2504	1.2	F	31.7	77.6	
4	SOCKEYE	585	2498	1.2	M	22.6	66.1	
4	SOCKEYE	559	2181	1.2	M	24.6	42.4	
4	SOCKEYE	552	1880	1.2	F	24.2	44.0	
4	SOCKEYE	544	1704	1.2	F	24.7	40.4	
4	SOCKEYE	585	2518	1.2	M	14.9	60.2	
4	SOCKEYE	570	2061	1.2	F	26.9	57.6	
4	STEELHEAD	573	1987	1.1	M	18.9	32.3	ADIPOSE CLIPPED, NO CWT
4	STEELHEAD	608	2838	2.1	F	24.8	75.9	
9	PINK	484	1581	0.1	F	32.8	34.0	
9	PINK	525	1935	0.1	M	14.0	47.9	
9	PINK	492	1333	0.1	M	18.8	33.4	
9	PINK	438	1261	0.1	F	37.7	35.7	
9	PINK	519	1510	0.1	M	36.8	33.5	
9	PINK	504	1575	0.1	F	79.6	60.2	
9	PINK	469		0.1	M	20.6	33.6	
9	PINK	478	1258	0.1	F	10.3	44.6	
9	PINK	459	1115	0.1	M	8.7	27.3	
9	PINK	472	1371	0.1	F	63.2	46.0	
9	PINK	532	1710	0.1	F	59.8	54.9	
9	PINK	494	1333	0.1	F	11.5	29.3	
9	PINK	485	1248	0.1	M	12.7	30.4	
9	PINK	504	1502	0.1	F	41.1	36.3	
9	PINK	473	1305	0.1	M	22.0	40.8	
9	PINK	509	1774	0.1	M	38.3	55.8	
9	PINK	479	1309	0.1	F	124.3	46.9	
9	PINK	474	1316	0.1	F	19.3	44.7	
9	PINK	471	1414	0.1	F	78.0	50.1	
9	PINK	462	1308	0.1	F	49.0	38.8	
9	PINK	456	1289	0.1	F	48.0	36.2	
9	PINK	466	1284	0.1	F	37.3	37.6	
9	PINK	461	1320	0.1	F	42.2	42.3	
9	PINK	496	1477	0.1	M	26.2	42.6	
9	PINK	481	1572	0.1	F	64.9	35.6	
9	PINK	471	1380	0.1	M	22.4	38.7	
9	PINK	472	1289	0.1	F	56.0	51.8	

Table 3 (continued).

SET#	SPECIES	FL(mm)	FISH WT g	AGE	SEX	GONAD WT g	LIVER WT g	COMMENTS
9	PINK	475	1263	0.1	M	37.0	42.6	
9	PINK	473	1345	0.1	F	116.2	53.4	
9	PINK	481	1406	0.1	M	15.7	37.0	
9	PINK	457	1254	0.1	M	16.3	34.2	
9	PINK	436	1074	0.1	F	32.9	32.6	
9	PINK	461	1211	0.1	M	16.6	40.1	
9	PINK	462	1349	0.1	F	47.9	61.3	
9	PINK	462	1238	0.1	F	30.1	41.0	
9	PINK	455	1168	0.1	F	31.9	34.6	
9	PINK	462	1268	0.1	F	46.8	32.1	
9	PINK			0.1	F			
9	CHUM	431	1063	0.2	F	5.2	21.9	
9	CHUM	582	2099	0.3	M	2.1	43.9	
9	CHUM	515	1568	0.2	M	2.4	39.1	
9	CHUM	655	3350	0.2	M	3.1	72.7	
9	CHUM	560	1990	0.2	F	49.0	47.2	
9	COHO	621	3442	1.1	F	65.8	89.1	
9	COHO	595	2818	2.1	F	33.4	78.7	
9	COHO	654	3202	1.1	F	53.1	104.3	
9	COHO	614		1.1	M	34.0	59.5	SEAL BITE
9	SOCKEYE	567	2430	1.3				LEPEOPHTHEIRUS SALMONIS LESIONS,SAMPLED
9	SOCKEYE	554	1981	X.X				L. SALMONIS LESIONS,SAMPLED
9	SOCKEYE	549	2055	1.2				L. SALMONIS LESIONS,SAMPLED
9	SOCKEYE	499	1444	1.2	F	19.1	27.4	
9	SOCKEYE	564	1853	X.X	F	26.3	40.9	
9	SOCKEYE	612	2589	1.3	F	86.4	45.0	
9	SOCKEYE	540	1904	0.2	M	10.8	35.0	
9	SOCKEYE	608	2764	1.2	M	32.2	54.1	
9	SOCKEYE	526	1856	1.2	F	28.0	46.3	
9	SOCKEYE	563	2057	1.2	F	35.0	59.9	
9	SOCKEYE	580	2103	1.2	M	33.9	52.6	
9	SOCKEYE	568	2197	1.2	M	27.1	46.0	VISERAL ADHESION CLASS 2, FORMED AS A REACTION TO INFECTION BY
9	SOCKEYE	535	1783	1.2	M	11.1	30.1	THE PARASITIC NEMATODE, AGUBERNACULUM PHILONEMA, CLASSIFIED FROM
9	SOCKEYE	583	2377	1.2	M	19.6	56.4	CLASS 0 - NO ADHESIONS, TO CLASS 4 - EXTENSIVE BINDING OF
9	SOCKEYE	610	2822	1.2	F	23.3	87.0	INTERNAL ORGANS TO ABDOMINAL WALLS
9	SOCKEYE	579	2026	1.2	F	41.1		
9	SOCKEYE	557	2154	1.2	F	42.2	65.0	
9	SOCKEYE	596	2834	1.2	F	43.3	77.3	
9	SOCKEYE	560	2298	1.2	F	47.7	46.8	
9	SOCKEYE	540	1889	1.2	F	35.0	46.1	
9	SOCKEYE	545	1921	1.2	F	34.2	48.1	
9	SOCKEYE	539	2019	1.2	F	37.8	50.7	
9	SOCKEYE	553	2082	1.2	F	27.8	48.4	
9	SOCKEYE	550	1896	1.2	M	60.6	29.5	
9	SOCKEYE	528	1985	1.2	M	32.3	24.6	VISERAL ADHESION CLASS 4
9	SOCKEYE	565	2097	1.2	M	19.7	53.6	
9	SOCKEYE	569	2516	1.2	M	29.8	74.0	

Table 3 (continued).

SET#	SPECIES	FL(mm)	FISH WT g	AGE	SEX	GONAD WT g	LIVER WT g	COMMENTS
9	SOCKEYE	579	2594	0.2	F	38.0	77.1	
9	STEELHEAD	705	3876	1.2	M	5.3	68.3	ADIPOSE CLIPPED, CWT# 104216
9	STEELHEAD	585	2592	1.1	M	3.7	70.2	ADIPOSE CLIPPED, NO CWT
9	STEELHEAD	591	2633	1.1	F	14.1	49.6	ADIPOSE CLIPPED, NO CWT
9	STEELHEAD	588	2569	1.1	M	8.5	75.1	ADIPOSE CLIPPED, NO CWT
9	STEELHEAD	558	2235	1.1	F	9.8	32.6	ADIPOSE CLIPPED, NO CWT
9	STEELHEAD	543	1863	1.1	M	8.6	40.1	ADIPOSE CLIPPED, NO CWT
10	PINK	508	1643	0.1	M	32.6	40.0	
10	PINK	516	1914	0.1	M	67.4	53.6	
10	PINK	527		0.1	M	51.4	56.1	
10	PINK	509		0.1	M	19.7	34.3	
10	PINK	528		0.1	M	45.6	62.2	
10	PINK	563	2165	0.1	M	53.3	62.9	
10	PINK	490	1571	0.1	M			
10	PINK	490	1362	0.1	M			
10	PINK	451	1171	0.1	F			
10	PINK	529	1709	0.1	M			
10	PINK	473		0.1	F			
10	PINK	479		0.1	F	33.9	31.2	
10	PINK	478	1322	0.1	F	34.6	42.2	
10	PINK	478	1454	0.1	F	28.1	40.8	
10	PINK	438	1106	0.1	F	44.1	38.5	
10	PINK	533	1868	0.1	M	40.6	54.8	
10	PINK	481	1384	0.1	F	56.4	42.9	
10	PINK	482	1467	0.1	F	56.4	49.9	
10	PINK	460	1322	0.1	M		35.1	
10	PINK	485	1559	0.1	M	22.2	42.9	
10	PINK	492	1467	0.1	F	74.4	51.3	
10	PINK	458	1251	0.1	F	63.1	46.8	
10	PINK	480	1422	0.1	F	43.6	49.8	
10	PINK	481	1285	0.1	F	33.5	41.0	
10	PINK	459	1268	0.1	F	61.1	44.8	
10	PINK	497		0.1	M	21.2	38.2	PART OF HEAD MISSING
10	PINK	470	1382	0.1	F	63.0	39.6	
10	PINK	458	1256	0.1	F	39.2	40.8	
10	PINK	466	1299	0.1	F	53.1	26.3	
10	PINK	513	1787	0.1	M	30.0	57.8	
10	PINK	490	1380	0.1	F	47.9	45.0	
10	PINK	491	1433	0.1	F	41.5	46.2	
10	PINK	460	1236	0.1	F	48.6	43.5	
10	PINK	490	1445	0.1	M	46.9	36.4	
10	PINK	469	1317	0.1	F	47.0	39.9	
10	PINK			0.1				FELL OFF NET, HAD BEEN EATEN BY SHARK
10	COHO	651		1.1	F	94.9	86.8	
10	SOCKEYE	615	3084	1.3	F	138.4	61.5	
10	SOCKEYE	526	1877	1.2	M	17.6	36.0	
10	STEELHEAD	680		X.X	F	23.9	56.7	ADIPOSE CLIPPED, NO CWT

Table 3 (continued).

SET#	SPECIES	FL(mm)	FISH WT g	AGE	SEX	GONAD WT g	LIVER WT g	COMMENTS
10	STEELHEAD	555	2479	X.1	M	11.4	46.7	ADIPOSE, RIGHT PECTORAL CLIPPED, NO CWT
10	STEELHEAD	580	2409	1.1	M	11.6	64.8	ADIPOSE, RIGHT PECTORAL CLIPPED, NO CWT
10	STEELHEAD	632	2740	1.1	F	30.2	46.6	ADIPOSE CLIPPED, NO CWT
LL 2	PINK	458	1099	0.1	F			
LL 2	PINK	468	1233	0.1	F			
LL 2	PINK	489	1554	0.1	F			
LL 2	PINK	450	1046	0.1	M			
LL 2	PINK	476	1033	0.1	M			
LL 2	PINK	482	1421	0.1	F			
LL 2	PINK	473	1336	0.1	F			
LL 2	PINK	460	1252	0.1	M			
LL 2	PINK	505		0.1				RELEASED ALIVE
LL 2	PINK	475		0.1				RELEASED ALIVE
LL 2	PINK	512		0.1				RELEASED ALIVE
LL 2	PINK	458		0.1				RELEASED ALIVE
LL 2	PINK	491		0.1				RELEASED ALIVE
LL 2	PINK	478		0.1				RELEASED ALIVE
LL 2	PINK	492		0.1				RELEASED ALIVE
LL 2	SOCKEYE	548						RELEASED ALIVE
LL 2	SOCKEYE	602		1.2				L. SALMONIS LESIONS,SAMPLED
LL 2	SOCKEYE	533		1.2				L. SALMONIS LESIONS,SAMPLED
LL 2	STEELHEAD	634	2810		M			ADIPOSE CLIPPED, NO CWT

Table 4. Length measurements of miscellaneous fish species caught by surface gillnet on the *W.E. Ricker* cruise to the eastern North Pacific, July 5-23, 1992.

Species	Sex	Length (cm) Notch	Fork	Total
Salmon shark	M	158	182	204
(*Lamna ditropis*)	M	97	111	125
	M	78	92	104
	M	100	110	135
	M	132	151	173
	F	124	144	160
Blue shark	F	93	102	126
(*Prionace glauca*)	-	158	176	212
	-	70	77	94
	-	67	74	92
Spiny dogfish	F	56	62	75
(*Squalus acanthias*)				
Albacore Tuna	-		74	
(*Thunnus alalunga*)	-		74	
	-		71	
Pelagic Armourhead	-		23	
(*Pentaceros richardsoni*)	-		31	

Table 5. Marine mammal sightings on the *W.E. Ricker* cruise to the eastern North Pacific, July 5-23, 1992.

Marine mammal species	Number of Sightings On Effort	Off Effort	Total
Dall's porpoise (*Phocoenoides dalli*)	32-132	18-72	50-204
Northern fur seal (*Callorhinus ursinus*)	17-21	7-12	24-33
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	2-9	4-15	6-24
Sperm whale (*Physeter macrocephalus*)	3-6	0-0	3-6
Unidentified whale	2-3	1-3	3-6
Unidentified small whale	1-2	1-1	2-3
Humpback whale (*Megaptera novaeangliae*)	1-3	0-0	1-3
Fin whale (*Balaenoptera physalus*)	0-0	1-1	1-1
Total:	58-176	32-104	90-280

Table 6. Seabird sightings on the *W.E. Ricker* cruise to the eastern North Pacific, July 5-23, 1992.

Bird species	Number of sightings
Leach's storm-petrel (*Oceanodroma leucorhoa*)	577
Fork-tailed storm-petrel (*Oceanodroma furcata*)	524
Sooty shearwater (*Puffinus griseus*)	504
Cassin's auklet (*Ptychoramphus aleuticus*)	401
Black-footed albatross (*Diomedea nigripes*)	227
Unid. black shearwater	139
Mottled petrel (*Pterodroma inexpectata*)	117
Unid. storm-petrel	89
Rhinoceros auklet (*Cerorhinca monocerata*)	73
Tufted puffin (*Fratercula cirrhata*)	45
Red phalarope (*Phalaropus fulicarius*)	43
Murphy's petrel (*Pterodroma ultima*)	22
Arctic tern (*Sterna paradisaea*)	18
Long-tailed jaeger (*Stercorarius longicaudus*)	16
Unid. procellarid	13
Red-necked phalarope (*Phalaropus lobatus*)	8

Table 6 (continued).

Bird species	Number of sightings
Northern fulmar (*Fulmarus glacialis*)	8
Pink-footed shearwater (*Puffinus creatopus*)	7
Parasitic jaeger (*Stercorarius parasiticus*)	6
Unid. dark pteridroma	6
Unid. dark storm-petrel	6
Unid. large alcid	5
Short-tailed shearwater (*Puffinus tenuirostris*)	5
South polar skua (*Catharacta maccormicki*)	4
Ancient murrelet (*Synthliboramphus antiquum*)	4
Unid. phalarope	4
Unid. small alcid	4
* Hawaiian petrel (*Pterodroma phaeopygia*)	3
Solander's petrel (*Pterodroma solandri*)	2
Laysan albatross (*Diomedea immutabilis*)	1
Common murre (*Uria aalge*)	1
Unid. pterodroma	1
Total:	2883

* in danger of extinction, endemic to Hawaii but rare, and endemic to the Galapagos but threatened by land clearance and the introduction of land animals (Nelson 1979).

Table 7. Summary of plankton bongo tows on the W.E. Ricker cruise to the eastern North Pacific, July 5-23, 1992.

Consec. No.	Stn. No.	Date	Lat./Long.	Net Depth (M)	Start of Tow	S.S.T.(°C)	S.S.S.(PPT)
1	PLC2	6/7	48°27.6'N 125°08.1'W	97	255	15.33	31.653
2	PLC3	6/7	48°23.5'N 125°20.8'W	89	432	13.87	31.823
3	PLA2	6/7	48°22.7'N 126°03.8'W	355	825	15.71	31.359
4	PLA3	6/7	48°24.7'N 126°15.8'W	518	1030		
5	HS92-1	6/7	48°49.4'N 128°19.4'W	519	2140	15.57	31.675
6	HS92-2	7/7	49°46.3'N 133°11.0'W	537	2128	13.79	32.369
7	HS92-3	8/7	50°42.5'N 138°02.8'W	541	2126	11.49	21.266
8	HS92-4	9/7	51°36.8'N 143°02.3'W	676	2255	11.26	28.709
9	HS92-5	10/7	51°30.2'N 144°59.7'W	700	2053	11.14	32.369
10	HS92-6	11/7	49°59.6'N 145°00.0'W	692	2143	11.28	32.401
11	HS92-7	12/7	48°29.7'N 145°00.0'W	713	2111	12.08	32.521
12	HS92-8	13/7	47°00.3'N 144°59.6'W	713	2111	13.28	31.722

Table 7 (continued).

Consec. No.	Stn. No.	Date	Lat./Long.	Net Depth (M)	Start of Tow	S.S.T.(°C)	S.S.S.(PPT)
13	HS92-9	14/7	45°59.8'N 144°59.3'W	700	1732	13.73	32.776
14	HS92-10	15/7	46°30.2'N 142°29.6'W	687	2150	14.03	32.634
15	HS92-11	16/7	48°20.1'N 142°25.3'W	700	2205	13.46	32.482
16	HS92-12	18/7	51°25.5'N 137°56.0'W	700	2220	12.70	32.347
17	HS92-13	19/7	50°41.4'N 138°00.2'W	742	1504	13.29	32.358
18	HS92-14	21/7	50°40.4'N 134°23.4'W	502	0022	13.78	32.194
19	LQ03	22/7	50°39.8'N 129°01.9'W	500	0025	12.51	29.195
20	CPE2	22/7	50°43.0'N 128°40.0'W	90	0257	11.22	31.891
21	CPE1	22/7	51°00.0'N 127°50.0'W	107	0812	10.41	31.638
22	CPF2	23/7	49°28.0'N 124°30.0'W	305	0121	17.86	26.810
23	CPF1	23/7	49°22.0'N 124°05.0'W	322	0410	18.21	25.877

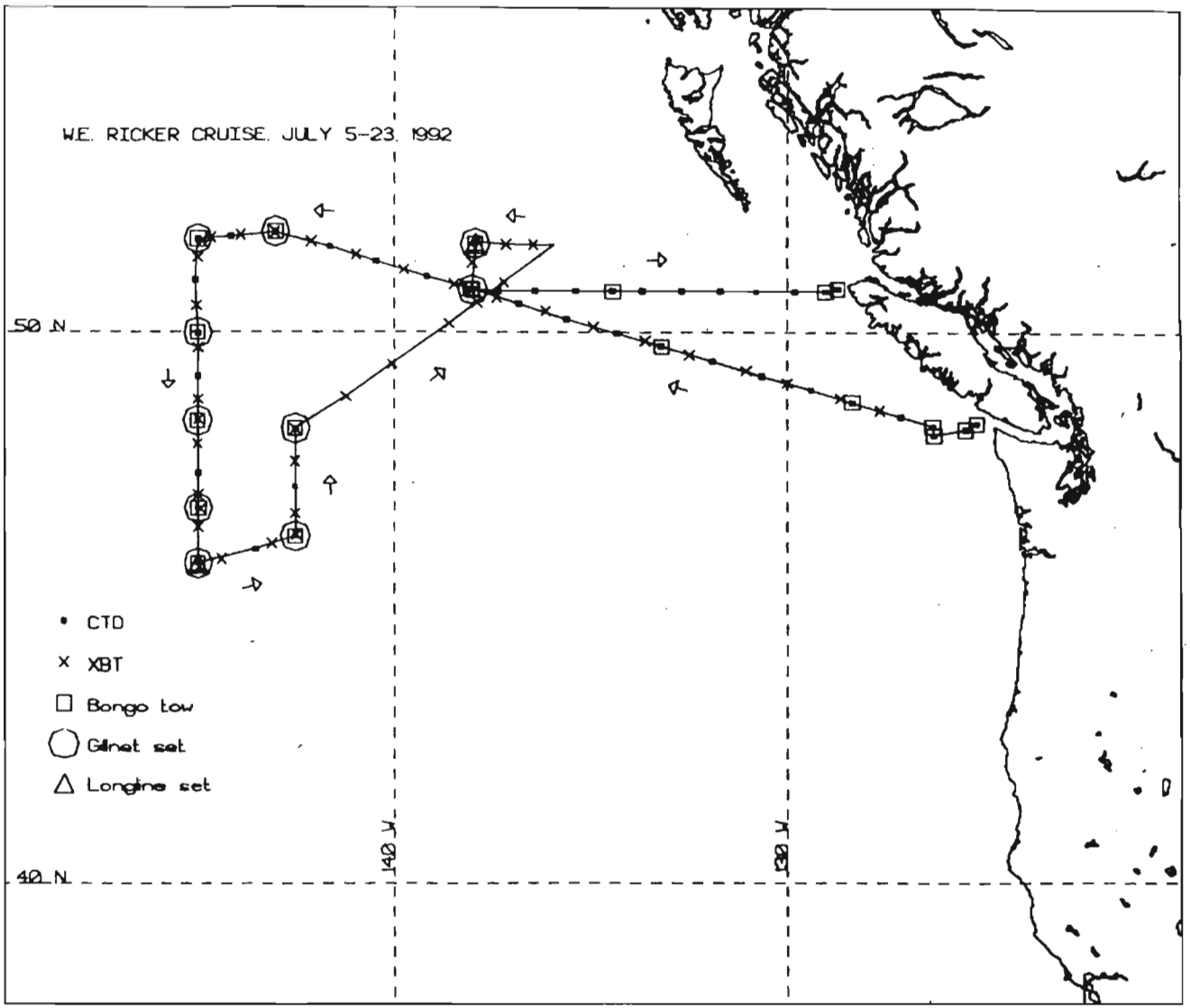

Fig. 1. Cruise track of the *W.E. Ricker*, July 5-23, 1992.

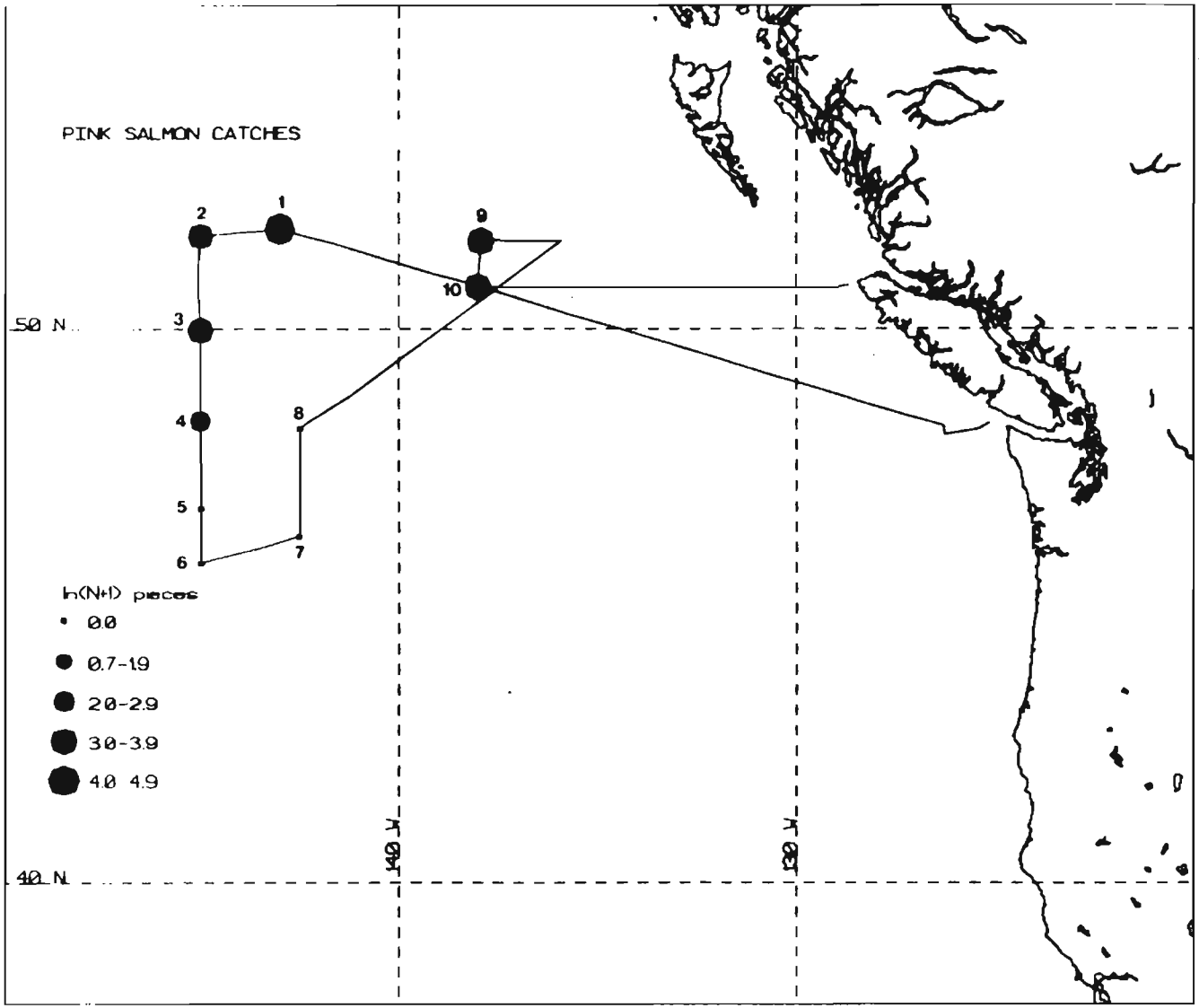

Fig. 2. Locations of pink salmon catches, July 5-23, 1992.

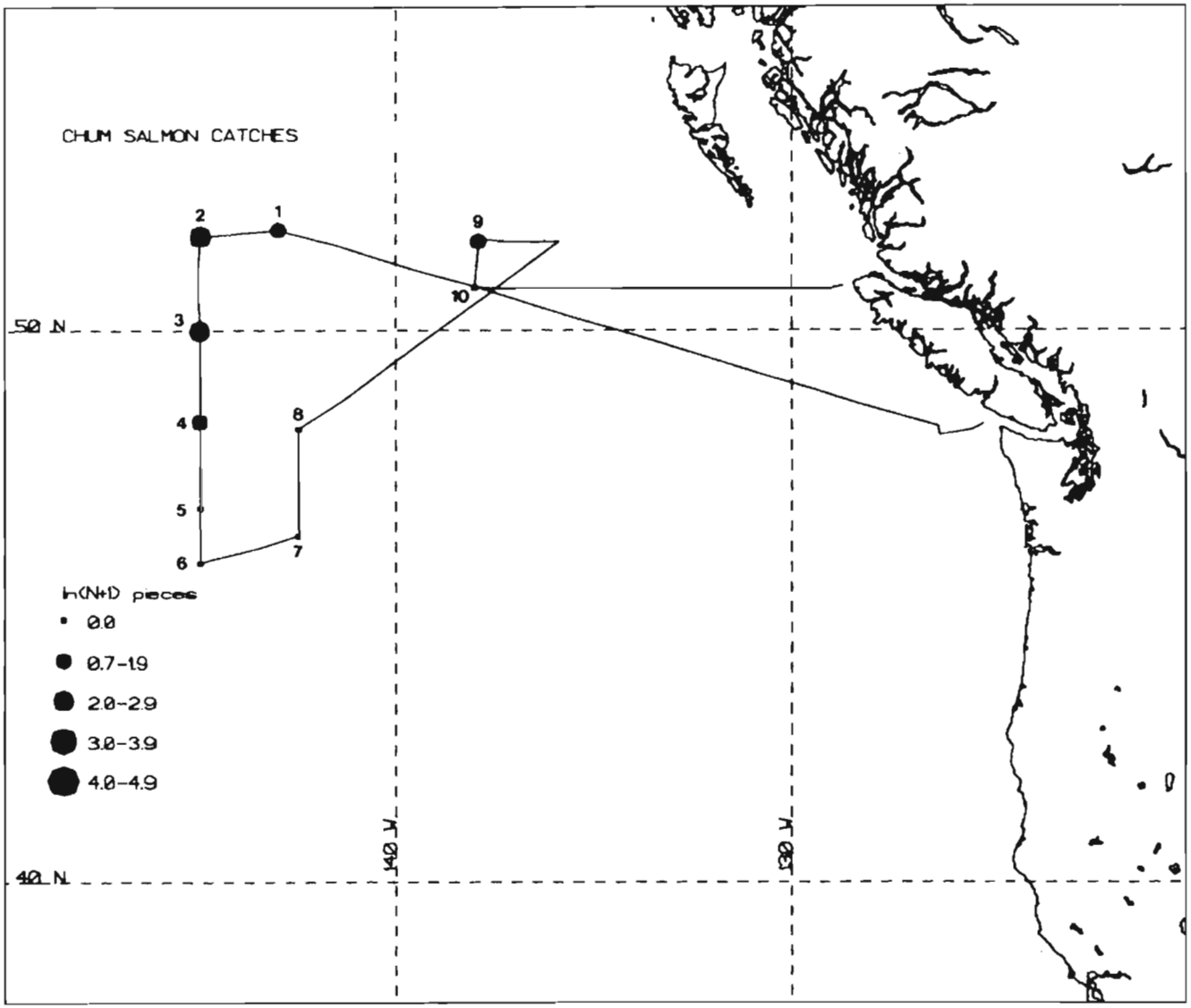

Fig. 3. Locations of chum salmon catches, July 5-23, 1992.

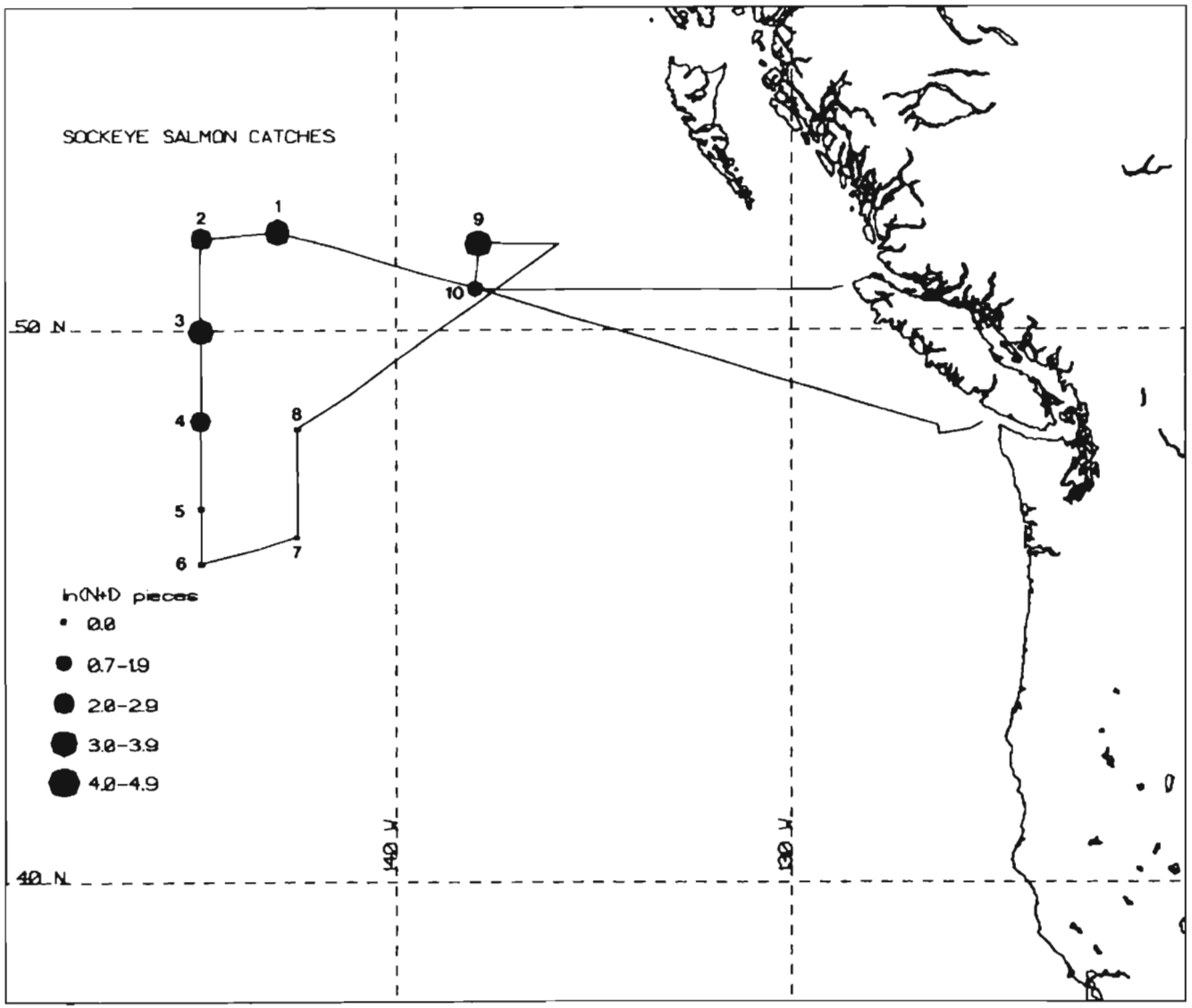

Fig. 4. Locations of sockeye salmon catches, July 5-23, 1992.

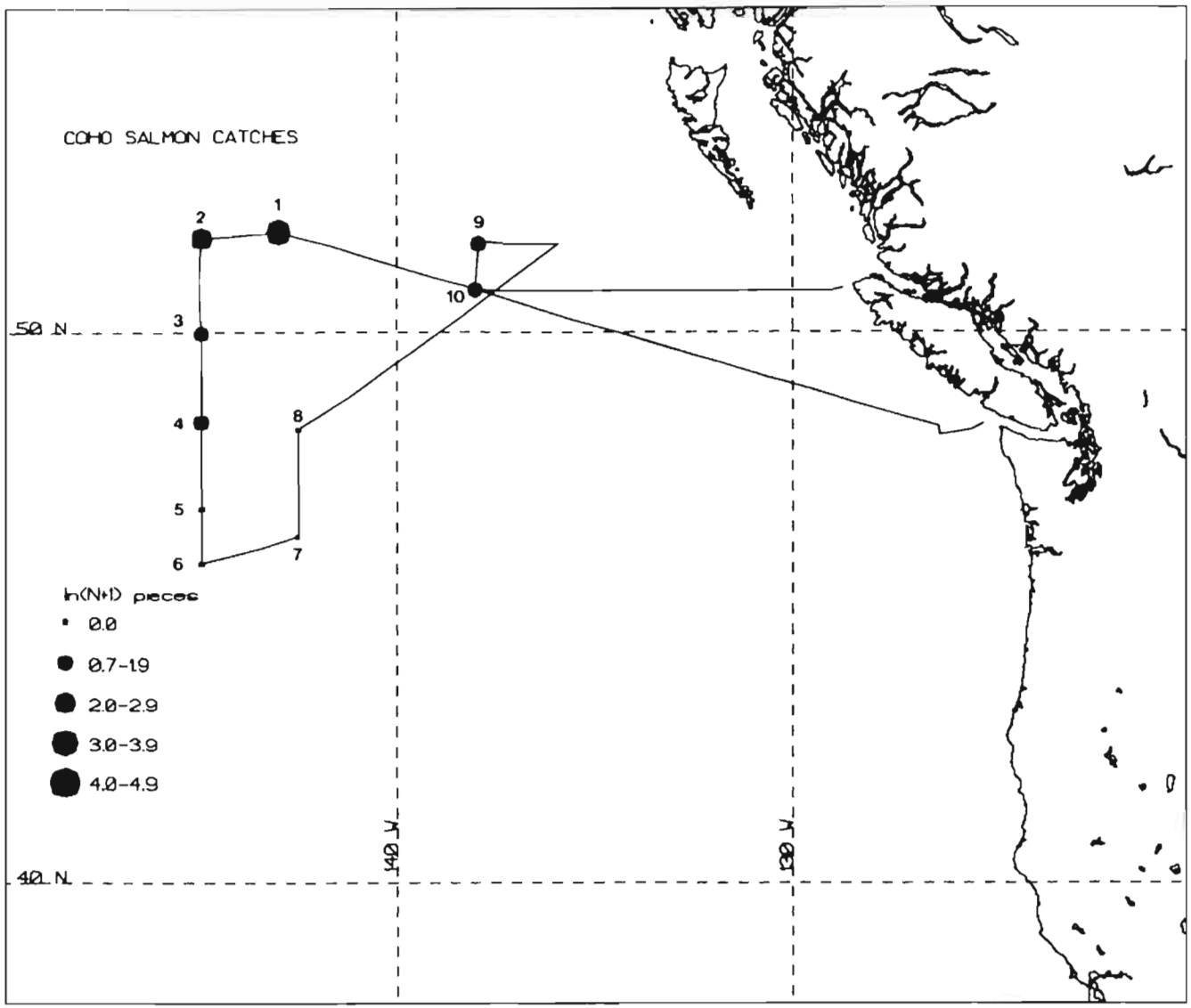

Fig. 5. Locations of coho salmon catches, July 5-23, 1992.

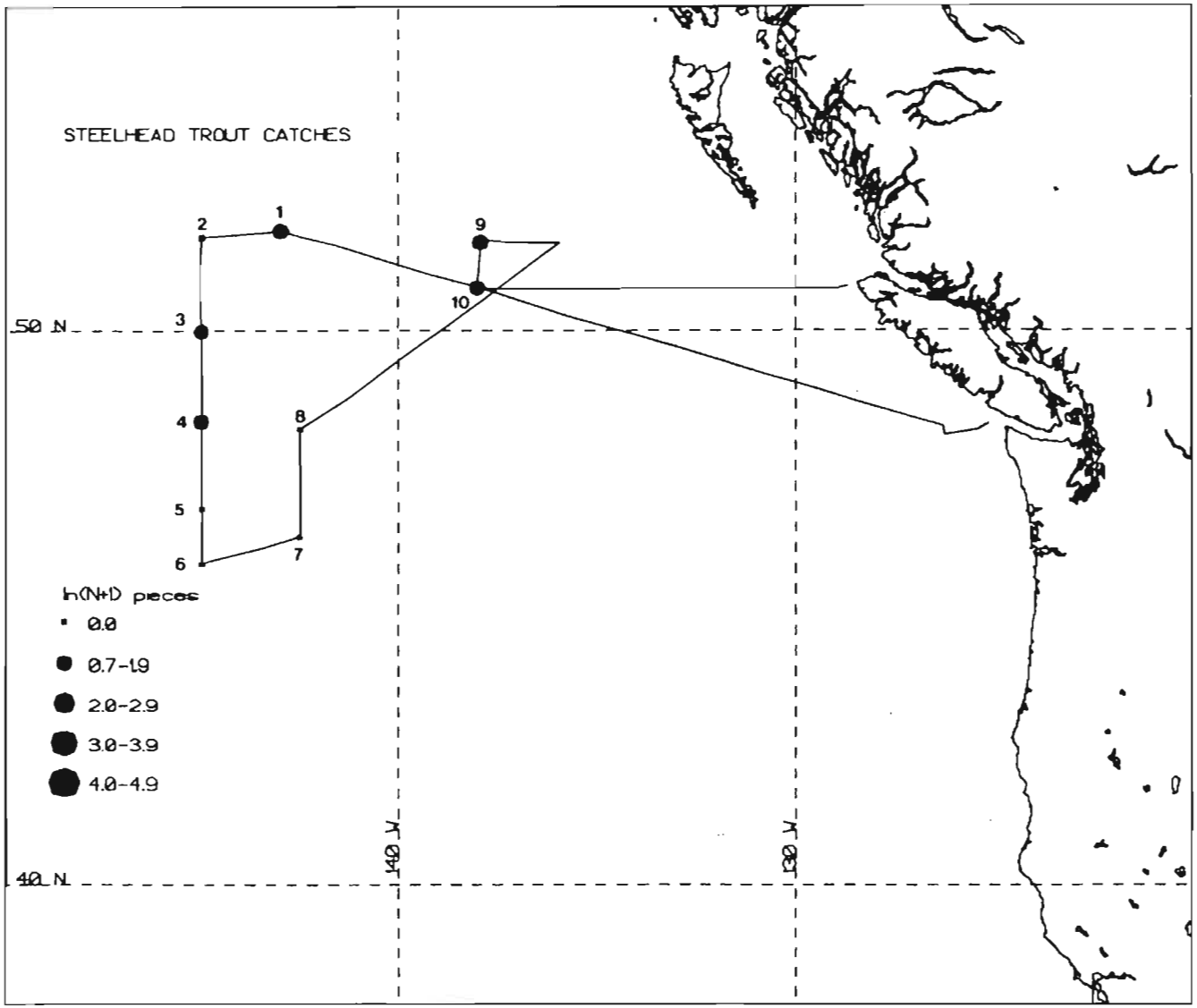

Fig. 6. Locations of steelhead trout catches, July 5-23, 1992.

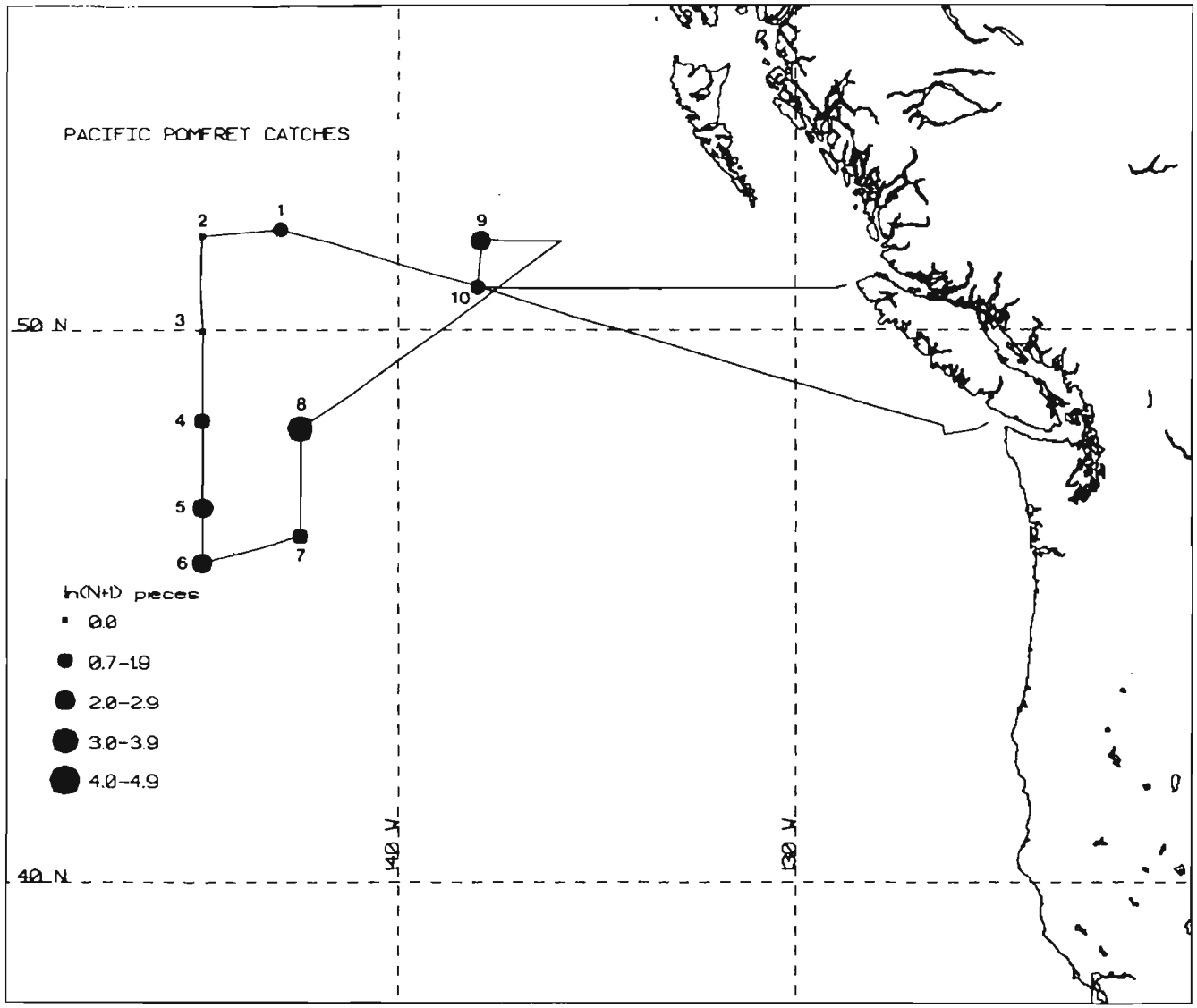

Fig. 7. Locations of Pacific pomfret catches, July 5-23, 1992.

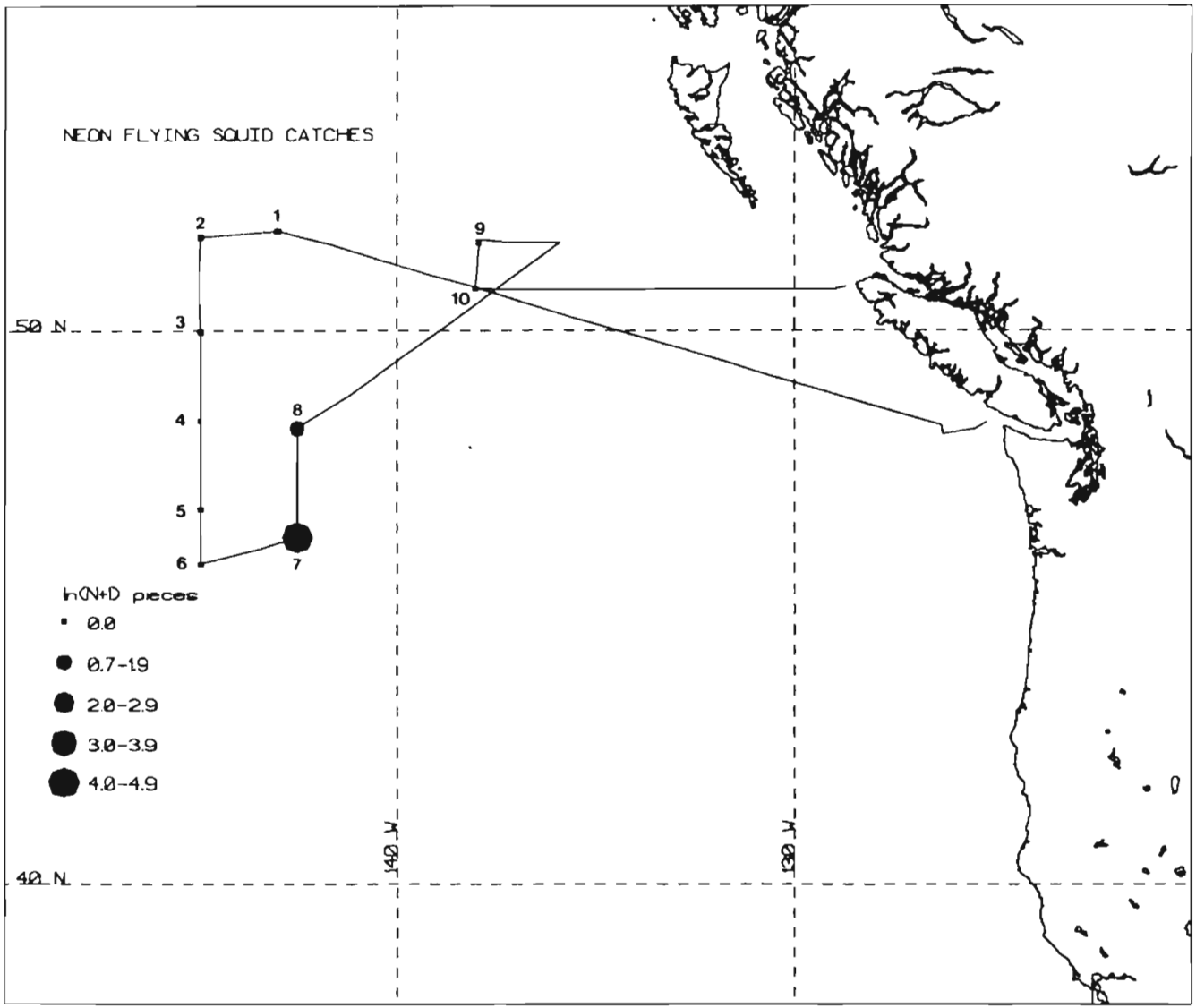

Fig. 8. Locations of neon flying squid catches, July 5-23, 1992.

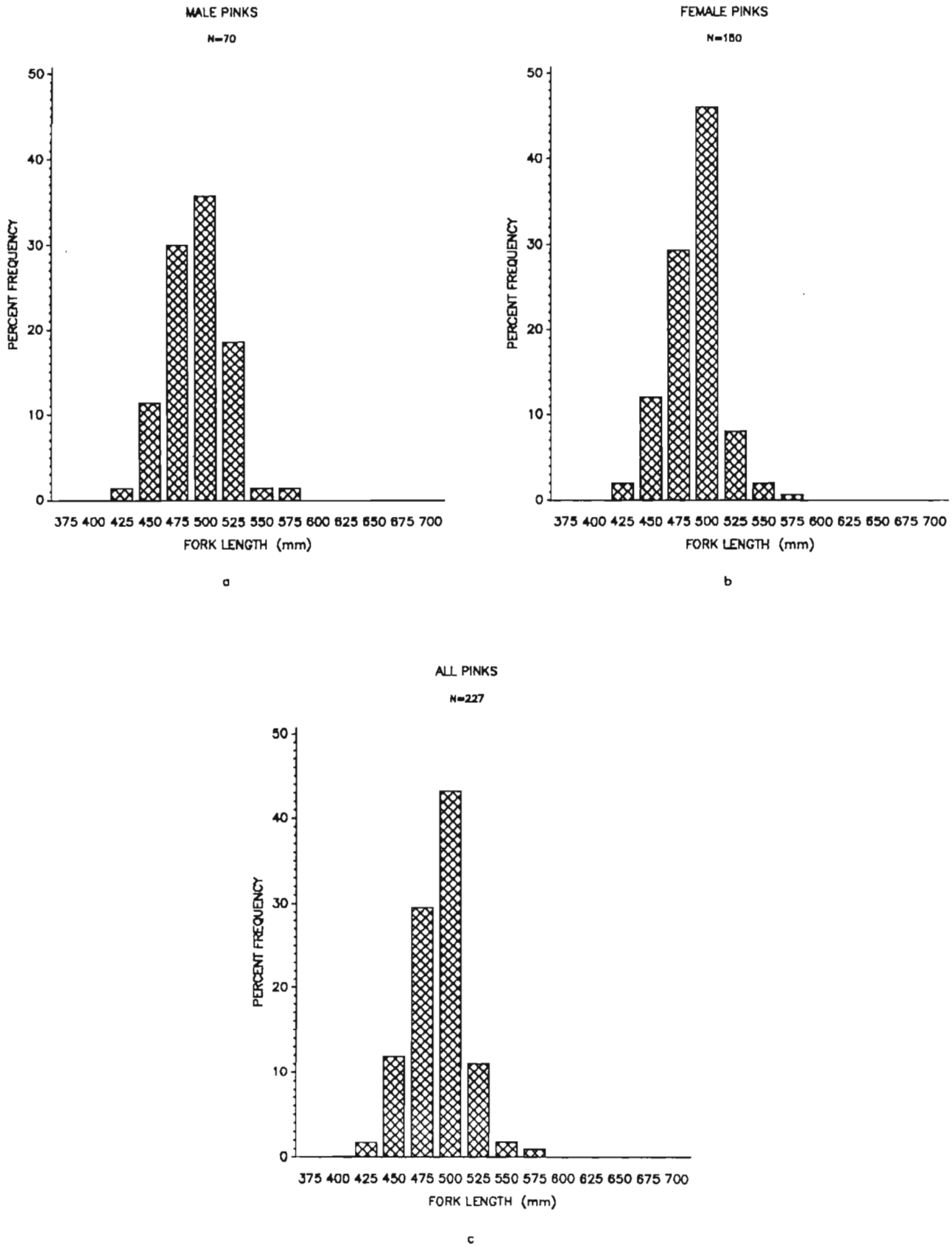

Fig. 9. Fork length frequencies, pink salmon, July 5-23, 1992.

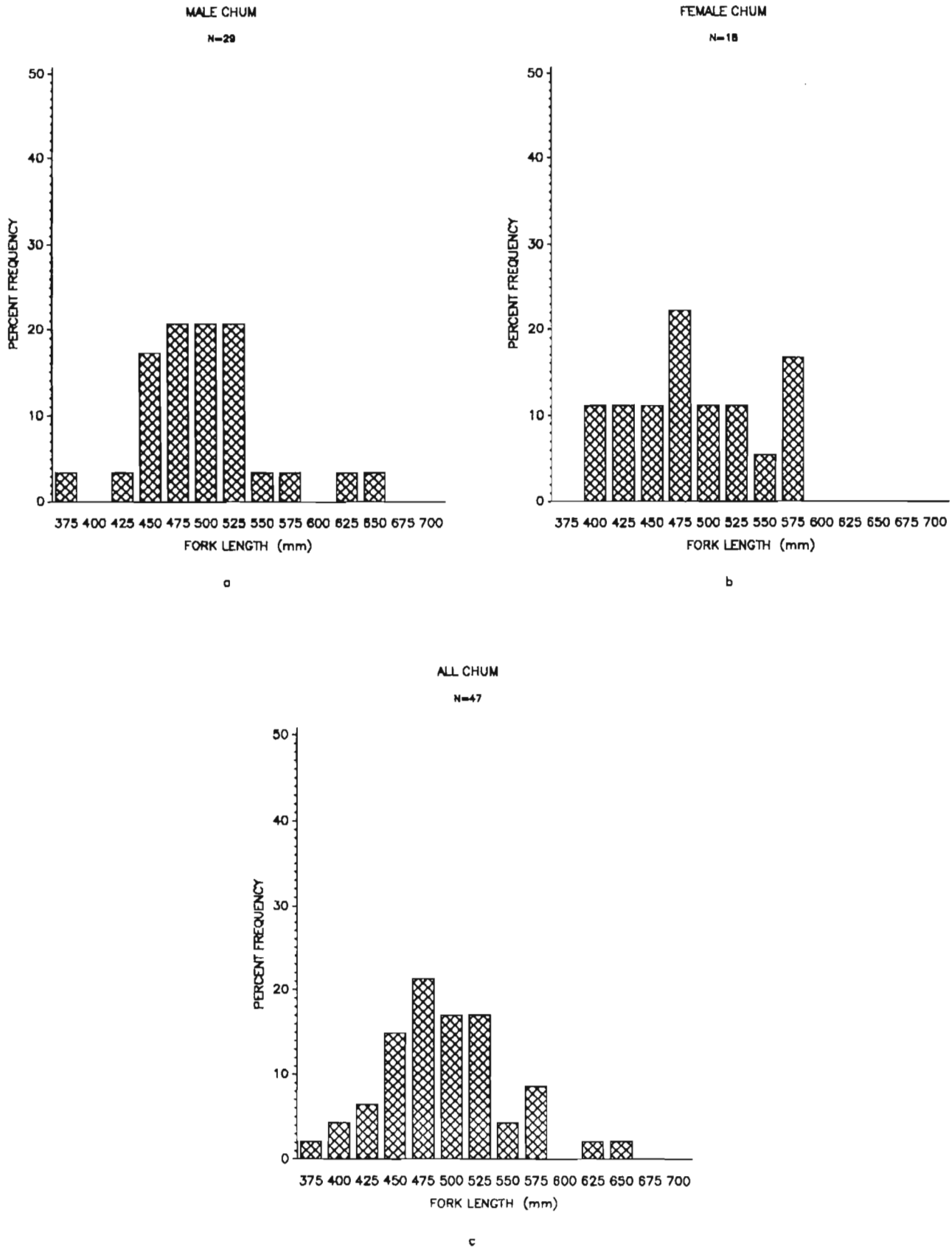

Fig. 10. Fork length frequencies, chum salmon, July 5-23, 1992.

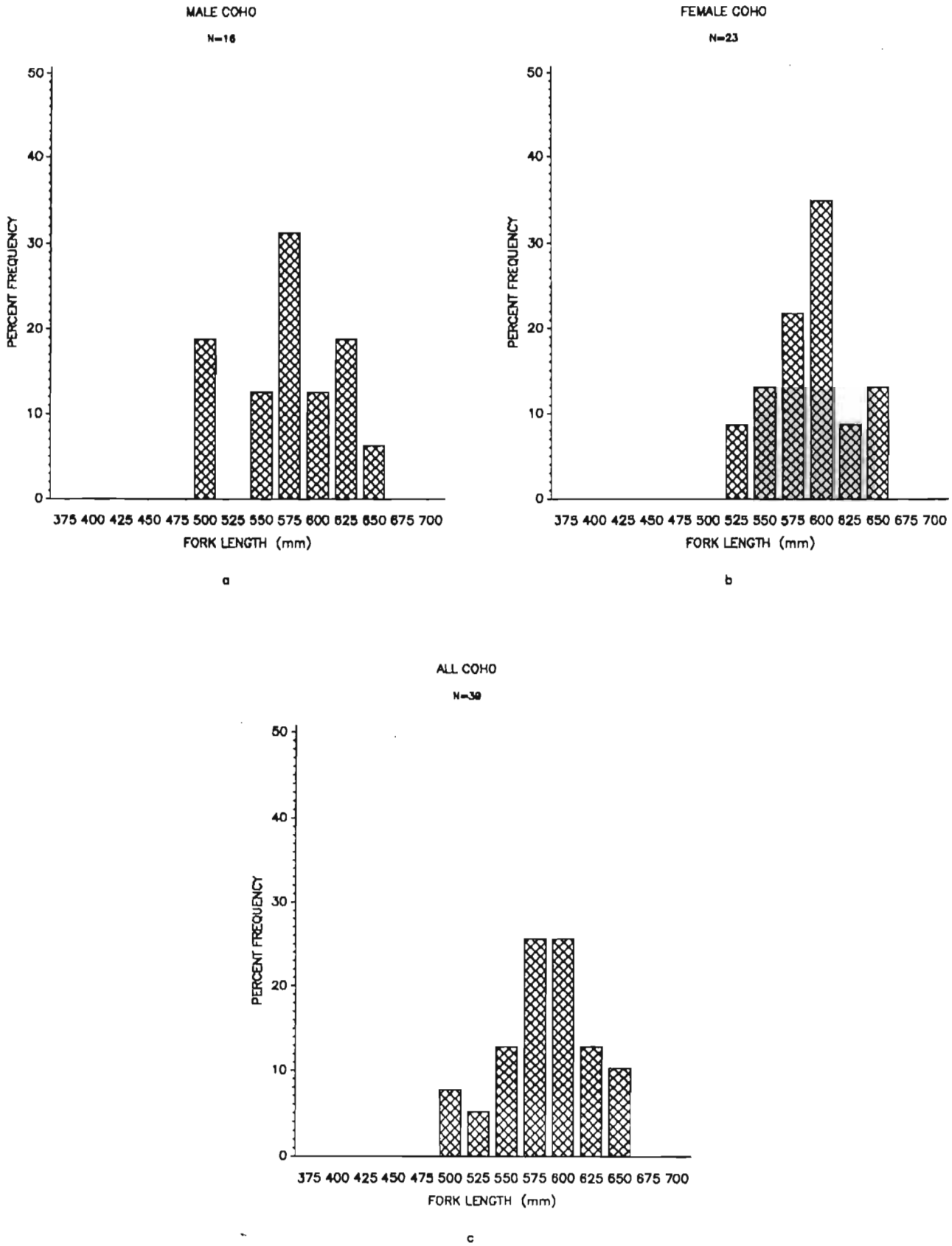

Fig. 11. Fork length frequencies, coho salmon, July 5-23, 1992.

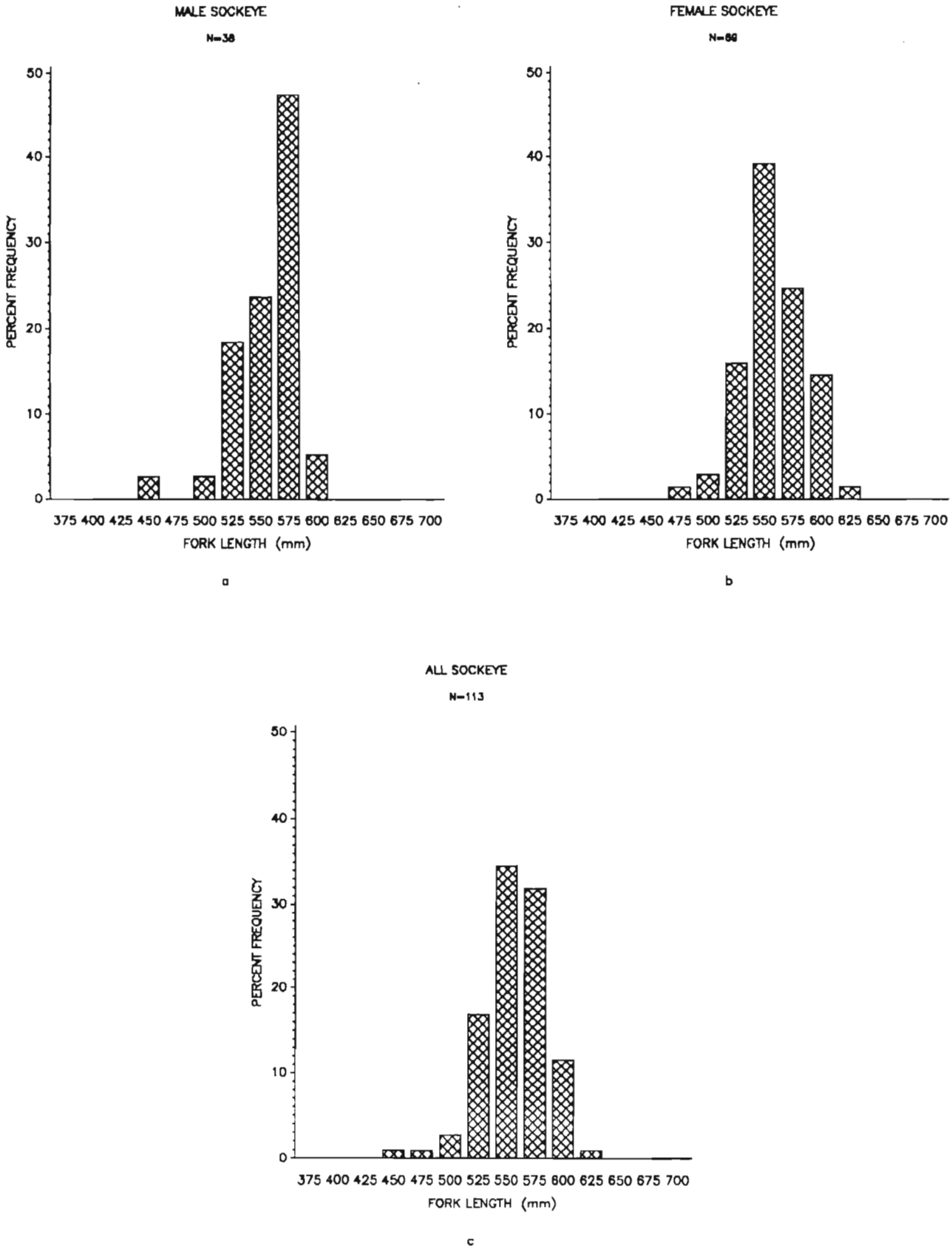

Fig. 12. Fork length frequencies, sockeye salmon, July 5-23, 1992.

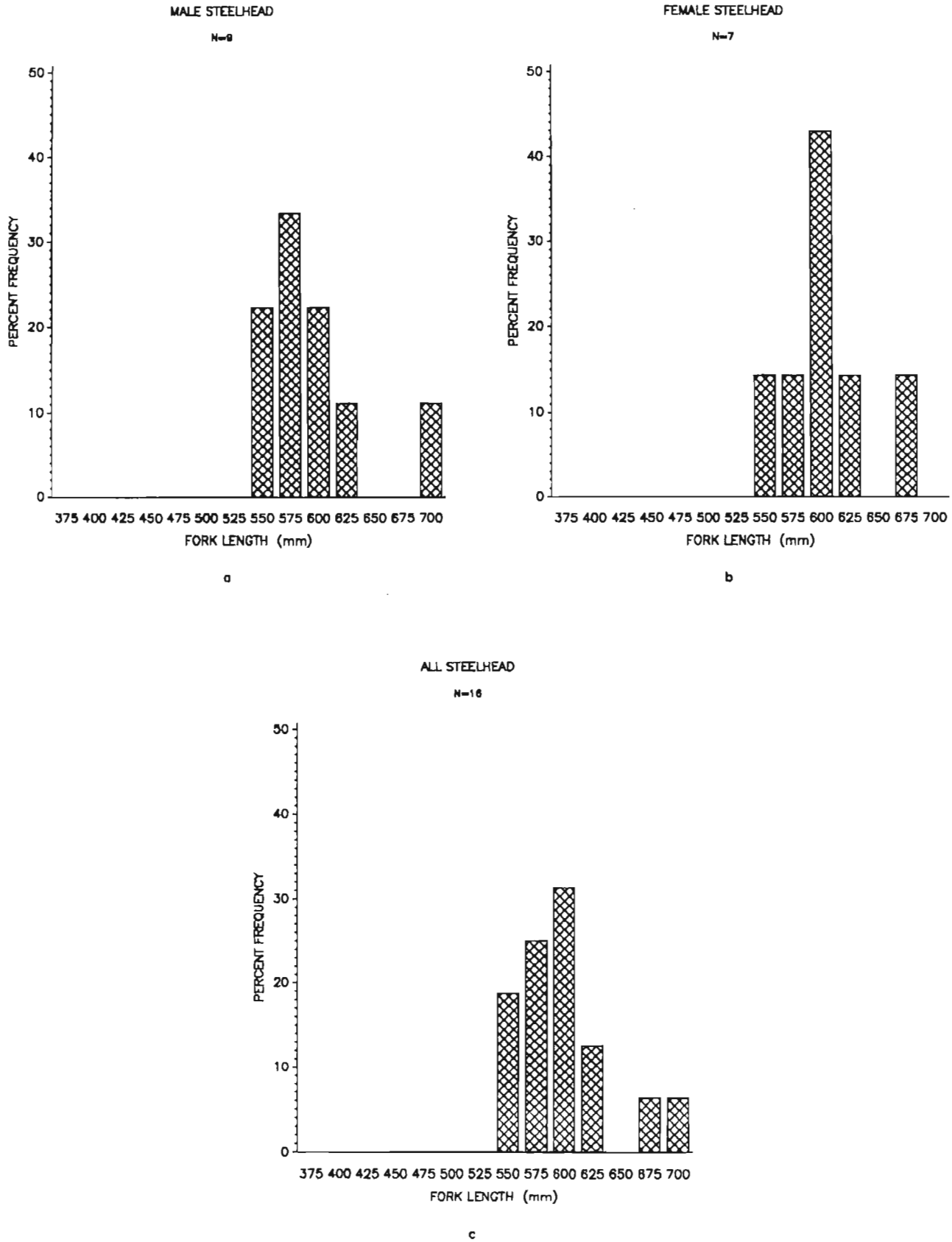

Fig. 13. Fork length frequencies, steelhead trout, July 5-23, 1992.

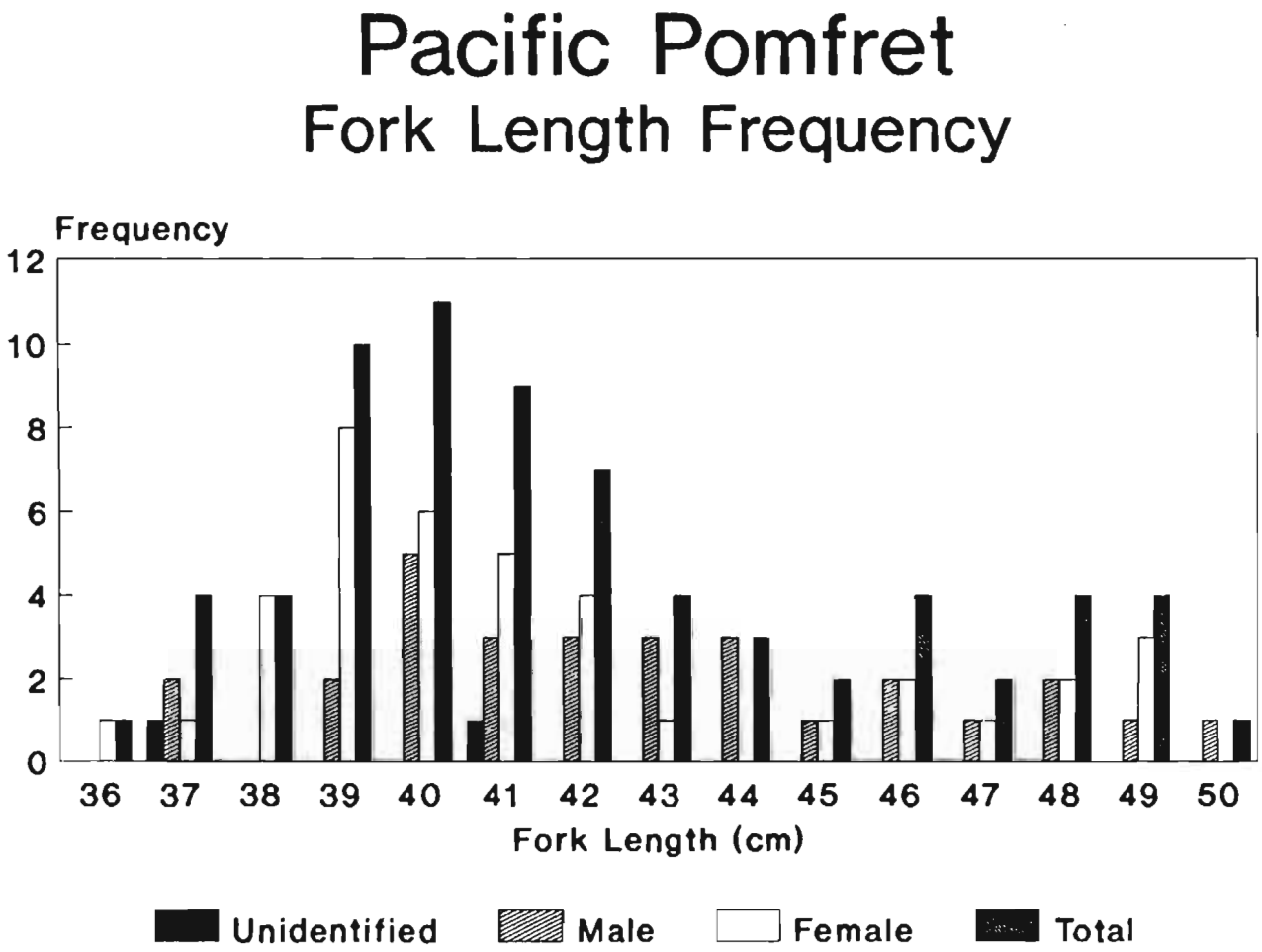

Fig. 14. Fork length frequencies, Pacific pomfret, July 5-23, 1992.

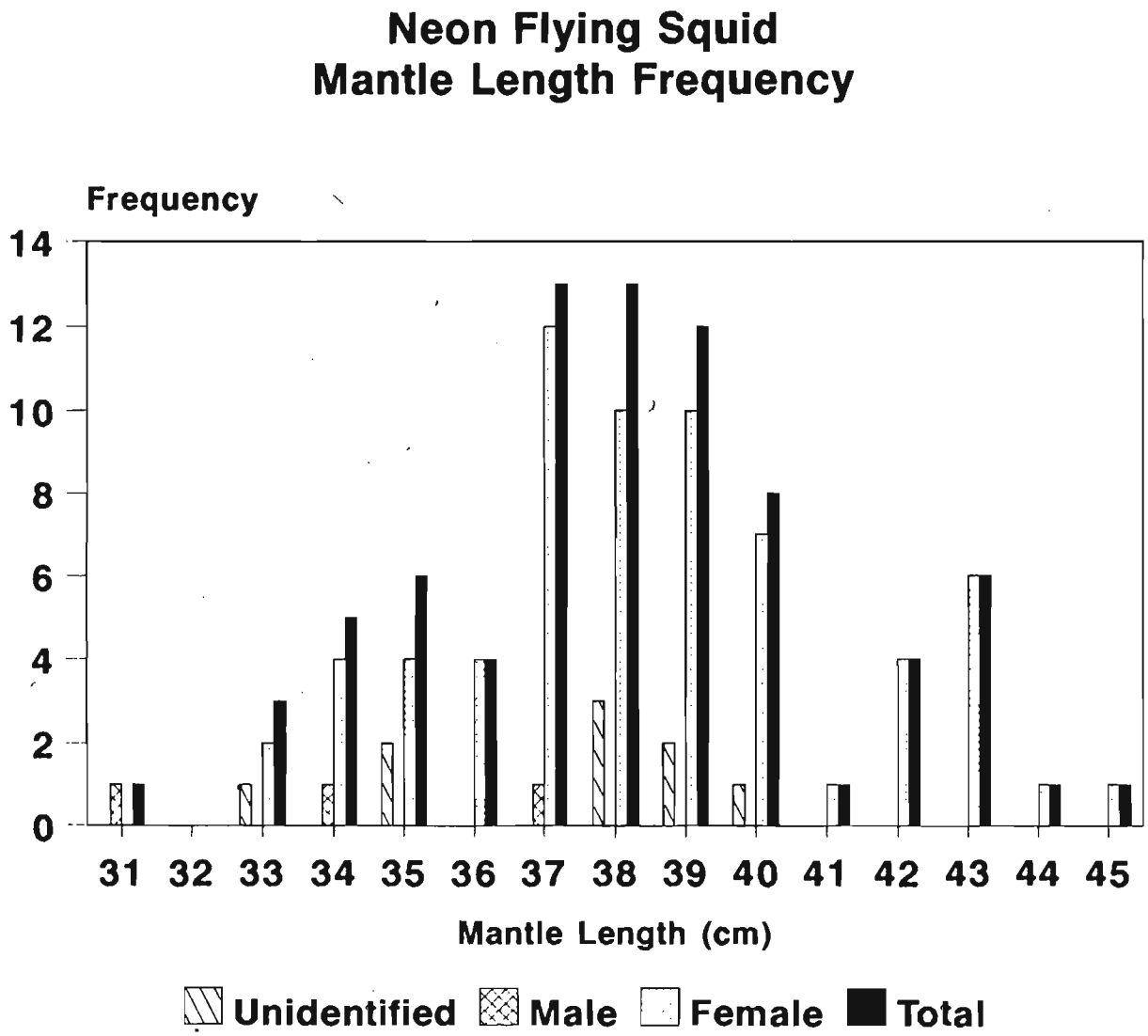

Fig. 15. Mantle length frequencies, neon flying squid, July 5-23, 1992.