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**SURVEY OF SALMON IN THE NORTH PACIFIC OCEAN
AND SOUTHERN BERING SEA---CAPE ST. ELIAS TO ATTU ISLAND
JULY-AUGUST 1997**

by

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**SURVEY OF SALMON IN THE NORTH PACIFIC OCEAN AND
SOUTHERN BERING SEA--CAPE ST. ELIAS TO ATTU ISLAND,
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Abstract

This report summarizes the preliminary results of a survey of the ocean distribution of young and maturing salmon and their habitat off Alaska during July-August, 1997 by the Auke Bay Laboratory, Alaska Fisheries Science Center. The work is part of a cooperative international research effort coordinated by the North Pacific Anadromous Fish Commission, to examine growth and survival of salmon during their ocean life. The survey was conducted on the F/V *Great Pacific*, a 38-m long stern ramp trawler. Eighteen transects, 80-210 nmi apart were sampled near surface, covering coastal waters from the central Gulf of Alaska westward through the Aleutian Islands, and parts of the southern Bering Sea. Salmon were sampled with a midwater rope trawl, towed at 5 knots over nearshore, shelf, slope (200-m depth contour), and oceanic waters out to 60-90 nmi offshore. The net typically fished from surface to 13-m deep with a 41-m horizontal spread. A total of 75 tows, each 2.5 to 5.0 nmi long, was completed, all within the U.S. 200 mile Exclusive Economic Zone. Prevailing sea surface temperatures were 14-15° C in the Gulf of Alaska and 7-9° C in the Aleutian Islands. The total catch of salmonids was 5,203 fish, including 1,814 juveniles (ocean age .0), 2,542 immatures (ocean age .1 or older), and 847 adults. The total numbers by species and percentage composition of juvenile (J), immature (I), and adult (A) salmon in the catch were: 1,336 pink salmon (59% J, 41% A), 2,311 chum salmon (14% J, 78% I, 8% A), 1,074 sockeye salmon (30% J, 65% I, 5% A), 406 coho salmon (88% J, 12% A), and 75 chinook salmon (25% J, 57% I, 17% A), and one adult steelhead. The net also captured a variety of other species, including Pacific herring and walleye pollock. Juvenile salmon were captured from Cape St. Elias west to Unimak Pass, mostly over shelf waters, but no juveniles were taken beyond Unalaska Island westward into the Aleutians. Immature salmon were captured on all transects, with greatest relative abundance in waters near the continental slope, which appears to be a focal point for their summer distribution.

Introduction

During July and August, 1997, a survey of salmon (*Oncorhynchus spp.*) distribution in the North Pacific Ocean and southern Bering Sea was conducted by the Auke Bay Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service. The survey began at Cape St. Elias in the central Gulf of Alaska and extended westward through the Aleutian Islands beyond Attu Is. (Figure 1). Primary objectives of the research were to learn more of the ocean distribution of juvenile (age-0), immature, and maturing salmon, their migration routes in coastal and oceanic waters, relative abundance and co-occurrence of species, origin, size composition and ocean growth, food habits, occurrence of associated fishes, predators or potential competitors in nearby waters, and prevalent oceanographic conditions over selected transects across the survey area. The work is part of international research coordinated by the North Pacific Anadromous Fish Commission to investigate ocean growth and survival of salmon, and examine potential factors responsible for long-term trends that show reduced size of returning adult salmon. This report summarizes preliminary results from the survey.

This was the second year of research by the Auke Bay Laboratory on ocean carrying capacity in the North Pacific. A similar survey was conducted during July and August, 1996 from Dixon Entrance to the Central Aleutians (Carlson, et al., 1996). By comparison, we started farther north and west in 1997, at Cape St. Elias, and went farther west, beyond Attu Island, to near the international dateline.

Methodology

The survey began off Cape St. Elias and extended west past Kodiak and the Alaska Peninsula through Unimak Pass and the Aleutians to Attu Is. and parts of the southern Bering Sea (Figure 1). The cruise was divided into two legs (Leg I--Kodiak to Dutch Harbor, 20 July to 2 August, and Leg II--Dutch Harbor to Attu I., 3 to 19 August). The cruise itinerary and participating scientists are listed in Table 1. Transects sampled by surface trawl were 80-210 nmi apart and roughly perpendicular to shore. Transects ran from prominent points of land to 60 nmi offshore, or further seaward if necessary, to extend beyond the continental slope (200 m depth contour). A description of the research gear, methodology, and fishing operations is shown in Table 2. Additional salmonid research activities conducted on the cruise are shown in Table 3.

The F/V *Great Pacific* is a 38 m long stern ramp trawler built in 1979. The vessel has a main engine of 1450 horsepower and a cruising speed of 10 kts. The fishing gear was a midwater rope trawl, model 400/580, made by Cantrawl Pacific Ltd¹. of Richmond, B.C. The net is 198 m long, has hexagonal mesh in wings and body, and has a 1.2-cm mesh liner in the codend. The net was fished with three 60 m, 1.9-cm bridles attached at a single point to steel alloy 5-m midwater trawl doors, each weighing 463 kg. The net was towed at 5 kts at or near surface, with floats on

¹ Reference to trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

the headrope and 260 m of warp line on each door, and was monitored with a Simrad 300 netsounder, which showed a typical spread of 41 m horizontally and 13 m vertically.

The net was towed both shoreward and seaward and covered nearshore, shelf, slope, and oceanic waters to examine distribution of salmon in relation to distance from shore and the foregoing marine habitat zones. Most tows lasted 30-60 minutes and covered 2.5 to 5 nmi respectively. Most sampling was done during daylight; a few tows were during darkness.

Catches were brought aboard, and routinely, the codend was dumped onto the sorting table (907 kg capacity). For catches exceeding 1000 kg, the codend contents were dumped into the trawlway forward of the stern ramp, and salmon and other specimens sorted out before the catch was washed over the stern ramp. From the catch, adult salmon and other fishes were identified to species and counted, and length, weight and scale and blood plasma samples taken from randomly selected salmon specimens for maturity analyses. Juvenile (ocean age .0) and immature (ocean age .1 or older) salmon were identified and sorted by species. Fork length and weight were recorded for juvenile, immature, and selected maturing salmon for analyses of growth and condition. Juvenile pink, chum, and sockeye salmon were frozen whole at -60°C for genetic analyses and also (pink and chum) examination for hatchery marked otoliths. Samples of genetic tissues (eye, heart, liver, muscle) were taken from selected collections of immature chum and sockeye salmon, and frozen at -60°C for laboratory analyses. Otoliths from immature chum and sockeye salmon were saved to document growth and to identify hatchery chum salmon with thermally induced otolith marks. Stomach contents of selected samples of immature and adult salmon were examined on deck to document primary foods and feeding intensity. Scale samples were taken from selected immature and adult salmon of all species to determine age, ocean growth, and potential stock identity.

Oceanographic observations were conducted on transects off prominent points, selected for geographic coverage of the Gulf of Alaska and Aleutians, with CTD (conductivity-temperature-depth) profiles recorded each 2.5 nmi, from surface to near bottom or 300 m depth, from near shore to oceanic waters 60 nmi seaward, using a Seacat SBE 19-01 Recorder. Following each trawl, surface (bucket) water temperature and salinity readings were taken using a YSI 30/50 salinity-temperature probe. A second surface water bucket sample was used to test for levels of C 14 and C 18 isotopes in the phytoplankton as a measure of energy transfer in the ecosystem. A 500 ml sample of seawater was poured through a fine mesh net to screen out zooplankton and the sieved water was passed through a fine pore glass fiber filter to collect the phytoplankton. Each filter was folded, sealed in aluminum foil and frozen for laboratory analysis. Bongo net oblique plankton tows were made at 21 selected points to cover nearshore, shelf, slope, and oceanic zones on oceanographic transects (Table 2). Sampling was to a depth of 200 m, or within 10 m of the bottom at shallower sites, using 60 cm nets and mesh sizes of 505 and 253 microns. The 505 mesh plankton samples were preserved in 5-10% formalin for species identification in the laboratory. The 253 mesh samples were frozen for laboratory analyses of their biomass and caloric value. Concurrently at these stations, vertical tows were made using a 0.5 m diameter plankton net with 200 mesh to collect micro zooplankton. The net was lowered, codend first, to depths <200 m and then retrieved. Samples were preserved in 5% formalin for species identification in the laboratory. Flow meters were used to estimate water volumes sampled by each net.

Results and Discussion

From Cape St. Elias westward past Attu Island, eighteen transects (Figure 1) were sampled (one, Scotch Cap, was repeated after two weeks), and 75 surface trawl tows were completed (Table 4). The total catch of salmonids was 5,203 fish: 1,814 juveniles, 2,542 immatures and 847 adults, shown by species and percentage (Table 5). Numbers were as follows: Juvenile (age-0) salmon catches totaled 784 pink (*O. gorbuscha*), 329 chum (*O. keta*), 326 sockeye (*O. nerka*), 356 coho (*O. kisutch*), and 19 chinook (*O. tshawytscha*). Immature salmon catches totaled 1,800 chum, 699 sockeye, and 43 chinook. Adult salmon catches totaled 552 pink, 182 chum, 49 sockeye, 50 coho, 13 chinook, and one steelhead (*O. mykiss*). Other species taken (Table 6) included salmon shark (*Lamna ditropis*), spiny dogfish (*Squalus acanthias*), Pacific lamprey (*Lampetra tridentata*), Pacific herring (*Clupea harengus*), capelin (*Mallotus villosus*), Pacific sand lance (*Ammodytes hexapterus*), Pacific saury (*Cololabis saira*), walleye pollock (*Theragra chalcogramma*), Pacific cod (*Gadus macrocephalus*), sablefish (*Anoplopoma fimbria*), Atka mackerel (*Pleurogrammus monopterygius*), rockfish (*Sebastes spp.*), daggartooth (*Anotopterus pharao*), Pacific pomfret (*Brama japonica*), Pacific sandfish (*Trichodon trichodon*), prowfish (*Zaprora silenus*), lumpsuckers (*Cyclopteridae*), wolf-eel (*Anarrichthys ocellatus*), and one Dall porpoise, *Phocoenoides dalli*.

Juvenile salmon were captured from Cape St. Elias west to Unimak Pass, but none westward from Unalaska Island. Largest catches of juvenile salmon were over the continental shelf, off Cape Puget, west of the entrance to Prince William Sound, and off Gore Point and Cape St. Elias. Juvenile pink salmon predominated by numbers, followed by juvenile chum, sockeye and coho, all equally represented (Table 5). Immature salmon were captured on all transects, mostly over and beyond the continental slope, with greatest numbers taken off Cape Prominence, south Unalaska Island, and sizeable numbers taken off Cape St. Elias, Gore Point, Scotch Cap, Samalga Island, and Adak Island. Immature chum salmon were most numerous, by nearly 3 to 1 over sockeye (Table 5), with chinook present in small numbers. Adult salmon were taken on most transects across the entire survey area, with pinks predominating, and other species few at any site.

The sizeable catches of juvenile pink and chum salmon at Cape St. Elias and Cape Puget and immature chum at Cape Prominence and Samalga Island (Table 5), provide sample numbers sufficient for genetic analyses to trace origins of young salmon captured at these and other locations during the cruise. We plan to conduct protein electrophoretic analyses on the above samples, and additional samples that initial test results warrant. These and other samples provide good potential for assessing frequency and origin of otolith marked hatchery fish. We plan to examine otoliths for hatchery marks from all juvenile pink and chum and all immature chum collected. Preliminary results from the July-August 1996 cruise showed an incidence of 42% of hatchery marks for juvenile pink salmon and 20% for juvenile chum, from catches along coastal transects near Prince William Sound in the central Gulf of Alaska (Carlson, et al. 1996).

There were 34 juvenile coho and one juvenile chinook lacking adipose fins. Of these, 2 juvenile coho and one juvenile chinook had coded wire tags (CWT). The CWT coho were taken 43-46 nmi off Cape Puget; one was from southern B.C., the other from southern Southeast Alaska. The CWT chinook was taken 6 nmi off Mitrofanina Island., and was from Cook Inlet (Dahlberg, et al. 1997).

Oceanographic observations were taken at five index site transects: Cape St. Elias, Cape Puget, Cape Chiniak, Scotch Cap, and S. Adak Island (Figures 2-6). Shelf width and water depth varied widely among the five transects. In general, a layer of abnormally warm 14-15° C surface water was present off Cape St. Elias nearshore and out to the continental slope. To the west, the warm surface water was present off Cape Puget and Cape Chiniak, but mostly beyond the shelf. Cooler 8-9° C surface waters were present off Scotch Cap and S. Adak Island transects.

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Literature Cited

- Carlson, H.R., K.W. Myers, E.V. Farley, H.W. Jaenicke, R.E. Haight, and C.M. Guthrie III. 1996. Cruise report of the F/V *Great Pacific* survey of young salmon in the North Pacific--Dixon Entrance to western Aleutian Islands--July-August 1996. (NPAFC Doc. 222.) 50 pp. Auke Bay Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA, 11305 Glacier Highway, Juneau, AK 99801-8626, U.S.A.
- Dahlberg, M., S. Fowler, and R. Heintz. 1997. Incidence of coded-wire tagged salmonids in commercial and research catches in the North Pacific Ocean and Bering Sea, 1996-1997. (NPAFC Doc.) Auke Bay Laboratory, Alaska Fisheries Science Center, NMFS, NOAA, 11305 Glacier Highway, Juneau, AK 99801-8626. xx pp.

Table 1. List of participating scientists and cruise itinerary for F/V *Great Pacific* cruise July 21-August 19, 1997 in Gulf of Alaska and Aleutian Islands.

Scientific Party:

Leg I: Kodiak to Dutch Harbor, July 21-August 2

Richard Carlson, Chief Scientist	NMFS, Auke Bay Laboratory
David Welch, Program Head, High Seas Salmon Research	Canada Dept. Fisheries & Oceans, Nanaimo Laboratory
Richard Haight, Fishery Biologist	NMFS, Auke Bay laboratory
Edward Farley, Fishery Biologist	TAG DataFlow/Alaska

Leg II: Dutch Harbor to Western Aleutians, August 3-19

Richard Carlson, Chief Scientist	NMFS, Auke Bay Laboratory
Katherine Myers, Program Leader, High Seas Salmon	Fisheries Research Institute, University of Washington
Edward Farley, Fishery Biologist	TAG DataFlow/Alaska

Cruise Itinerary:

21 July	Kodiak---load scientific party and equipment, depart enroute Cape St. Elias
22 July	Underway to arrive seaward end of Cape St. Elias transect 2300 hrs, began work
23 July	Continued surface tows, plankton tows, oceanographic observations in to 20 nmi
24 July	Resumed operations, completed C. St. Elias transect to nearshore, underway west
25 July	Began fishing, plankton, oceanography on Cape Puget transect, out to 40 nmi
26 July	Resumed operations, completed Cape Puget trans. out to 63 nmi, underway west
27 July	Fishing operations off Gore Point, completed transect to 97 nmi out
28 July	Began fishing, plankton, oceanography off Cape Chiniak to 30 nmi out
29 July	Resumed operations, completed C.Chiniak trans. to 60 nmi out, underway west
30 July	Arrived seaward end of Mitrofanina I. trans., began fishing 80 nmi out to nearshore
31 July	Completed Mitrofanina Is. transect 0230 hrs, underway west enroute Unimak Pass
1 August	Fishing operations off Scotch Cap, completed transect to 60 nmi out
2 August	Ran to Dutch Harbor, in port to exchange scientists
3 August	In port, departed enroute Cape Prominence, S. Unalaska Is.
4 August	Fishing operations off Cape Prominence, completed transect to 32 nmi out
5 August	Fishing operations off Samalga Is., completed transect to 32 nmi out
6 August	Fishing operations off Seguam Is., completed transect to 49 nmi out

7 August Fishing and oceanographic operations off So. Adak Is. nearshore to 60 nmi
8 August Completed S. Adak Is. trans. 0100 hrs, then Semisopchnoi I., 50 to 20 nmi out
9 August Fishing operations off Kiska Is., completed transect nearshore to 54 nmi out
10 August Underway west, arrived Attu Island
11 August Fishing operations off SW Attu Is., completed transect to 41 nmi out
12 August Fishing operations over Stalemate Bank, then N. Attu Is., 4-9 nmi out
13 August Underway running east
14 August Underway running east, enroute Unimak Pass
15 August Fishing and oceanographic operations off Scotch Cap to 52 nmi out
16 August Fishing operations off Cape Sarichef to 51 nmi out
17 August Fishing operations off Cape Cheerful, 51 to 16 nmi out, underway to port
18 August Arrived Dutch Harbor/Unalaska, in port, disembark scientists, samples
19 August In port. Unload gear, end cruise.

Table 2. Description of research gear and fishing operations aboard the *Great Pacific* in 1997.

Research Item/Gear	Purpose	Specifications	Deployment	Sample/Data	Comments
A. Hydrographic					
CTD: SEACAT SBE 19-01 Conductivity, Temperature, Depth Recorder (SEA-BIRD Electronics, Inc., Seattle, WA, USA) with DO sensor (SBE 23Ba, Beckman-type polarographic element) and fluorometer. Manufactured: 1988. Calibrated: July 1995 & March 1996.	Collect physical and productivity data along transects to gather information related to salmon growth and survival studies: oceanographic environment at salmon sampling stations, productivity, develop ocean currents profiles	Meas. range - Temp.: -5° - 35° C; Conduct.: 0 - 7 S/m (0 to 70 mmno/cm); Pressure: 50, 100, 150, 200, 300, 500, 1000, 1500, 3000, 5000, or 10,000 psia; DO: 0 - 15 ml/l; Chlorophyll: 0.03 µg/l - 30 µg/l or 0.1 µg/l - 100 µg/l	Vertical to 300 m (or to approx. 5 m above the bottom at shallower depths), each deployment approx. 2.5 nm apart along each of 4 standard oceanographic transects (SOTs; ~26 stations) and at start and end of fishing stations along other selected transects	Temperature, conductivity, pressure, salinity, dissolved oxygen, and chlorophyll at 1 m increment; data from approx. 148 stations in 1997	Each deployment of CTD took approx. 20 minutes at 300-m depth stations; raw data is stored and transmitted to computer in binary form, conversions to engineering units made with Vers. 4.219 SEASOFT software
Water bucket and hand-held salinity, conductivity, temperature probe (YSI 30, Yellow Springs, Ohio, USA)	To compare sea surface/air interface water temperatures and salinities from near shore, across the shelf, and in open ocean waters, to observe these conditions at salmon collection stations, and to correlate with data from the CTD	Resolution: 0.01°C and 0.05 psu	Bucket samples taken at the surface at the end of each fishing station	Sea surface temperature and salinity; data collected from approx. 75 stations in 1997	Bucket casts were made during midwater trawl retrieval at end of tow.

Table 2. (cont'd)

Research Item/Gear	Purpose	Specifications	Deployment	Sample/Data	Comments
B. Plankton					
Surface water sample	To test for levels of C14 and C18 isotopes in the phytoplankton as a method of measuring energy transfer in the ecosystem	500 ml of sea water, from a surface bucket sample, poured through a fine mesh net to retain all zooplankton. To retain phytoplankton, the sieved water passed through a 47 mm diameter, GF/F glass fiber filter, pore size $\sim 0.7 \mu\text{m}$	Bucket casts were made at each transect station at end of the midwater net tow.	Filters, with phytoplankton samples, folded in half, sealed in aluminum foil, and frozen for laboratory analysis. Samples collected from 21 stations in 1997.	
WP-2 net	To collect micro zooplankton samples to sizes $\approx 0.200 \text{ mm}$ for abundance and presence within the biome at each transect station	Net 0.5 m diameter; 200 μm mesh; rate of speed 1 = 2 m/sec; flow meter to calculate volume sampled	Vertical to 200 m (or to approx. 5 m above the bottom at shallower depths), each deployment approx. 2.5 nm apart along each of 4 SOTs	Samples preserved in 5% formaldehyde; data collected from 21 stations in 1997	Each deployment takes approx. 5-15 mins., depending on depth
Bongo nets, two mesh sizes: 253 and 505 μm	With the 253 μm mesh net, to determine biomass and caloric value of sample. With 505 μm mesh net to identify species and estimate their abundance	Nets 60 cm diameter, mesh sizes 253 and 505 μm , a flow meter in mouth of each net to calculate volume sampled. Setting speeds: vessel 2 kt, net lowered 1 m/sec. Retrieval speeds: vessel 1 to 1.5 kt, net pulled in at 1 m/3 sec.	Oblique tows to 200 m (or to approx. 10 m above the bottom at shallower depths), each deployment approx. 2.5 nm apart along each of 4 SOTs	Samples in 253 mesh net sieved into 3 size groups. Each size group packaged and frozen for laboratory analysis. Samples in 505 mesh net preserved in 5-10% formaldehyde; data collected from 21 stations in 1997	Each deployment takes approx. 15-30 mins. depending on depth; Note: winch retrieval problems forced reduced vessel speed to ≈ 1.5 kt.

Table 2. (cont'd)

Research Item/Gear	Purpose	Specifications	Deployment	Sample/Data	Comments
C. Salmonids					
Midwater rope trawl, model 400/580 (Cantrawl Pacific Ltd., Richmond, B.C., Canada); designed for higher-than -average towing speeds	To collect biological samples and data for salmonid distribution, growth, survival, and stock identification studies	198 m-long, hexagonal mesh in wings and body, 1.2-cm mesh liner in the codend, fished with three 60-m, 1.9 cm bridles attached at a single point to steel alloy 5.5-m ² midwater trawl doors, each weighing 463 kg	Towed at 5 kt for 1/2 or 1 h, at or near surface w/floats on the headrope; 260-m warp line on each door; monitored with Simrad 300 netsounder (spread approx. 44-m wide x 9 m-deep)	No. of fish by species; fork length (FL) and body weight (BW) for all juvenile salmon; scales, FL, and BW from up to 20 fish of each species for immature and adult salmonids; 75 stations sampled in 1997	Lengths measured with Limnotera FMB-IV, electronic fish measuring board; body weights measured with Marel M 2000 series, electronic platform scale

Table 3. Additional salmonid research activities conducted aboard the *Great Pacific* in 1997.

Subject	Sample (no. collected)	Method	Data or Samples Collected
A. Salmonid Food Habits and Feeding Ecology			
Stomach contents	All juvenile salmonids in catch; stomachs from 521 immature and adult salmonids	Whole body samples of juveniles frozen for later analysis; shipboard analysis of immature and adult salmonids: stomachs from esophagus to pyloric valve collected from up to 20 fish of each species in each trawl operation during 2nd cruise leg	For immature and adult salmonids: prey weight, % composition by volume of each prey type, % empty stomachs, fullness, and digestion indices; corresponding biological (length, weight, sex, maturity), catch (location, time, etc.), and oceanographic data
B. Salmonid Ocean Growth and Maturity			
Growth and maturity indices and physiological studies	Blood serum samples; 60 chum, 32 sockeye, 20 chinook, and 6 pink salmon	Blood drawn from caudal vein; centrifuged at 3000 rpm for 15 min; 1.0 ml serum in each of two 1.5 ml cryo-tubes; frozen at -60°C	Accompanying scale samples, biological, and oceanographic data; duplicate samples collected from each fish, one sample for United States and one for Japan
Validation of visual identification of maturity stage	521 immature and maturing salmonids, all species	During 2nd cruise leg, gonads examined visually and categorized as maturing or immature; whole gonad weights measured from a subsample	Species, sex, maturity stage (immature or maturing), body weight (g), fork length (mm), gonad weight (g); serum collected from a subsample for sex hormone studies

Table 3. (cont'd)

Subject	Sample (no. collected)	Method	Data or Samples Collected
C. Stock Identification			
Genetic stock identification	Isozyme samples (All juvenile salmonids; immature salmon: 1,400 chum and 400 sockeye)	All juvenile salmon frozen whole for later collection of tissue samples; immature sockeye salmon: head cut behind the pectoral fin including eye, heart, liver, and muscle tissue; heads bagged, labeled, and frozen	Frozen whole fish samples or heads; species, haul no., fish no., length (mm)
Otolith marks	Otoliths (all juvenile salmon; 1,687 immature chum salmon)	Whole juvenile salmon and portion of head containing otolith of immature chum salmon labeled with individual fish numbers and frozen for laboratory collection of otoliths	Whole fish or head samples, species, haul no., fish no., length (mm), and body weight (g)
Coded-wire tags	34 juvenile coho and 1 juvenile chinook salmon	All salmonids in catch visually examined for adipose fin clips	Frozen whole fish samples; fork length (mm), weight (g), date, haul no., catch location
Scale pattern analysis	Immature and adult salmonids: 713 chum, 365 sockeye, 44 chinook, and 2 coho salmon, and 1 steelhead	Scales collected from up to 20 fish of each species in each haul from immature and adult salmonids; one or more scales per fish mounted on gummed cards, preferred body area of scale collection noted	Scales and corresponding biological data (length, weight); scale samples will be evaluated in the laboratory to determine if the number and quality of preferred scale samples are adequate for stock identification analysis

Table 4. Number of stations per transect, total number of nautical miles towed per transect, and combined catch of juvenile, immature, and adult salmon by species aboard the *F/V Great Pacific* in July and August, 1997.

Transects	No. Stations	Total No. nmi Towed	Pink	Chum	Total Catch of Sockeye	Coho	Chinook	Steelhead
Gulf of Alaska								
Cape St. Elias	8	18.2	203	292	22	68	0	0
Cape Puget	7	17.9	492	156	237	198	0	0
Gore Point	4	19.4	229	410	77	119	12	0
Cape Chiniak	6	15.0	54	124	9	5	7	0
Mitrofanía Island	4	18.6	97	63	36	6	16	0
Scotch Cap	4	19.4	34	305	104	1	7	0
Total	33	109	1109	1350	485	397	42	0
Aleutian Islands								
Cape Prominence	3	14.4	76	458	250	6	3	0
Samalga Island	3	7.1	53	167	36	1	8	0
Seaguam Island	4	12.8	2	17	29	0	0	0
Adak Island	7	16.7	3	16	92	0	1	0
Semisopochnoi Island	2	8.4	0	8	14	0	0	0
Kiska Island	4	16.3	0	22	26	0	2	0
Attu Island S.	3	14.5	3	26	19	0	7	0
Stalemate Bank	1	0.8	0	7	4	0	2	1
Attu Island N.	1	4.6	0	19	1	0	2	0
Scotch Cap	6	15.7	26	67	91	0	2	0
Cape Sarichef	5	14.7	50	57	24	1	3	0
Cape Cheerful	3	12.5	14	97	3	1	3	0
Total	42	138	227	961	589	9	33	1
Grand Total	75	247	1336	2311	1074	406	75	1

Table 5. Percent catch of juvenile (%J), immature (%I), and adult (%A) salmon by species aboard the *F/V Great Pacific* in July and August, 1997.

Transects	Pink			Chum				Sockeye				Coho			Chinook			
	N	%J	%A	N	%J	%I	%A	N	%J	%I	%A	N	%J	%A	N	%J	%I	%A
Gulf of Alaska																		
Cape St. Elias	203	80	20	292	42	55	3	22	73	18	9	68	91	9	0	0	0	0
Cape Puget	492	89	11	156	83	14	3	237	99	0	1	198	90	10	0	0	0	0
Gore Point	229	79	21	410	17	71	13	77	64	32	4	119	96	4	12	17	0	83
Cape Chiniak	54	2	98	124	2	73	24	9	78	0	22	5	20	80	7	14	71	14
Mitrofanias Island	97	0	100	63	3	78	19	36	33	33	33	6	0	100	16	44	44	13
Scotch Cap	34	0	100	305	0	86	14	104	0	94	6	1	0	100	7	0	100	0
Aleutian Islands																		
Cape Prominence	76	0	100	458	0	100	0	250	0	98	2	6	0	100	3	0	100	0
Samalga Island	53	0	100	167	0	94	6	36	0	89	11	1	0	100	8	0	100	0
Seaguam Island	2	0	100	17	0	100	0	29	0	100	0	0	0	0	0	0	0	0
Adak Island	3	0	100	16	0	94	6	92	0	99	1	0	0	0	1	0	0	0
Semisopchnoi Island	0	0	0	8	0	88	13	14	0	100	0	0	0	0	0	0	0	0
Kiska Island	0	0	0	22	0	100	0	26	0	100	0	0	0	0	2	0	100	0
Attu Island S.	3	0	100	26	0	88	12	19	0	95	5	0	0	0	7	100	0	0
Stalemate Bank	0	0	0	7	0	100	0	4	0	100	0	0	0	0	2	0	100	0
Attu Island N.	0	0	0	19	0	84	16	1	0	100	0	0	0	0	2	100	0	0
Scotch Cap	26	0	100	67	0	99	1	91	4	95	1	0	0	0	2	0	100	0
Cape Sarichef	50	0	100	57	2	82	16	24	8	58	33	1	0	100	3	0	100	0
Cape Cheerful	14	0	100	97	1	95	4	3	33	33	33	1	100	0	3	0	100	0
Total	1336	59	41	2311	14	78	8	1074	30	65	5	406	88	12	75	25	57	17

Table 6. Catch records for non-salmonids captured on the F/V *Great Pacific* cruise July and August 1997, in the North Pacific Ocean and Southern Bering Sea.

Transects	Pacific lamprey	Spiny dogfish	Salmon shark	Pacific herring	Capelin	Pacific sand lance	Pacific cod (J)	Walleye pollock (J)	Walleye pollock (A)	Sablefish	Pacific saury
Gulf of Alaska											
Cape St. Elias				5	3	3		67			
Cape Puget		7									
Gore Point		11			4	1		2		113	
Cape Chiniak		1		3		22		4			
Mitrofanina Island					2000			3	34		
Scotch Cap I				4						2	
Scotch Cap II			1				1	1	10		
Aleutian Islands											
Cape Prominence				2						7	
Samalga Island				20000					23		
Seaguam Island											
Adak Island											
Semisopochnoi Island											
Kiska Island											50
Attu Island S.							1				
Stalemate Bank											
Attu Island N.											
Cape Sarichef	14			157		1					
Cape Cheerful				145				1			
Total	14	19	1	20316	2007	27	2	78	76	113	50

Table 6 (con't). Catch records for non-salmonids captured on the F/V *Great Pacific* cruise July and August 1997, in the North Pacific Ocean and Southern Bering Sea.

Transects	Rockfish	Dagger-tooth	Pacific pomfret	Prow-fish (A)	Prow-fish (J)	Wolf-eel (J)	Spiny lump sucker	Smooth lump sucker	Atka mackerel	Greenling (J)	Crested sculpin
Gulf of Alaska											
Cape St. Elias		3	87		36	1					
Cape Puget	5					1					
Gore Point	300					1					1
Cape Chiniak			11		1	1		2		1	
Mitrofanina Island	1							2			
Scotch Cap I								1	1		
Scotch Cap II											
Aleutian Islands											
Cape Prominence					1						
Samalga Island					2			1	1600		
Seaguam Island	2						1		80		
Adak Island	2	2					1		3		
Semisopochnoi Island					2				2		
Kiska Island									2401		
Attu Island S.								1	11		
Stalemate Bank							1	1			
Attu Island N.				1			4	1	1		
Cape Sarichef									39		1
Cape Cheerful									3		1
Total	310	5	98	1	42	4	7	9	4141	1	3

Table 6 (con't). Catch records for non-salmonids captured on the F/V *Great Pacific* cruise July and August 1997, in the North Pacific Ocean and Southern Bering Sea.

Transects	Pacific sandfish	Lantern-fish	Arrowtooth flounder	Sturgeon poacher	Dall porpoise
Gulf of Alaska					
Cape St. Elias	1	15			
Cape Puget					
Gore Point					
Cape Chiniak				1	
Mitrofanian Island			1		
Scotch Cap I					
Scotch Cap II					
Aleutian Islands					
Cape Prominence					
Samalga Island					
Seaguam Island					
Adak Island					
Semisopochnoi Island					
Kiska Island					
Attu Island S.					
Stalemate Bank					1
Attu Island N.					
Cape Sarichef	2				
Cape Cheerful					
Total	3	15	1	1	1

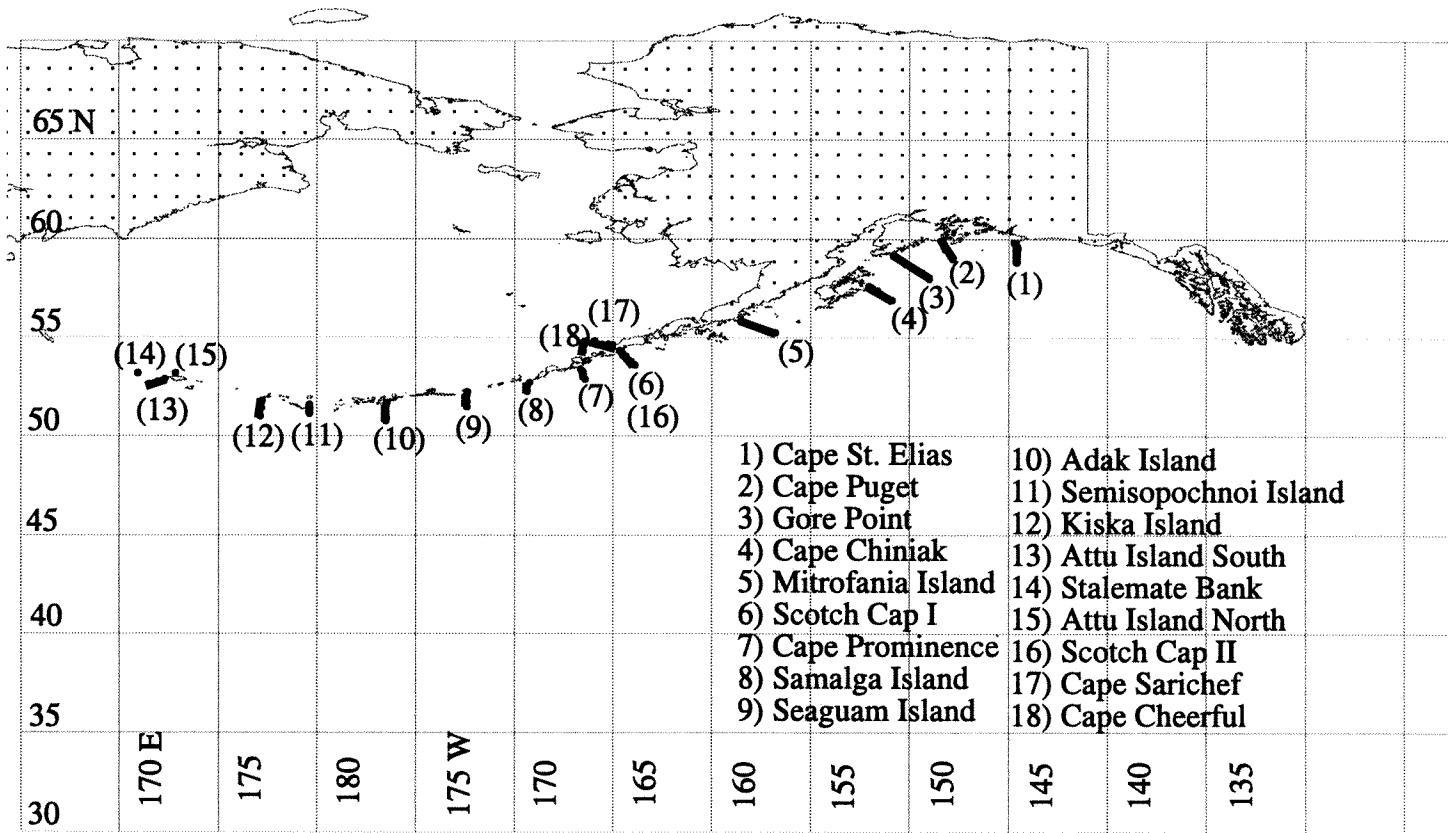


Figure 1. Overview map of North Pacific Ocean showing area covered and transects sampled by F/V GREAT PACIFIC in July and August 1997.

Cape St. Elias

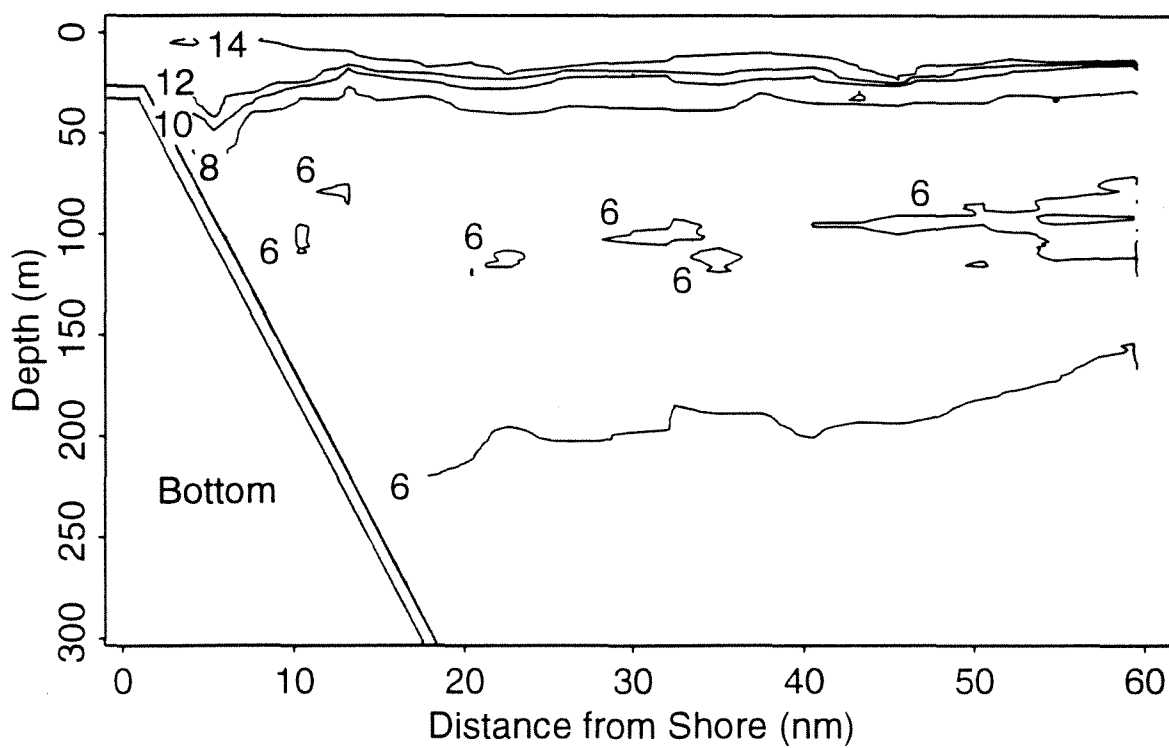


Figure 2. Temperature profile ($^{\circ}\text{C}$) off Cape St. Elias from nearshore to 60 nautical miles taken aboard the *F/V Great Pacific* on July 23 and 24, 1997.

Cape Puget

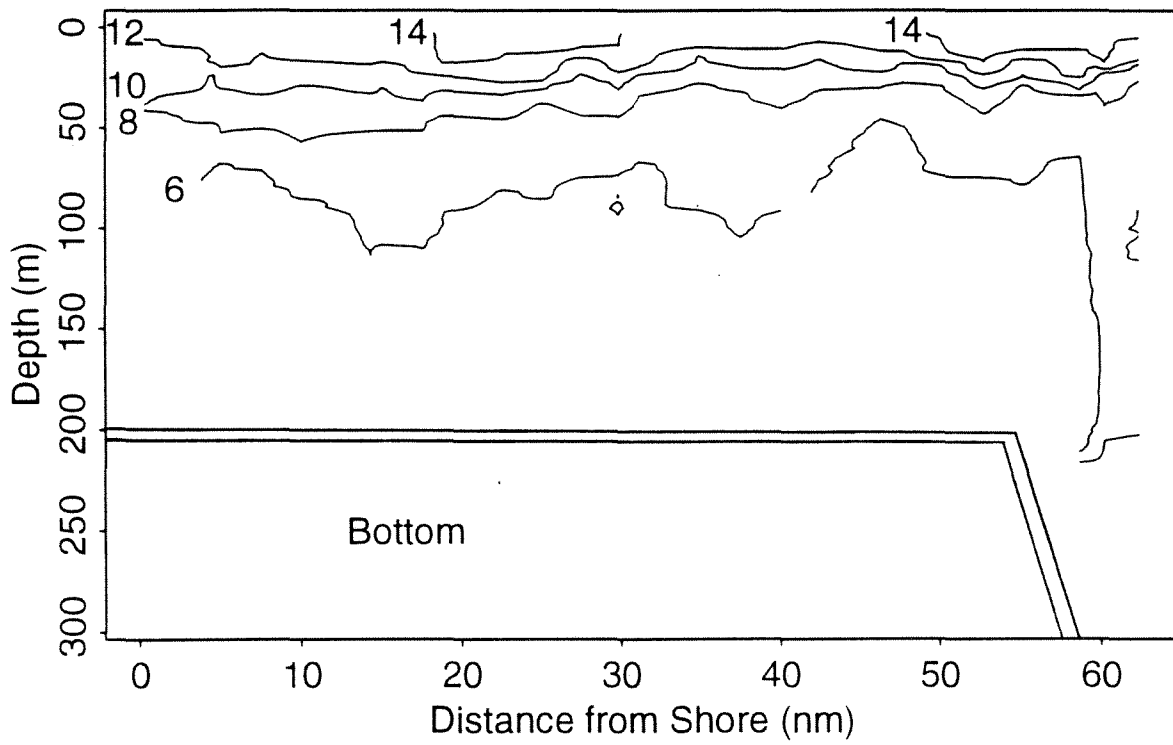


Figure 3. Temperature profile ($^{\circ}\text{C}$) off Cape Puget from nearshore to 60 nautical miles taken aboard the *F/V Great Pacific* on July 25 and 26, 1997.

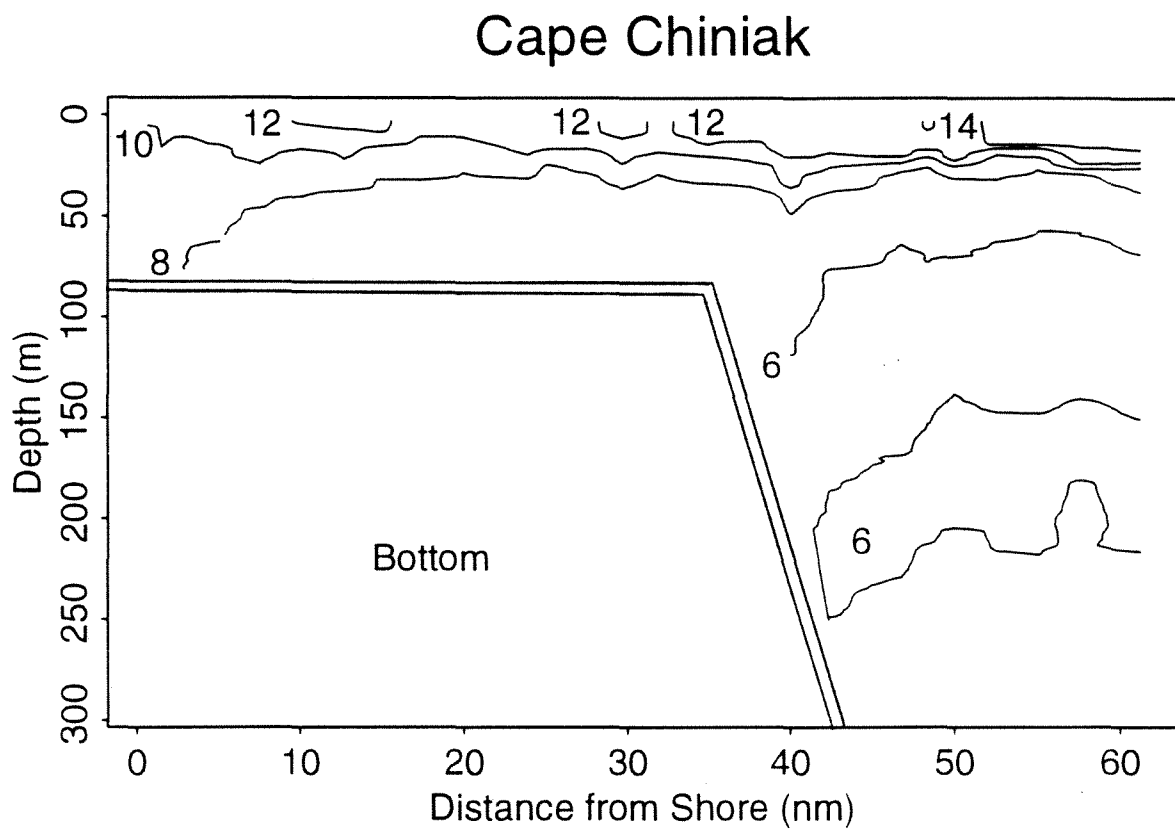


Figure 4. Temperature profile ($^{\circ}\text{C}$) off Cape Chiniak from nearshore to 60 nautical miles taken aboard the *F/V Great Pacific* on July 28 and 29, 1997.

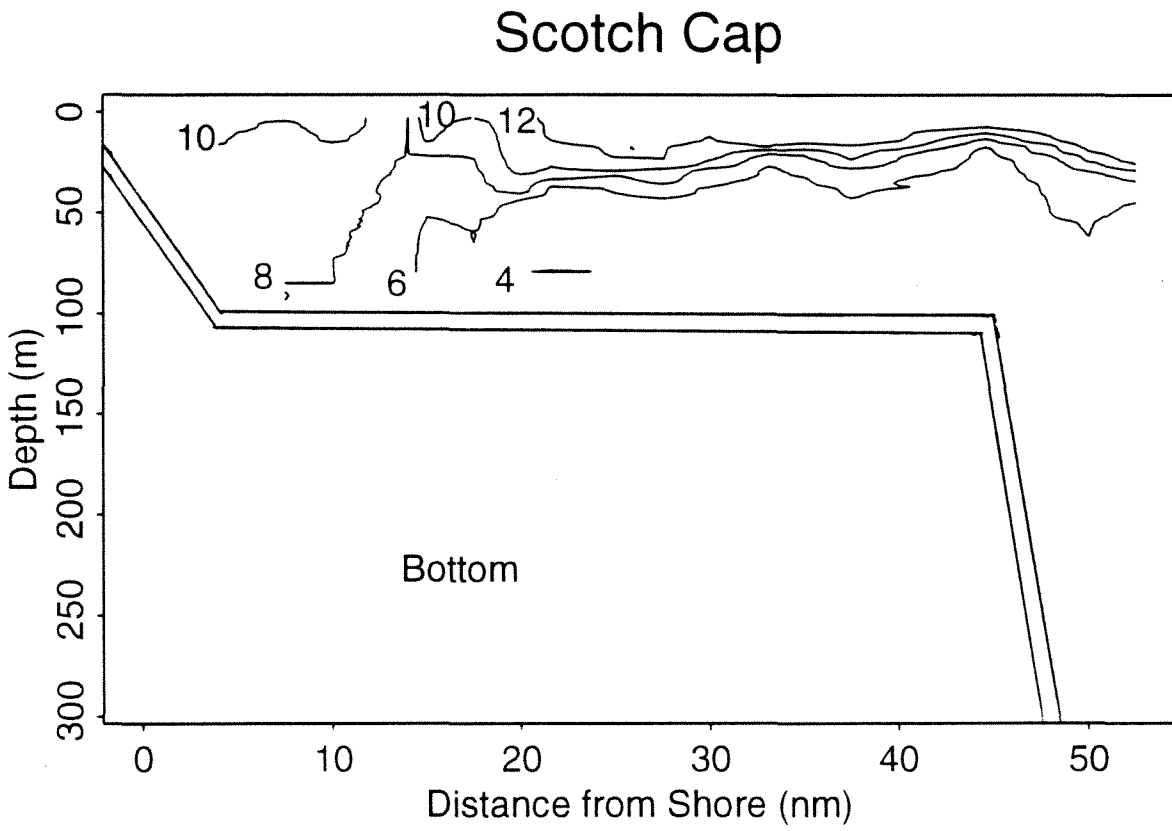


Figure 5. Temperature profile ($^{\circ}\text{C}$) off Scotch Cap from nearshore to 50 nautical miles taken aboard the *F/V Great Pacific* on August 15, 1997.

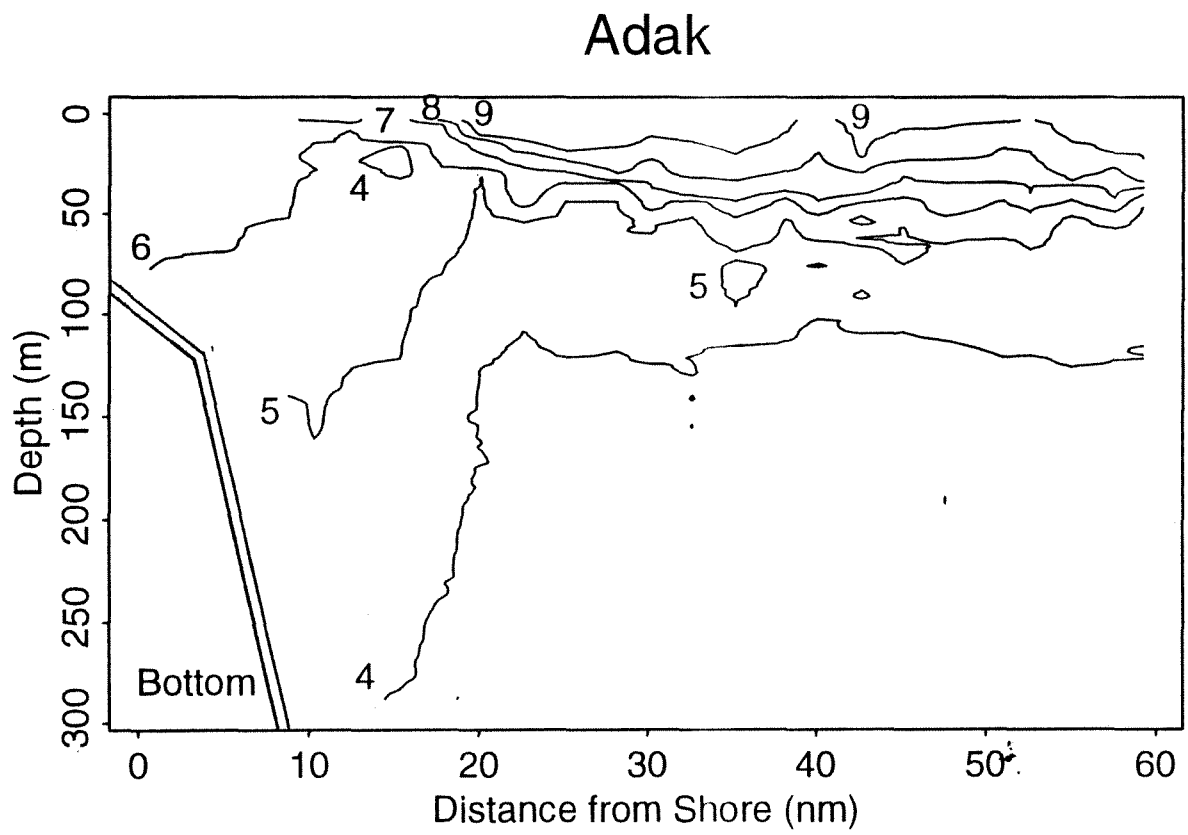


Figure 6. Temperature profile ($^{\circ}\text{C}$) off Adak Island from nearshore to 60 nautical miles taken aboard the *F/V Great Pacific* on August 7, 1997.