

**THE 1997 INTERNATIONAL COOPERATIVE SALMON
RESEARCH CRUISE OF THE *OSHORO MARU***

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THE 1997 INTERNATIONAL COOPERATIVE SALMON RESEARCH CRUISE OF THE *OSHORO MARU*

ABSTRACT

Preliminary information is presented on international cooperative salmon research conducted during the June-July 1997 cruise of the *Oshoro maru*. An objective of cooperative high-seas salmon research conducted under the North Pacific Anadromous Fish Commission Science Plan is salmon stock assessment through annual surveys along standard transects in the North Pacific Ocean and Bering Sea. Salmon surveys conducted aboard the *Oshoro maru* along 180° longitude in the central North Pacific Ocean in June since 1978 have provided a valuable time series of fisheries and oceanographic data. This was the fourth consecutive year of cooperative Japan-U.S. sampling for salmon along a 145°W-longitude transect in the central Gulf of Alaska in early July. The primary objective of the 1997 cooperative research was to continue the collection of oceanographic and biological data along the 180° and 145°W transects. In 1997, mid-June mean sea surface temperatures (SSTs; 9.2°C) at gillnet fishing stations were 2.1°C cooler along the 180° transect and early July mean SSTs (12.4°C) were 2.5°C warmer along the 145°W transect than in 1996. This reverses a warming trend in mean SSTs at 180° stations and a cooling trend at 145°W stations that was observed over the previous three years. Catches by gillnet totaled 2,036 salmonids, including 225 salmonids (361 in 1996) in the central North Pacific Ocean (180° transect) and 1,811 salmonids (1,982 in 1996) in the Gulf of Alaska. At longline stations, 11 salmon (17 in 1996) in the central North Pacific Ocean and 28 salmon (33 salmon in 1996) in the Gulf of Alaska were tagged and released. One tagged sockeye salmon (maturing, age 1.2) released at 145°W, 54°N on 10 July was recovered in a commercial fishery in the San Juan Islands, Washington, on 12 August 1997. One coded-wire tagged steelhead (juvenile, age 1.0), which originated from a release of hatchery fish into a coastal Washington stream in 1997, was recovered at 145°W, 52°N on 8 July. Biological samples and data were collected for various other cooperative studies of salmon distribution, abundance, stock origins, maturity and growth, food habits, bioenergetics, and other aspects of ocean biology and ecology; results will be reported later.

INTRODUCTION

This document reports on preliminary results of the 1997 international cooperative salmon (*Oncorhynchus* spp.) research cruise of the *Oshoro maru* in the central North Pacific Ocean and Gulf of Alaska. An objective of international cooperative high-seas salmon research conducted under the North Pacific Anadromous Fish Commission (NPAFC) Science Plan is salmon stock assessment through annual surveys along standard transects in the North Pacific Ocean and Bering Sea (FAJ 1994a,b; NPAFC 1995, 1996, 1997). Salmon surveys conducted by the *Oshoro maru*, Hokkaido University, Faculty of Fisheries, along 180° in the central North Pacific Ocean since 1978 have provided a valuable time series of fisheries and oceanographic data. In recent years, the Faculty of Fisheries and the Fisheries Research Institute (FRI), School of Fisheries,

University of Washington, have cooperated in salmon research aboard the *Oshoro maru* in the central North Pacific and Gulf of Alaska (Walker 1993, Walker and Myers 1994, Walker et al. 1994, Myers et al. 1995, Myers et al. 1996). In 1997, scientists from the Fisheries Agency of Japan (FAJ), Canadian Department of Fisheries and Oceans, and University of Alaska also participated in the Gulf of Alaska survey. The primary objective of the 1997 cooperative salmon research was to continue the collection of oceanographic and biological data along the 180° transect and along a 145°W transect in the central Gulf of Alaska.

METHODS

Survey Area and Cruise Schedule

Hydrographic, plankton, salmonid sampling, and additional sampling for salmonid feeding ecology, growth, and stock identification studies was conducted in the central North Pacific Ocean and Gulf of Alaska (Fig. 1, Tables 1 and 2). In international waters, surface longlines (B-gear) and gillnets (C-gear is non-selective varied research mesh and A-gear is commercial mesh) were used to catch salmonids. At stations within the U.S. 200-mile zone, only the surface longline was used to catch fish. Along 180° longitude in the central North Pacific Ocean, fishing for salmonids was conducted northward from 39°N to 47°N latitude. Along the 145°W transect, salmonids were sampled northward from 50°N to 56°N.

The *Oshoro maru* departed Hakodate on 3 June 1997. From 11 to 21 June, salmon and oceanographic research was conducted northward along the 180° transect. The vessel made a port call in Kodiak, Alaska, from 27 to 30 June, where scientists participating in the Gulf of Alaska cruise leg boarded. From 2-13 July, oceanographic and salmon research was conducted in the Gulf of Alaska. On 14 July, the *Oshoro maru* arrived in Seward, Alaska, where Gulf of Alaska participants disembarked. On 15 July, scientists participated in a post-cruise workshop, "The Biology and Oceanography of Subarctic Ocean."

Oceanographic Sampling

Oceanographic research conducted in 1997 included hydrographic, plankton, larval fish, and beam trawl sampling (Table 1A-D). Computer files of CTD data summaries were used to plot temperature and salinity isopleths along the 180° and 145°W transects.

Gillnet Sampling

Gillnet sampling was conducted by *Oshoro maru* personnel (Table 1E). Gillnet gear was set in the evening, allowed to soak overnight, and was retrieved the following morning. As the gillnet was hauled, the catch was sorted into baskets by mesh size and species. As the sorted fish were moved down the processing line, scale samples were collected, and species, fork length (mm), body weight (g), sex, and gonad weight (g) were recorded by mesh size on biological data forms. The catch by mesh size and species was recorded in an operations book, and was later entered into a computer file.

Longline Research and Tagging

All viable salmonids caught on longlines were double-tagged with both FAJ (red and white, 1.6 cm in diameter) and FRI (red and white, 2.0 cm in diameter) Petersen disk tags (Table 1E). In 1997, a significant effort was made by *Oshoro maru* personnel to minimize handling and holding time of salmon prior to release. As the longline was retrieved, the fish were landed in a dipnet and quickly put into a tank with flowing water for recovery. If possible without injuring the fish, the longline hook was removed. Viable fish were removed from the tank and placed on a measuring board. Fork length (mm) was measured, and a scale sample was taken. The tags, which have a hole in the center, were threaded onto a plastic cinch strap, which is inserted into a hollow needle. The fish was held firmly upright, and the needle was inserted through the dorsal musculature, just in front of the dorsal fin. The plastic strap was quickly cinched, and the tagged fish was either put in the holding tank to recover or released immediately over the side. Data on species, length, and tag number of each fish were recorded on data forms.

Fish Lacking Adipose Fins

By prior arrangement with FAJ, snouts were collected from salmonids lacking an adipose fin (Table 2C). Snouts collected from fish lacking adipose fins were labeled with catch and biological information and frozen. After the Seward port call, snout samples were shipped to the U.S. National Marine Fisheries Service, Auke Bay Laboratory (ABL), where they were examined for coded-wire tags. ABL reports release and recovery information on coded-wire tags to NPAFC.

Scale Sampling

Scale samples were collected for verification of species identification, and for age, growth, and stock origin studies (Tables 1 and 2). Scale samples were collected by *Oshoro maru* personnel from all longline-caught fish and from up to 30 fish of each species caught in each mesh size of gillnet used in each set. All scales were collected from the International North Pacific Fisheries Commission (INPFC) preferred body area (identified by the letter "A" on data forms; Davis et al. 1990), except in cases where all preferred scales were missing (identified by the letter "C" on data forms), and placed on gummed cards.

Additional Biological Sampling

At gillnet and longline stations in the Gulf of Alaska, additional research activities by Canadian, Japanese, and U.S. scientists included collection of salmonid stomachs, blood, brains, olfactory organs, otoliths, spleens, and scales for food habits, growth, maturity, migration, and stock identification studies (Table 2).

RESULTS AND DISCUSSION

Oceanographic Conditions

Temperature and salinity isopleths along the 180° and 145°W transects in 1997 are shown in Figure 2. In 1997, mid-June mean sea surface temperatures (9.2°C; SSTs) at the gillnet fishing stations were 2.1°C cooler along the 180° transect and early July mean SSTs (12.4°C) were 2.5°C warmer along the 145°W transect than in 1996. This reverses

a warming trend in mean SSTs at 180° stations and a cooling trend at 145°W stations observed over the previous three years (Myers et al. 1996).

Gillnet Catches

Different gillnet configurations were used along the 180° and 145°W transects, and these configurations were similar to those used in 1996 (Table 3; Myers et al. 1996). Salmonid sampling was conducted at 16 gillnet stations (Fig. 1; Table 4). Because of poor weather and sea conditions, there was no gillnet sampling at the 42°N and 43°N stations along the 180° transect. The total catch at gillnet stations was 2,036 salmonids: 912 sockeye (*O. nerka*; 583 in 1996), 506 chum (*O. keta*; 707 in 1996), 371 pink (*O. gorbuscha*; 377 in 1996), 185 coho (*O. kisutch*; 593 in 1996), 2 chinook (*O. tshawytscha*; 16 in 1996), and 60 steelhead (*O. mykiss*; 67 in 1996). Sockeye salmon catches along the 145°W transect were higher (802 fish) than in 1996 (536 fish) even though SSTs were relatively warm (12°-13° C).

Longline Sampling and Tag Recovery

Salmonid sampling was conducted at 13 longline stations (Fig. 1; Table 5). Eleven salmon in the central North Pacific Ocean and 28 salmon in the central Gulf of Alaska were tagged and released. The serial numbers of tags released at each station are reported annually to NPAFC by FAJ, and recoveries of tagged fish are reported by FRI. One double-tagged sockeye salmon (maturing, age 1.2) released at 145°W, 54°N on 10 July was recovered in a commercial purse seine fishery in the San Juan Islands, Washington, on 12 August 1997.

Fish Lacking Adipose Fins

Snouts were collected from 24 salmonids lacking adipose fins (22 steelhead and 2 sockeye; Table 2C). Two of the steelhead contained wire tags, but one was not coded (S. Fowler, ABL, personal communication). The other tagged steelhead, a juvenile (age 1.0) fish recovered at 145°W, 52°N on 8 July, originated from a release of hatchery fish into a coastal Washington stream (Salmon R., tributary of the Queets R.).

Scale Sampling

During the cruise, U.S. and Japanese scientists used a portable scale press to make two sets of acetate impressions (one for FRI and one for Hokkaido Salmon Hatchery) of all scales collected by *Oshoro maru* personnel. After the Seward port call, the original gummed scale cards were mailed to FAJ, National Research Institute of Far Seas Fisheries, Shimizu, for age determination and laboratory verification of species identification. U.S. scientists also collected a duplicate set of scale samples from all fish sampled in the gillnet and longline catches for use in growth studies. The results of these studies will be reported later.

Additional Biological Sampling

In the Gulf of Alaska, biological samples were collected for stock identification, food habit, growth, maturity, and migration studies (Table 2). A Canadian scientist collected 856 tissue samples from sockeye salmon at the 145°W gillnet stations for genetic (DNA) stock identification analyses. Japanese scientists collected blood serum

samples from 143 salmonids for cooperative Japan-U.S. analyses of growth and sex hormones. Japanese scientists also collected brain, olfactory organ, and otolith samples from 21 chum and sockeye salmon for studies of mechanisms of migration. U.S. scientists collected stomachs from 843 salmonids for food habit studies. A Japanese scientist preserved subsamples of stomach contents from up to 10 fish per species in each operation for additional laboratory studies. The results of these studies will be reported later.

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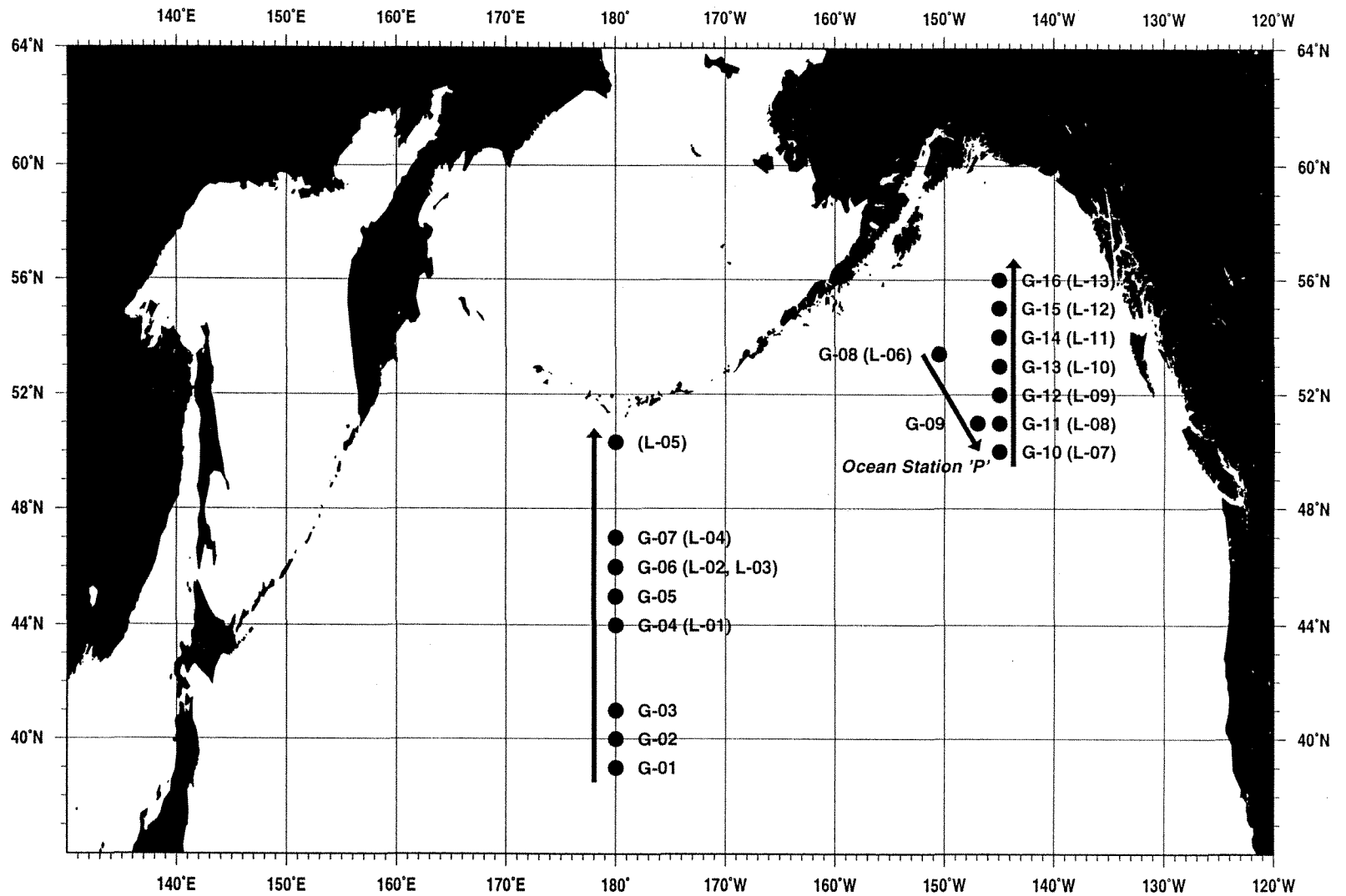


Figure 1. Location of fishing stations of the *Oshoro Maru*, 11 June to 12 July, 1997 (G=Gillnet stations, L=Longline stations).

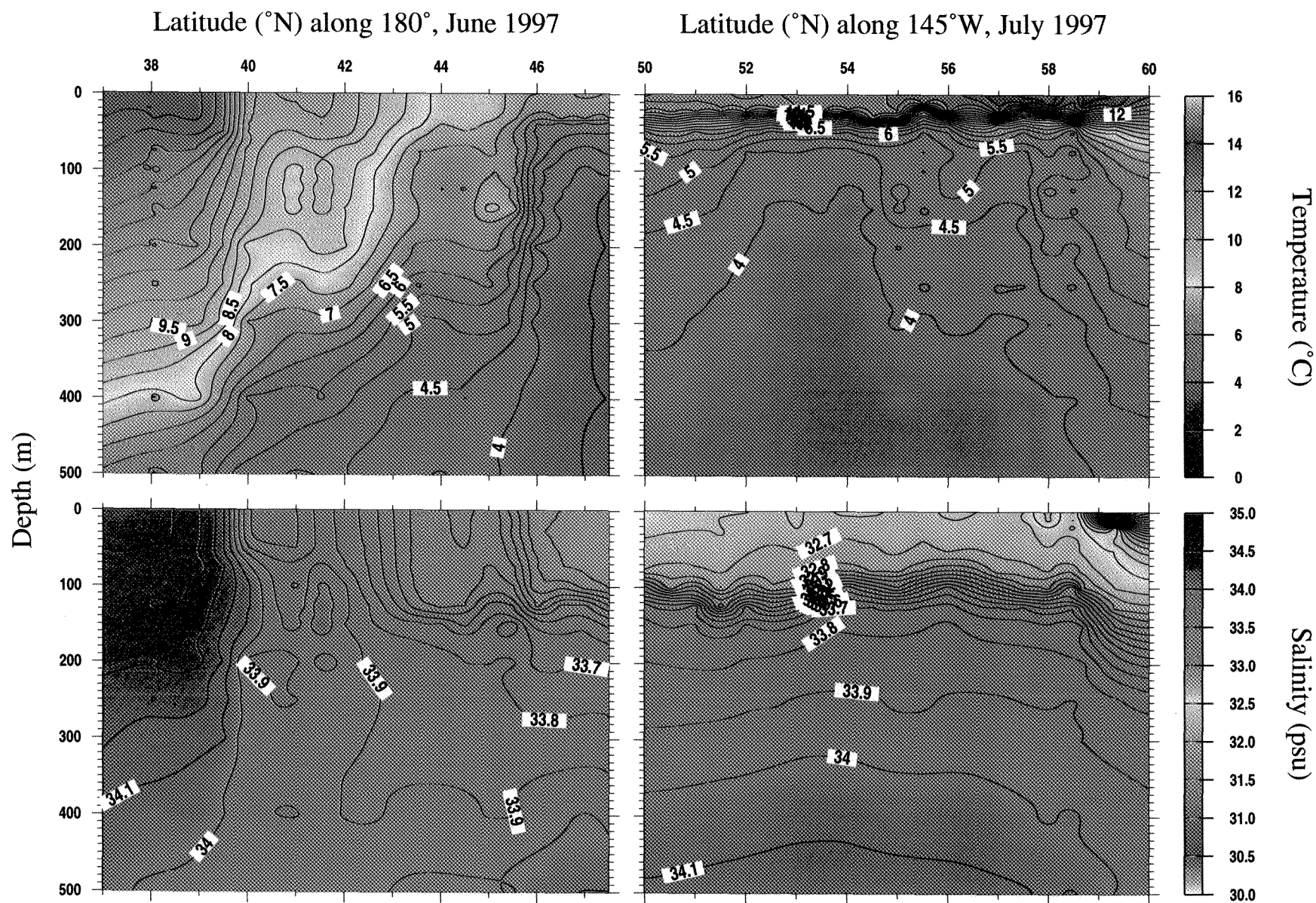


Figure 2. Temperature and salinity profiles of the 180° (upper and lower left) and 145° W (upper and lower right) transect lines, from CTD data in 1997.

Table 1. Description of research gear and fishing operations aboard the *Oshoro maru* in 1997.

Research Item/Gear	Purpose	Specifications	Deployment	Sample/Data	Comments
A. Hydrographic					
Neil Brown Mark III B CTD	Used to collect temperature, salinity, and water samples along the cruise track. These data have been collected in the North Pacific along the 180° transect since 1978, and in 1980-81, 1994-present on the 145° W transect.	CTD winch: Hydraulic 1t x 72 m/min., 6.4Ø x 4000 m	Vertical haul, to 1500m, 3000 m, or to bottom on shallow stations. Work on deck was completed by deck officers, crew, cadets and graduate students. Water samples and data processing on the ship was completed by graduate students.	Salinity, temperature, and dynamic depth anomaly were meas. at depths from 0-2500m, 0-3000m, or 0 - bottom. Water samples were collected at depth of 800, 500, 300, 200, 150, 125, 100, 75, 50, 30, 20, 10 for a 1500 m tow. For a 3000 m tow water was collected at 3000, 2000, 1000, 800, 500, 300, 200x2, 150x2, 125x2. Then a 2nd cast would collect from 100x2, 75x2, 50x2, 30x2, 20x2, 10x2. Water samples were analyzed for nutrients and nitrates.	Sigma-t, thermosteric anomaly, specific volume anomaly, geopotential anomaly were calculated by the shipboard computer. Bucket samples collected for sea surface temperature and salinity.
Van Dorn Water Sampling	To obtain large sea water samples for analysis of the chemical compounds related to biological activity.	20-l Van Dorn bottle used to collect samples from particular depths.	20-l water samples were collected from depth of 0, 10, 20, 30, 50, 100, 200 m.	The samples were filtered onto different pore size filters and stored at -80°C. Then later analyzed for particulate organic carbon (POC), chl _a , and phytoplankton pigment.	This sampling method allows for sampling of very small particles that cannot be collected in nets.
B. Plankton					
Single Norpac Net Shallow Tow 0-150m	Estimate biomass and identify zooplankton. The time series of these collections in the Gulf of Alaska are in: 1956-62, 1980-85, 1987-present.	Ring diameter: 0.45m; Mesh Size: 0.35 mm; Filtering Cloth: #200; Length: 1.8 m	Vertical tow: 0-150 m. Ship holds position so the tow stays vertical. Net lowered at a speed less than 1.0 m/s and retrieved at 1 m/s.	Samples were bottled in 5% formaldehyde and stored for biomass work to be completed at the end of the cruise.	Copepods are the predominant taxa collected by this gear.

Table 1. cont'd.

Research Item/Gear	Purpose	Specifications	Deployment	Sample/Data	Comments
B. Plankton (cont'd.)					
Single Norpac Net Deep Tow 0 -1200 m	This sampling was done to capture the copepod, <i>Neocalanus</i> , after they have completed their life cycle and ontogenetic down migration	Ring diameter: 0.45 m; Mesh Size: 0.35 mm; Filtering Cloth: #200; Length: 1.8 m Flowmeter in the center of the ring.	Vertical tow: 0-1200 m. Net was lowered at a speed less than 1.0 m/s, and retrieved at 1 m/s. Ship holds position so the tow stays vertical. Work on deck done by deck officers, crew, foreign scientists, graduate students, and cadets.	The objective is to look for length variation as an index of previous growth.	As copepods migrate down they will digest themselves, in turn becoming smaller.
Twin Norpac Net	Estimate biomass and identify zooplankton. This net system has been used periodically over the years.	This is two single Norpac nets held together by a metal frame. Each of the nets had its own flowmeter.	Ring diameter: 0.45 m, mesh size (each net had a different size mesh): 0.1 mm and 0.35 mm; vertical tow: 0-150 m. Net was lowered at a speed less than 1.0 m/s, and retrieved at 1 m/s. Ship holds position so the tow stays vertical. Work on deck done by deck officers, crew, graduate students, and cadets.	Samples were bottled in 5% formaldehyde and stored for biomass work and copepod identification to be completed after the cruise.	The twin Norpac allows for collection of two samples from the same water column.
Gamaguchi Net	This net was used to collect zooplankton samples from specific areas in the water column. This net is like a Norpac net but has a closing mouth.	Ring Diameter: 0.6 m Mesh Size: 0.1 mm.	Separate night vertical tows to: 2000-1000m, 1000-500m, 500-250m, 250-thermocline, thermocline-0 m. Ship holds position so the tow stays vertical. Work on deck done by officers, crew, graduate students, and cadets.	The samples are collected from specific depth areas. These samples are stored in formaldehyde and later analyzed for species composition.	This net allows for only a certain area of the water column to be sampled, which in turn allows for observations to be made on the separation of species throughout the water column.

Table 1. cont'd.

Research Item/Gear	Purpose	Specifications	Deployment	Sample/Data	Comments
C. Larval fish					
Larval Net	This net was used for the collection of larval fish found near the surface at night. These samples have been collected for several years	Mouth diameter: 1.3 m; length: 4.5 m; mesh: 3-mm mesh cloth in the upper 300 cm, 0.33 mm mesh in the lower 150 cm. Flowmeter was centered at mouth of the net.	Horizontal haul with a fish-larva net was made just under the sea surface for 10 minutes at a speed of approx. 2 knots. Sampling was conducted by the officers of the <i>Oshoro maru</i> .	The larval fish samples were preserved in formaldehyde for later identification in the laboratory.	Many species of larval fish will come to the surface during the night.
D. Other non-salmon					
Beam Trawl	This horizontal tow collects species throughout the water column at sunset.	Net length: 17 m; cod end length :0.5 m; mouth opening: 2.0 m on one side, 2.5 m on other side.	Horizontal tow for 2400 m, with the trawl going down to 800 m and then up.	The samples were preserved for carbon 14 analysis. Carbon ratios will give an idea of age of the water column.	Large variety and sizes of species were collected from small species such as copepods to large species such as octopus, approximately 20 cm in length.
E. Salmonids					
Research Gillnet	Salmon abundance and biological data for ocean ecology and stock assessment; non-selective research (C) net introduced in 1971; systematic surveys with gillnet for abundance estimation commenced in 1972, 145°W transect in 1980-81, 1994-1997.	Net configuration varied at different stations (Table 3); overall length: 2.45 km (49 tans, 50 m/tan); depth: approx. 6 m; hydraulic net hauler: 0.3 t x 177 m/min.	Set (ship time: sunset, approximately 1800; Haul (ship) time: sunrise, approximately 0500; operation supervised by captain and officers; work done by officers, crew, cadets, and research staff.	No. of fish by mesh and species; for each mesh size in C-net: fork length, sex, gonad weight, scale(s) for up to 100 fish of each species (body weight for up to 60 fish); A-net (commercial meshes): same data as C-net except in 1997 only 30 fish of each species sampled per mesh.	1 scale per fish from sockeye, chum, and pink; 2 scales per fish from coho, chinook, and steelhead (1 scale from each side of body).
Surface Longline	Live capture of fish for high seas tagging research; long time series of data 1955-present in North Pacific.	No. hachi (basket) per operation varied in 1997 (Table 5); hachi mainline: 127 m long; 34 branch lines/hachi; 3 m between branch lines; fishing depth: approx. 2 m; bait: small salted anchovy.	Set and haul (ship) times varied in 1997 (see Table 5); operation supervised by captain and deck officers; work done by crew, cadets, and scientists.	No. of fish by species; mortalities: fork length, body wt., scale(s); viable fish; fork length, scale(s), tag nos.	Fish are double-tagged with two red and white, approx. 1.6 -2.0 cm Petersen disk tags (one Japan tag, one FRI tag) attached to the fish in front of the dorsal fin with a plastic cinch.

Table 2. Additional salmonid research activities conducted aboard the *Oshoro maru* in 1997.

Subject	Sample (no. collected)	Fishing Gear	Method	Data or Samples collected
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A. Salmonid Food Habits and Feeding Ecology

Stomach contents	Stomachs collected from 843 salmonids; stomach contents of up to 10 fish per species in each operation preserved after shipboard examination in 10% formaldehyde	Gillnet and longline	Shipboard analysis; stomachs from esophagus to pyloric valve collected from up to 20 fish of each species in each gillnet operation	Prey weight, % composition by volume of each prey type, fullness and digestion indices; type specimens of prey for ident. to genus and species (preserved in 10% formaldehyde); specimens of prey for caloric content analysis (frozen)
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B. Salmonid Ocean Growth, Maturity, and Mechanisms of Migration

Growth and maturity indices and physiological studies	Blood serum samples: 24 sockeye, 57 chum, 19 pink, 22 coho, 20 steelhead, 1 chinook; brain and olfactory tissue samples and otoliths from 11 sockeye and 10 chum salmon	Gillnet, longline	Blood drawn from caudal vein; centrifuged at 3000 rpm for 15 min; 1.0 ml in each of two 1.5 ml cryo-tubes; frozen at -80°C	Accompanying scale samples, biological, and oceanographic data; duplicate blood serum samples collected from each fish, one sample for United States and one for Japan
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C. Stock Identification

Genetic stock identification	Scale scrapes and spleen samples from sockeye salmon (856 samples)	Gillnet	Samples preserved in ethanol for DNA analysis	Accompanying biological and oceanographic data
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Table 2. cont'd.

Subject	Sample (no. collected)	Fishing Gear	Method	Data or Samples collected
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C. Stock Identification (cont'd)

High seas coded-wire tag recovery	Snouts from fish lacking the adipose fin (22 steelhead, 2 sockeye)	Gillnet and longline (mortalities)	All fish in the catch were examined	Snouts (frozen) and accompanying catch, data, biological data, and scale samples; snouts shipped to U.S. NMFS, Auke Bay Laboratory, Juneau, for tag detection and decoding
Double tagging experiments	Tagged fish (40 live fish)	Longline	All viable salmonids in longline catches were double-tagged with Japan and FRI tags	Tag nos., Japan/FRI: AA2063/KK709, AA2065-70/KK711-16, AA2072-75/KK718-21, CC6501-28/LL1001-28

Table 3. Gillnet configurations used in 1997.
1 tan = 50-m long section of gillnet.

Type*	Size (mm)	180°	G. of Alaska
		No. tans	No. tans
A	115	6	9
F	19	1	0
F	29	1	0
F	37	1	0
C	48	3	3
C	93	3	3
C	157	3	3
C	106	3	3
C	63	3	3
C	121	3	3
C	72	3	3
C	138	3	3
C	82	3	3
C	55	3	3
F	42	1	0
F	33	1	0
F	25	1	0
F	22	1	0
A	121	6	10
Total		49	49

* A = traditional salmon commercial gillnet

C = salmon research gillnet

F = experimental gillnet (non-salmon research)

Table 4. Salmon caught in 1997 *Oshoro Maru* gillnet operations. Location, sea surface temperature (SST, °C), surface salinity (psu, practical salinity units), number of 50-m tans, and catch by research-mesh and commercial-mesh gillnet for each fishing station.

Station	Date	Location	SST		Gear	Tans	Sockeye	Chum	Pink	Coho	Chinook	Steelhead	Total Salmon
			Salin.										
G-01	11-Jun-97	39° 00 N	13.7		Commercial	12	0	0	0	0	0	0	0
		180° 00	34.43		Research	30	0	0	0	0	0	0	0
					Total	42	0	0	0	0	0	0	0
G-02	12-Jun-97	40° 00 N	10.7		Commercial	12	0	0	0	2	0	0	2
		180° 00	33.83		Research	30	0	0	0	1	0	0	1
					Total	42	0	0	0	3	0	0	3
G-03	13-Jun-97	41° 00 N	10.4		Commercial	12	0	0	0	0	0	0	0
		180° 00	33.70		Research	30	0	10	1	2	0	0	13
					Total	42	0	10	1	2	0	0	13
G-04	15-Jun-97	44° 00 N	7.9		Commercial	12	0	0	3	6	0	3	12
		180° 00	33.32		Research	30	0	11	6	8	0	3	28
					Total	42	0	11	9	14	0	6	40
G-05	17-Jun-97	45° 00 N	7.9		Commercial	12	0	0	2	1	0	1	4
		180° 00	-		Research	30	1	11	16	1	0	2	31
					Total	42	1	11	18	2	0	3	35
G-06	18-Jun-97	46° 00 N	6.9		Commercial	12	0	0	1	2	0	0	3
		180° 00	32.93		Research	30	9	33	32	1	0	1	76
					Total	42	9	33	33	3	0	1	79
G-07	19-Jun-97	47° 00 N	7.2		Commercial	12	1	2	0	1	0	0	4
		180° 00	33.25		Research	30	7	12	27	3	1	1	51
					Total	42	8	14	27	4	1	1	55
Sub-total, 180° Stations					Commercial	84	1	2	6	12	0	4	25
					Research	210	17	77	82	16	1	7	200
					Total	294	18	79	88	28	1	11	225

Table 4. Cont'd.

Station	Date	Location	SST		Gear	Tans	Sockeye	Chum	Pink	Coho	Chinook	Steelhead	Total Salmon
			Salin.										
G-08	3-Jul-97	53° 25 N	11.6		Commercial	19	12	8	23	17	1	3	64
			32.66		Research	30	20	51	24	18	0	1	114
		150° 30 W		Total	49	32	59	47	35	1	4	178	
G-09	5-Jul-97	51° 10 N	11.6		Commercial	19	42	7	2	9	0	4	64
			32.54		Research	30	18	46	3	10	0	6	83
		146° 52 W		Total	49	60	53	5	19	0	10	147	
G-10	6-Jul-97	50° 00 N	12.5		Commercial	19	17	2	0	0	0	7	26
			32.52		Research	30	10	14	0	1	0	0	25
		145° 00 W		Total	49	27	16	0	1	0	7	51	
G-11	7-Jul-97	51° 00 N	12.0		Commercial	19	45	6	1	7	0	1	60
			32.56		Research	30	19	15	0	3	0	0	37
		145° 00 W		Total	49	64	21	1	10	0	1	97	
G-12	8-Jul-97	52° 00 N	12.2		Commercial	19	46	3	8	9	0	1	67
			32.60		Research	30	47	9	1	6	0	7	70
		145° 00 W		Total	49	93	12	9	15	0	8	137	
G-13	9-Jul-97	53° 00 N	12.2		Commercial	19	97	4	12	9	0	2	124
			32.59		Research	30	61	21	17	6	0	2	107
		145° 00 W		Total	49	158	25	29	15	0	4	231	
G-14	10-Jul-97	54° 00 N	12.4		Commercial	19	85	16	29	8	0	1	139
			32.52		Research	30	35	67	31	19	0	1	153
		145° 00 W		Total	49	120	83	60	27	0	2	292	
G-15	11-Jul-97	55° 00 N	12.6		Commercial	19	113	7	37	10	0	0	167
			32.64		Research	30	96	36	41	13	0	2	188
		145° 00 W		Total	49	209	43	78	23	0	2	355	
G-16	12-Jul-97	56° 00 N	13.0		Commercial	19	72	8	39	5	0	6	130
			32.57		Research	30	59	107	15	7	0	5	193
		145° 00 W		Total	49	131	115	54	12	0	11	323	
Sub-total, Gulf of Alaska Stations					Commercial	171	529	61	151	74	1	25	841
					Research	270	365	366	132	83	0	24	970
					Total	441	894	427	283	157	1	49	1811
Total Salmon Catch					Commercial	255	530	63	157	86	1	29	866
Stations G-01 - G-16					Research	480	382	443	214	99	1	31	1170
					Total	735	912	506	371	185	2	60	2036

Table 5. Salmonids tagged and released during 1997 *Oshoro Maru* longline operations. Location, sea surface temperature (SST, °C), surface salinity (psu, practical salinity units), and catch tagged and released. S.M.T. = Ship Mean Time; hachi = unit of longline gear (34 hooks per hachi).

Station	Date	Time (S.M.T.)	Latitude	Longitude	SST	Salin.	Hachi	Sockeye	Chum	Pink	Coho	Chinook	Steelhead	Total
L-01	6/14/97	14:30-17:30	43° 59 N	180° 00	7.8	33.32	10	0	0	0	0	0	0	0
L-02	6/17/97	15:00-18:00	46° 00 N	179° 58 W	7.0	32.93	10	0	0	0	0	0	0	0
L-03	6/18/97	4:30-6:30	45° 59 N	179° 52 W	7.0	32.93	10	0	2	1	0	0	0	3
L-04	6/19/97	4:30-6:30	47° 01 N	179° 58 W	7.8	33.25	10	0	2	3	0	0	0	5
L-05	6/21/97	11:30-2:30	50° 18 N	179° 51 W	7.0	32.76	10	0	0	3	0	0	0	3
L-06	7/2/97	13:30-18:00	53° 25 N	150° 30 W	11.4	32.66	10	0	6	0	3	0	0	9
L-07	7/6/97	4:30-6:45	49° 58 N	145° 02 W	12.2	32.52	15	0	0	0	0	0	0	0
L-08	7/7/97	4:30-6:30	50° 58 N	145° 01 W	11.8	32.56	10	0	0	1	0	0	0	1
L-09	7/8/97	4:30-7:00	51° 57 N	144° 58 W	12.4	32.60	12	2	0	0	0	0	0	2
L-10	7/9/97	4:30-7:15	52° 59 N	144° 56 W	12.2	32.59	13	2	3	0	3	0	0	8
L-11	7/10/97	4:30-6:30	54° 01 N	144° 59 W	12.4	32.52	10	1	2	0	0	0	0	3
L-12	7/11/97	4:30-7:00	55° 02 N	144° 56 W	12.6	32.64	10	0	1	0	0	0	0	1
L-13	7/12/97	4:30-7:30	56° 01 N	144° 58 W	12.8	32.57	10	0	0	2	2	0	0	4
Total								5	16	10	8	0	0	39