

Results of 2003 Salmon Research Cruise of the *Oshoro maru*

by

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ABSTRACT

In order to elucidate the distribution and abundance of pelagic nekton, gillnet surveys and oceanographic observations were conducted along 155° E, 165° E, and 165° W in the northern North Pacific Ocean. Each survey was conducted in Cruise #135 (mid-May along 155° E), Cruise #136 (mid-June along 155° E), and Cruise #137 (early-July along 165° E and late-July along 165° W), 2003.

In Cruise #135 and #136, the Polar Front and the Subarctic Boundary occurred near 43.5° N and 39.3° N along 155° E. In Cruise #136, the thermocline appeared between 0-50db in the Transition Domain, then sea surface temperature was 2°C higher than in Cruise #135. But sea surface temperatures in 2003 were 1-2°C colder than in 2002 in the Transition Domain along 155° E. In Cruise #137, the Polar Front and the Subarctic Boundary occurred near 45.2° N and 40° N along 165° E, and near 47° N and 40.3° N along 165° W.

Gillnet survey was conducted at 16 stations. A total of 2,126 salmonids was caught by gillnet surveys, including 175 sockeye salmon (*Oncorhynchus nerka*), 674 chum (*O. keta*), 1,190 pink (*O. gorbuscha*), 72 coho (*O. kisutch*), 6 chinook (*O. tshawytscha*) and, 9 steelhead trout (*O. mykiss*).

In mid-May along 155° E, the most dominant was pink salmon (87.3%). Chum salmon abundance was high at 39.5° N. The abundance of chum and pink salmon were much higher in Cruise #136 than in Cruise #135. Along 155° E, chum salmon was more abundant in 2003 than in 2002.

In early-July along 165° E (Cruise #137), all sockeye salmon was collected at 49.5° N in the Subarctic region and chum salmon also abundance was high at 49.5° N. Both pink and coho salmon were most abundant at 45° N near the Polar Front.

Salmonids were collected only at 50° N in late-July along 165° W, sockeye and chum salmon were abundant, but pink salmon was not collected.

Age compositions differed along three transects. For sockeye salmon, the dominant age groups were ocean age .3 and .2 along 165° E, and ocean age .2 along 165° W. For chum salmon, the dominant age groups were ocean age .3 along 155° E, ocean age .3 and .1 along 165° E, ocean age .1 along 165° W. Very few ocean age .2 fish were collected north of the three transects.

INTRODUCTION

The *Oshoro maru* and the *Hokusei maru* have conducted pelagic nekton research and studied the oceanic structure and marine biology in the North Pacific Ocean, Bering Sea and/or Chukuchi Sea every summer since 1953. Data collected by the *Oshoro maru* and the *Hokusei maru* have been published annually since 1957 (Hokkaido University, 1957-2003).

Since 1978, several transects have been repeatedly sampled to study long-term changes in the North Pacific Ocean ecosystem. These transects include 180 °, 165 ° W, 145 ° W by the *Oshoro maru* and 155 ° E, 170 ° E, 175 ° 30'E by the *Hokusei maru*.

The *Hokusei maru* was decommissioned in March 2002, so our salmon research cruises in the North Pacific Ocean are conducted by three cruises of the *Oshoro Maru* since 2002.

In 2003, the cruises have sampled along 155 ° E from 35 ° N to 44 ° N since 1982, along 165 ° W from 38 ° N to 50 ° N since 1998 and new research line along 165 ° E from 35 ° N to 50 ° N. The primary objects of these cruises are to continue several years and collecting oceanographic and biological data along these transects.

This document reports the preliminary results of the 2003 research cruises of the *Oshoro maru* in the North Pacific Ocean.

METHODS

1. Survey Area and Cruise Schedule

Oceanographic, gillnet, and surface longline research were conducted along the 155° E, 165 ° E and 165° W in the northern North Pacific Ocean during three cruises: #135 (10-23 May), #136 (3-16 June), and #137 (27 June - 24 Aug.) (Fig. 1).

2. Oceanographic Observation

Oceanographic stations were occupied from 36.5° N to 44° N along 155° E in Cruise #135 and #136. In Cruise #137, oceanographic stations were occupied from 35 ° N to 50° N along 165° E and from 38° N to 50° N along 165° W (Table 1).

Data collected by CTD, XCTD and XBT instruments were used to plot the temperature and salinity.

3. Drift Gillnet Sampling

A drift gillnet was used to catch salmonids and the other organisms at 16 stations (Table 2). The gillnet configurations is shown in Table 3. The net comprised of 30 tans of C-Gear gillnet (non-selective varied research mesh, Takagi, 1975), 12 tans of A-Gear gillnet (commercial mesh),

and 7 tans of F-Gear gillnet (special mesh). Each tan was 50m long.

Gillnet gear was set in the evening, allowed to soak overnight, and retrieved the following morning.

The number of organisms caught was counted by species for each mesh size.

Fork length (F.L.), body weight, and gonad weight by sex of a maximum 60 fishes for each salmon species of each mesh size were measured, and scale samples were collected from the International North Pacific Fisheries Commission (INPFC) preferred body area and placed on gummed cards for verification of species identification, and for age, growth and stock origin studies.

Sockeye salmon (*Oncorhynchus nerka*), and chum salmon (*Oncorhynchus keta*) were classified as mature or immature based on gonad weight (Takagi, 1961).

By prior arrangement with the FAJ, snouts were collected from each salmonid lacking an adipose fin. These snouts were labeled with catch and biological information and frozen. Snout samples were sent to the FRA (Japan), Hokkaido National Fisheries Research Institute, where they will be examined for coded-wire tags.

4. Surface Longline Sampling and Tagging

Three surface longline samplings were operated to tag and release viable salmonids along 165° E and 165° W in Cruise #137 (Table 4). Ten hachi (baskets) were used at each station.

One hachi; mainline: 127m long; 34 branch lines/hachi; 3m between branch lines;

Fishing depth: 2m ; Bait: Salted anchovies.

All viable salmonids were double-tagged with FAJ (red and white, 1.6 cm in diameter) and FRI Petersen (red and white, 2.0 cm in diameter) disk tags.

Data on species, length and tag number of each fish were recorded on data forms. The scale collection method and data recorded on length, species and tag number were the same as those in standard methods.

5. Additional Biological Sampling

At gillnet stations, additional research activities included collection of whole salmon, salmonid stomachs, muscle tissues, and blood samples for studies of food habits, growth, stock identification, and female-specific serum proteins.

RESULTS AND DISCUSSION

Final oceanographic data and biological data collected during the cruises will be published in the “*DATA RECORDER OF OCEANOGRAPHIC OBSERVATIONS AND EXPLORATORY FISHING NO. 47*” of Hokkaido University no later than March 2004.

1. Oceanographic Conditions

Temperature and salinity sections (0-800db) are shown in Figure 2.

The geographic positions of the Polar Front and the Subarctic Boundary (Dodimead et al., 1963, Favorite et al., 1976, Roden, 1991) were as follows.

[155° E line]

In Cruise #135 and #136, the Polar Front which is indicated by the vertical 4 °C isotherm at 100m depth occurred near 43.5 °N. The Subarctic Boundary that is indicated by the vertical 34.0 psu isohaline occurred near 39.3 °N. In mid-June, the sea surface temperature north of 41 °N was 2°C higher than in mid-May, then the thermocline appeared between 30-50db in the Transition Domain. But the sea surface temperatures in 2003 were 1-2°C colder than in 2002 in the Transition Domain.

[165° E line]

The Polar Front and the Subarctic Boundary occurred near 45.2° N and 40° N. The thermocline was distributed between 30-50db north of 41° N.

[165° W line]

The Polar Front and the Subarctic Boundary occurred near 47° N and 40.3° N.

2. Distribution and abundance of organisms caught by drift gillnet

The number of organisms caught by the drift gillnet at each station are shown in Table 5-(1) (Cruise #135), 5-(2) (Cruise #136), and 5-(3) (Cruise #137).

[155° E line : Cruise #135]

A total of 44 chum (*Oncorhynchus keta*) and 303 pink salmon (*O. gorbuscha*) were collected. Pink salmon abundance was high at 42.5° N (N=196) and chum salmon concentrated at 39.5° N (N=39) near the Subarctic Boundary. As for dominant non-salmonids species, neon flying squid (*Ommastrephes bartramii*, N=82), pacific saury (*Cololabis saira*, N=28) were collected at 41° N. Pacific pomfret (*Brama japonica*) was collected at 39.5° N (N=125) and at 38° N (N=100). Japanese anchovy (*Engraulis japonicus*, N=7870) abundance was very high at 39.5° N.

[155° E line : Cruise #136]

A total of 452 chum, 665 pink and 1 coho salmon (*Oncorhynchus kisutch*) were collected in this cruise. The abundance of chum (N=451) and pink salmon (N=665) were much higher in Cruise #136 than in Cruise #135. Chum salmon was more abundant in 2003 than in 2002. As for dominant non-salmonids species, neon flying squid (N=236) was collected at 38° N and 36.5° N. Pacific saury (N=28) were collected at 41° N. Pacific pomfret (N=144) was widely distributed in the Transition Domain. Japanese anchovy (N=57) abundance was low. Pacific saury was not collected.

[165° E line : Cruise #137]

A total of 121 sockeye (*Oncorhynchus nerka*), 113 chum, 222 pink, 58 coho, and 4 chinook salmon (*O. tshawytscha*) were collected in this cruise. All sockeye salmon was collected at 49.5° N in the Subarctic region, chum salmon (N=89) was also abundant at 49.5° N. The abundance of pink salmon (N=183) was high and almost of coho (N=54) and chinook salmon (N=3) were also

collected at 45° N near Polar Front.

As for dominant non-salmonids species, neon flying squid (N=14) was collected at 39° N. Pacific saury (N=1805) was abundant at 41° N. Almost of pacific pomfret (N=32) was collected at 41° N. Japanese anchovy was not collected.

[165° W line : Cruise #137]

A total of 54 sockeye, 65 chum, 13 coho, 2 chinook salmon, and 9 steelhead trout (*Oncorhynchus mykiss*) were collected in this cruise. All salmonids was collected at 50° N in the Subarctic region. Pink salmon was not collected. As for dominant non-salmonids species, neon flyng squid (N=217) was concentrated at 39° N. Pacific saury (N=1805) was collected at 44.5° N and 39° N. Pacific pomfret (N=9) abundance was low.

3. Biological characteristics of salmonids

Fork length frequency and male ratio of sockeye, chum, and pink salmon caught by C-gear gillnet at each longitude line, and line graph corresponds to fork length frequency by three ocean age stages in Cruise #135, #136, and #137 are shown in Figure 3.

[Sockeye salmon]

Along 165° E, the dominant age groups collected by C-gear gillnet were ocean age .3 (44.9%) and .2 (44.9%). Fork lengths of ocean age .3 fish ranged between 430-635mm (mean ± STD: 568.4±41.44mm), and ocean age .2 fish ranged between 432-589mm (mean ± STD: 473.4±32.51mm).

Along 165° W, almost of sockeye salmon collected by C-gear gillnet were ocean age .2 (73.0%). Fork lengths of ocean age .2 fish ranged between 440-530mm (mean ± STD: 492.8±23.75mm).

[Chum salmon]

Along 155° E , 85.0% of chum salmon collected by C-gear gillnet were ocean age .3. Their fork length ranged between 414-658mm (mean ± STD: 554.4±30.44mm).

Along 165° E , the dominant age groups were ocean age .1 (32.3%) and .3 (54.8%). Fork lengths of ocean age .1 fish ranged between 312-393mm (mean ± STD: 350.8±17.97mm), and ocean age .3 fish ranged between 448-664mm (mean ± STD: 560.4±46.57mm).

Along 165° W, the dominant age groups were ocean age .1(56.9%). Fork lengths of ocean age .1 fish ranged between 315-494mm (mean ± STD: 367.9±33.37mm). Ocean age .2 fish were collected very few (4.0%) throughout the all cruise.

[Pink salmon]

Fork length frequency distributions of pink salmon were as follows:

155° E (mid-May): mean ± STD =403.1±22.1mm, mode=412mm F.L.

155° E (mid-June): mean ± STD =426.1±22.4mm, mode=450mm F.L.

165° E (early-July): mean ± STD =455.6±22.2mm, mode=510mm F.L.

In 155° E (mid-June), the proportions of males were low (39%).

4. Surface longline sampling and tagging

Two viable chum salmon (386mm, 474mm F.L.) were caught at 54° N, 165° W, and one viable pink (472mm F.L.) and two viable coho salmon (562mm, 563mm F.L.) were collected at 45° N, 165° E. They were double-tagged with FAJ and FRI Petersen disk tags (Table 6).

5. Fish lacking adipose fins

Snouts were collected from 4 steelhead lacking adipose fins for coded-wire tag detection (Table 7).

ACKNOWLEDGMENTS

The *Oshoro maru* belongs to the Ministry of Education, Science, Sports and Culture, Government of Japan, and is a training vessel for students and fisheries technicians. We thank the INPFC, NPAFC and their affiliated scientists who have helped us to conduct salmon-research in the North Pacific Ocean over many years. Your cooperation has helped us to train and teach many scientists and leaders in the fishing industry through our salmon research program.

Also we thanks the other officers, crew, guest scientists, graduate students, and cadets of the *Oshoro maru* for their outstanding assistance and cooperation in sampling and data collection under sometimes severe conditions.

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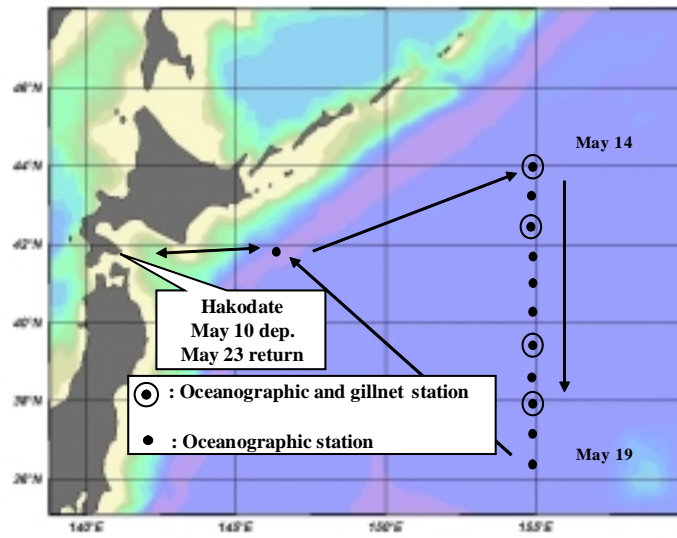


Fig 1-1 Cruise #135 (May 10 – 23)

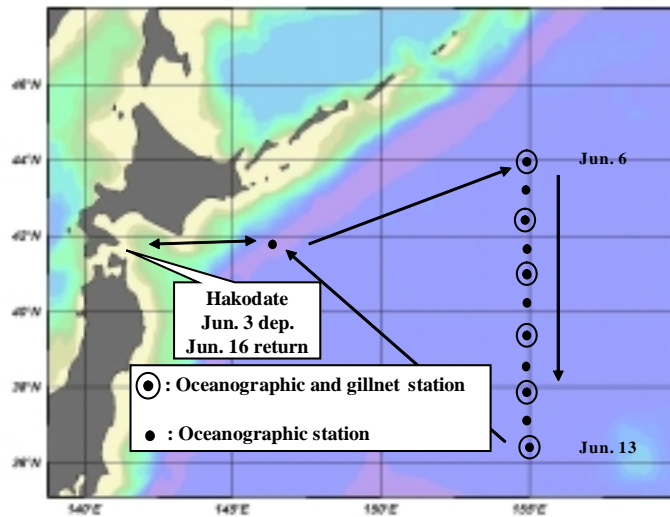


Fig 1-2 Cruise #136 (Jun. 3 – 16)

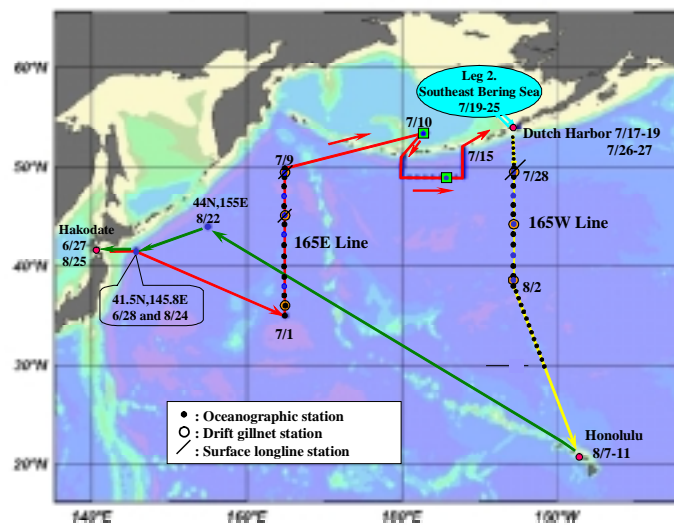
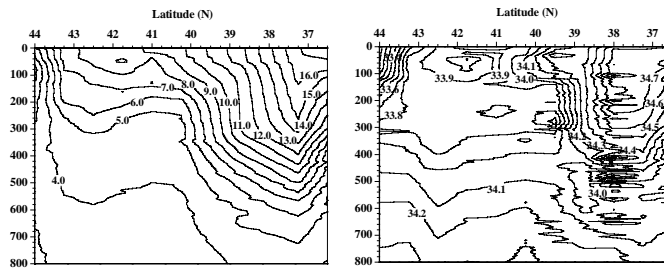


Fig. 1-3 Cruise #137 (June 27 – Aug 25)

Fig. 1 Cruise track and location of oceanographic, drift gillnet, and surface longline stations during each cruise

Cruise #135:155° E, May



Cruise #136:155° E, June

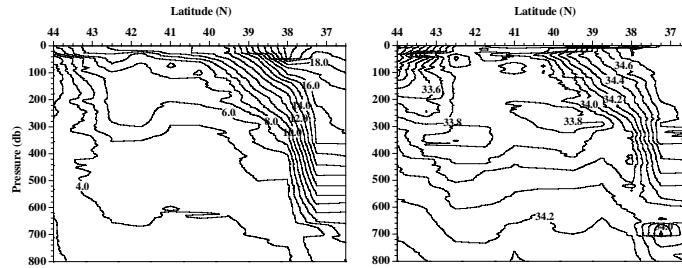
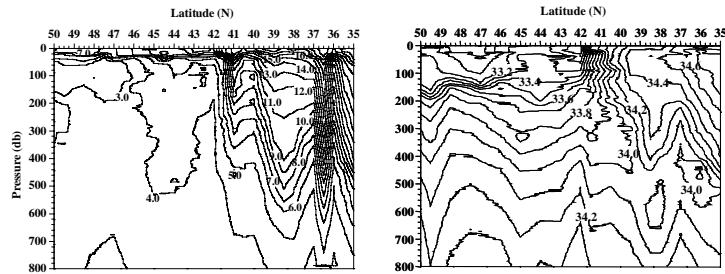


Fig.2-1 Temperature and salinity from surface to 800db pressure along the 155° E transect in the Oshoro maru Cruise #135 and #136, 2003.

Cruise #137:165° E, early July



Cruise #137:165° W, late July

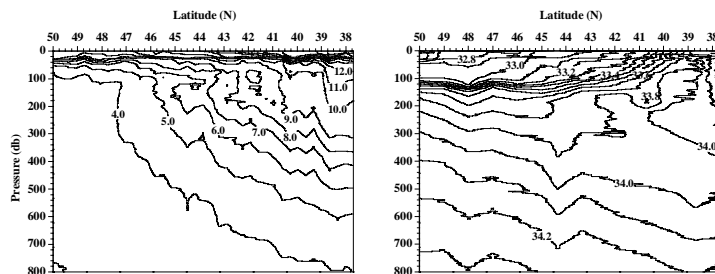


Fig.2-2 Temperature and salinity from surface to 800db pressure along the 165° E and 165° W transect in the Oshoro maru Cruise #137, 2003.

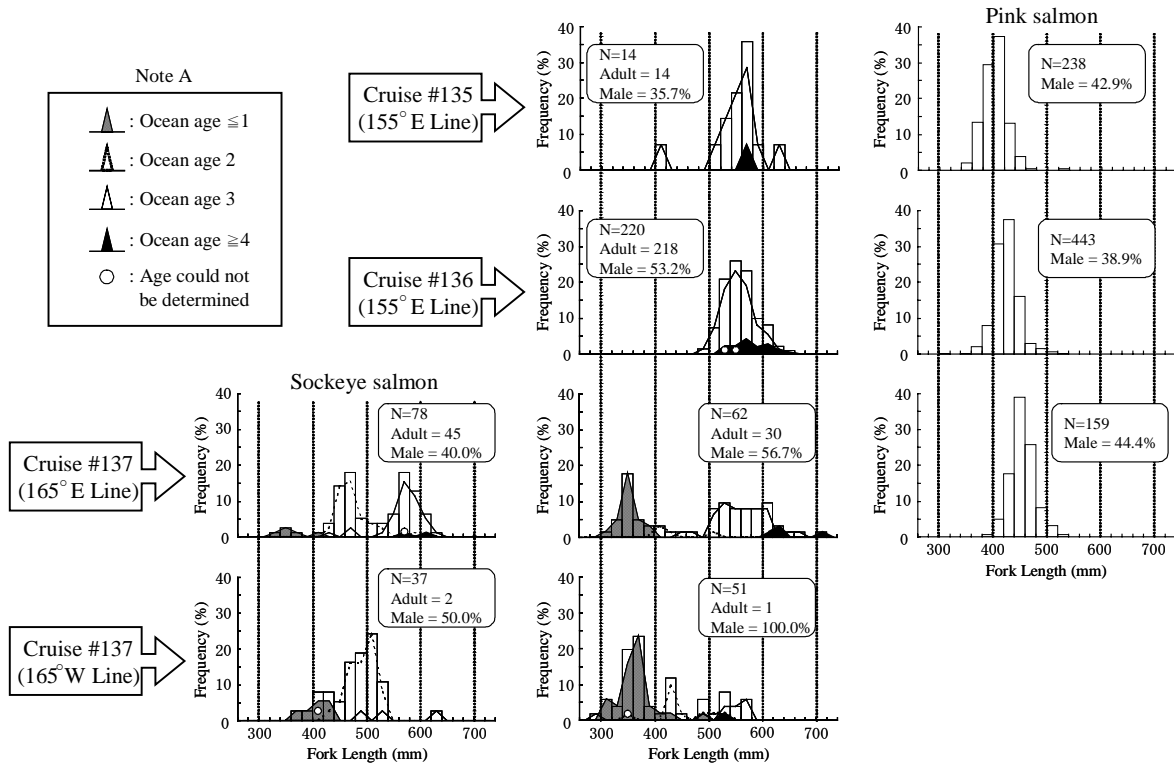


Fig. 3 Fork length frequency and male ratio of sockeye, chum, and pink salmon caught by C-gear gillnet at each longitude line in the Oshoro Maru Cruise #135, #136, and #137.

Line graph corresponds to fork length frequency by three ocean age stages (see note A). Male ratio is calculated only from adult fish samples.

Table 1. List of oceanographic stations along the 155° E , 165° E and 165° W

Cruise #135						
Station	Lat.	Long.	Date	S.M.T. *1	T.D. *2	Remark
OS03059	44-01.0N	155-01.0E	5/13	1920	+10	CTD
OS03060	43-15.1N	155-00.0E	5/15	1026	+10	CTD
OS03061	42-30.1N	154-59.9E	5/15	1540	+10	CTD
OS03062	41-45.1N	154-59.9E	5/16	1003	+10	CTD
OS03063	41-00.3N	155-00.1E	5/16	1738	+10	CTD
OS03064	40-14.5N	155-00.1E	5/17	0700	+10	XCTD
OS03065	39-29.0N	155-02.0E	5/17	1840	+10	CTD
OS03066	38-45.1N	155-00.0E	5/18	0937	+10	CTD
OS03067	38-03.3N	154-58.5E	5/18	1850	+10	CTD
OS03068	37-15.0N	154-59.9E	5/19	1153	+10	XCTD
OS03069	36-30.1N	155-00.1E	5/19	1825	+10	XCTD
Cruise #136						
Station	Lat.	Long.	Date	S.M.T. *1	T.D. *2	Remark
OS03079	44-00.0N	154-59.0E	6/6	2355	+10	CTD
OS03080	43-15.1N	154-59.8E	6/8	0940	+10	CTD
OS03081	42-30.1N	155-00.0E	6/8	1519	+10	CTD
OS03082	41-45.1N	155-00.0E	6/9	0943	+10	CTD
OS03083	41-00.0N	155-00.0E	6/9	1444	+10	CTD
OS03084	40-15.1N	154-59.9E	6/10	0915	+10	CTD
OS03085	39-29.9N	155-00.0E	6/10	1405	+10	CTD
OS03086	38-45.1N	155-00.1E	6/11	0817	+10	CTD
OS03087	38-00.2N	155-00.4E	6/11	1341	+10	CTD
OS03088	37-15.2N	155-00.2E	6/12	1025	+10	CTD
OS03089	36-30.2N	154-59.8E	6/12	0641	+10	CTD
*1: S.M.T.= Ship's Mean Time						
*2: T.D.= Time Difference between G.M.T. and Ship Time						

Table 2 Position and research conditions of drift gillnet at each station in the *Oshoro maru* Cruise #135, #136, and #137

Cruise #135												
Station	Date and Time (S.M.T.)		T.D.	Set position		D.S.	Bottom depth (m)	Wr	Wind (Force)	Oceanographic Station No.		
	Net set	Net haul		Lat.(N)	Long.(E)							
OSG 0301	May 14	15:48-16:13	May 15	04:30-05:35	+10:00	44-00.7	155-00.6	030	5310	o	SSE -5	OS 03059
OSG 0302	15	18:00-18:26	16	04:26-05:37	+10:00	42-32.4	155-00.9	060	5161	o	SW -4	OS 03061
OSG 0303	17	18:00-18:30	18	04:35-05:58	+10:00	39-31.0	154-59.9	160	5625	o	NW -4	OS 03065
OSG 0304	18	18:00-18:25	19	04:35-05:48	+10:00	38-00.7	154-59.7	300	5900	r	East -5	OS 03067
Cruise #136												
Station	Date and Time (S.M.T.)		T.D.	Set position		D.S.	Bottom depth (m)	Wr	Wind (Force)	Oceanographic Station No.		
	Net set	Net haul		Lat.(N)	Long.(E)							
OSG 0305	June 7	17:47-18:14	June 8	04:24-05:40	+10:00	44-00.3	154-59.2	220	5294	r	West -2	OS 03079
OSG 0306	8	17:50-18:12	9	04:30-05:35	+10:00	42-29.8	154-59.7	250	5220	o	ENE -4	OS 03081
OSG 0307	9	17:48-18:12	10	04:30-05:25	+10:00	40-59.7	154-59.4	240	5476	o	NE -5	OS 03083
OSG 0308	10	17:50-18:15	11	04:25-05:18	+10:00	39-28.9	154-59.5	225	5616	c	North-3	OS 03085
OSG 0309	11	17:52-18:21	12	04:25-05:48	+10:00	37-59.8	155-00.5	100	5079	bc	SSE -3	OS 03087
OSG 0310	12	17:50-18:20	13	04:27-05:24	+10:00	36-30.3	154-59.8	325	5690	bc	SE -2	OS 03089
Cruise #137												
Station	Date and Time (S.M.T.)		T.D.	Set position		D.S.	Bottom depth (m)	Wr	Wind (Force)	Oceanographic Station No.		
	Net set	Net haul		Lat.	Long.							
OSG 0311	July 2	17:49-18:13	July 3	05:07-06:20	+11:00	35-59.8N	164-59.9E	070	5508	c	SSE -2	OS 03094
OSG 0312	6	17:53-18:17	7	05:07-06:20	+11:00	44-58.3N	164-58.8E	230	5905	f	NE -3	OS 03112
OSG 0313	8	17:49-18:12	9	04:57-05:58	+11:00	49-30.1N	164-59.8E	205	5510	o	NNW-3	OS 03121
OSG 0314	28	17:54-18:16	29	05:00-05:53	-11:00	50-00.3N	165-00.1W	060	5015	o	SW -5	OS 03182
OSG 0315	30	17:50-18:13	31	04:50-05:59	-11:00	44-30.0N	165-00.0W	300	5460	f	East -3	OS 03199
OSG 0316	Aug. 1	17:46-18:13	Aug. 2	05:07-06:30	-11:00	39-00.5N	165-00.1W	340	5420	bc	SE -4	OS 03216

T.D. : Time Difference between G.M.T. and S.M.T. D.S. : Direction in which net was set
 Wr. : Weather (b: 0-25% clouded, bc: 25-75% clouded, c: over 75%-99% clouded, o:100% clouded, f: fog, r: rain)

Table 3 Gillnet configurations used in the *Oshoro maru* Cruise #135, #136, and #137.

Station	Number of tan for each mesh size (mm)																				Total	
	A-Gear				C-Gear										F-Gear							
	112	115	118	121	48	55	63	72	82	93	106	121	138	157	19	22	25	29	33	37		42
OSG 0301	6	-	6	-	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0302	6	-	6	-	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0303	6	-	6	-	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0304	6	-	6	-	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0305	6	-	6	-	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0306	6	-	6	-	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0307	6	-	6	-	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0308	6	-	6	-	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0309	6	-	6	-	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0310	6	-	5	-	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	48
OSG 0311	-	6	-	6	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0312	-	6	-	6	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0313	-	6	-	6	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0314	-	6	-	6	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0315	-	6	-	6	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49
OSG 0316	-	6	-	6	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	49

Table 4 List of surface longline station during the *Oshoro maru* Cruise #137

Station	Date and Time (S.M.T.)		Set Position		D.S.	No. of hooks	Wr	Wind (Force)	Oceanographic Station No.	Gillnet Station No.
	Line set	Line haul	Lat.	Long.						
OSSL 0301	July 7 04:21-04:40	July 7 06:55-07:15	44-57.0N	164-54.8E	030	340	r	NE -3	OS 03112	OSG 0312
OSSL 0302	9 04:23-04:43	9 06:37-07:01	49-25.5N	164-56.1E	025	340	o	calm	OS 03121	OSG 0313
OSSL 0303	29 04:28-04:47	29 06:26-06:48	50-00.6N	164-53.7W	260	340	o	SSW -4	OS 03182	OSG 0314

D.S. : Direction of Set toward Wr. : Weather (o: 100% clouded, r: rain)

Table 5-(1) Data on number of organisms caught by drift gillnet during the *Oshoro maru* Cruise # 135

Common name	Scientific name	OSG 0301				OSG 0302				OSG 0303				OSG 0304							
		Gear				Total	Gear				Total	Gear				Total					
		A	C	(%)	F		A	C	(%)	F		A	C	(%)	F		A	C	(%)	F	
Sockeye salmon	<i>Oncorhynchus nerka</i>	0	0	-	0	0	0	-	0	0	0	-	0	0	0	-	0	0	0		
Chum salmon	<i>Oncorhynchus keta</i>	2	2	(2.4)	0	4	1	0	-	0	1	27	12	(10.4)	0	39	0	0	-	0	0
Pink salmon	<i>Oncorhynchus gorbuscha</i>	9	79	(96.3)	0	88	6	190	(97.4)	0	196	1	18	(15.7)	0	19	0	0	-	0	0
Coho salmon	<i>Oncorhynchus kisutch</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Steelhead	<i>Oncorhynchus mykiss</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Boreal clubhook squid	<i>Onychoteuthis borealijaponicus</i>	0	0	-	0	0	0	5	(2.6)	0	5	0	0	-	30	30	0	1	(0.8)	2	3
Eight-armed squid	<i>Gonatopsis borealis</i>	0	1	(1.2)	1	2	0	0	-	0	0	0	0	-	9	9	0	0	-	0	0
Neon flying squid	<i>Ommastrephes bartramii</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	24	34	(28.8)	0	58
Blue shark	<i>Prionace glauca</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	5	4	(3.4)	0	9
Japanese pilchard	<i>Sardinops melanostictus</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	50	50	0	0	-	0	0
Japanese anchovy	<i>Engraulis japonicus</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	7870	7870	0	0	-	2	2
Pacific saury	<i>Cololabis saira</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	24	24	0	0	-	4	4
Barracudas	Sphyraenidae	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	4	4
Dolphin	<i>Coryphaena hippurus</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	1	0	-	0	1
Pacific pomfret	<i>Brama japonica</i>	0	0	-	0	0	0	0	-	0	0	36	85	(73.9)	4	125	21	79	(66.9)	0	100
Sooty shearwater	<i>Puffinus griseus</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	3	3	0	0	-	0	0

(%) indicates % of total numeric catch by C-gear gillnet in each station.

Table 5-(2) Data on number of organisms caught by drift gillnet during the *Oshoro maru* Cruise # 136

Common name	Scientific name	OSG 0305				Total	OSG 0306				Total	OSG 0307				Total					
		Gear					Gear					Gear									
		A	C	(%)	F	A	C	(%)	F	A	C	(%)	F								
Sockeye salmon	<i>Oncorhynchus nerka</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Chum salmon	<i>Oncorhynchus keta</i>	98	130	(27.5)	0	228	104	77	(29.4)	0	181	29	13	(7.1)	0	42					
Pink salmon	<i>Oncorhynchus gorbuscha</i>	58	336	(71.2)	0	394	16	145	(55.3)	1	162	9	100	(54.9)	0	109					
Coho salmon	<i>Oncorhynchus kisutch</i>	1	0	-	0	1	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Steelhead	<i>Oncorhynchus mykiss</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Boreal clubhook squid	<i>Onychoteuthis borealijaponicus</i>	0	1	(0.2)	0	1	0	16	(6.1)	0	16	0	4	(2.2)	0	4					
Eight-armed squid	<i>Gonatopsis borealis</i>	0	3	(0.6)	1	4	0	0	-	0	0	0	1	(0.5)	0	1					
Japanese common squid	<i>Todarodes pacificus</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Neon flying squid	<i>Ommastrephes bartramii</i>	0	0	-	0	0	0	0	-	0	0	0	1	(0.5)	0	1					
Blue shark	<i>Prionace glauca</i>	0	0	-	0	0	0	0	-	0	0	1	0	-	0	1					
Shortfin mako	<i>Isurus oxyrinchus</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Japanese anchovy	<i>Engraulis japonicus</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	33	33					
Lanternfishes	Myctophidae	0	0	-	2	2	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Longnose lancetfish	<i>Alepisaurus ferox</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Pacific saury	<i>Cololabis saira</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Flyingfishes	Exocoetidae	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Dolphin	<i>Coryphaena hippurus</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Pacific pomfret	<i>Brama japonica</i>	0	0	-	0	0	7	20	(7.6)	0	27	31	63	(34.6)	1	95					
Pacific mackerel	<i>Scomber japonicus</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Skipjack tuna	<i>Katsuwonus pelamis</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Albacore	<i>Thunnus alalunga</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Short-tailed shearwater	<i>Puffinus tenuirostris</i>	0	1	(0.2)	0	1	0	3	(1.1)	0	3	1	0	-	0	1					
Leach's storm petrel	<i>Oceanodroma leucorhoa</i>	0	1	(0.2)	0	1	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Horned puffin	<i>Fratercula corniculata</i>	0	0	-	0	0	0	1	(0.4)	0	1	0	0	-	0	0	0	0	-	0	0

(%) indicates % of total numeric catch by C-gear gillnet in each station.

Table 5-(2) Continued.

Station		OSG 0308					OSG 0309					OSG 0310				
Common name	Scientific name	Gear				Total	Gear				Total	Gear				Total
		A	C	(%)	F		A	C	(%)	F		A	C	(%)	F	
Sockeye salmon	<i>Oncorhynchus nerka</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Chum salmon	<i>Oncorhynchus keta</i>	1	0	-	0	1	0	0	-	0	0	0	0	-	0	0
Pink salmon	<i>Oncorhynchus gorbuscha</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Coho salmon	<i>Oncorhynchus kisutch</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Steelhead	<i>Oncorhynchus mykiss</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Boreal clubhook squid	<i>Onychoteuthis borealijaponicus</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Eight-armed squid	<i>Gonatopsis borealis</i>	0	3	(75.0)	0	3	0	0	-	0	0	0	0	-	0	0
Japanese common squid	<i>Todarodes pacificus</i>	0	0	-	1	1	0	0	-	0	0	0	0	-	0	0
Neon flying squid	<i>Ommastrephes bartramii</i>	0	0	-	0	0	0	101	(53.7)	54	155	0	76	(58.9)	4	80
Blue shark	<i>Prionace glauca</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Shortfin mako	<i>Isurus oxyrinchus</i>	0	0	-	0	0	0	0	-	0	0	1	2	(1.6)	0	3
Japanese anchovy	<i>Engraulis japonicus</i>	0	0	-	24	24	0	0	-	0	0	0	0	-	0	0
Lanternfishes	Myctophidae	0	0	-	21	21	0	0	-	0	0	0	0	-	0	0
Longnose lancetfish	<i>Alepisaurus ferox</i>	0	0	-	1	1	0	0	-	0	0	0	0	-	0	0
Pacific saury	<i>Cololabis saira</i>	0	0	-	1	1	0	0	-	0	0	0	0	-	0	0
Flyingfishes	Exocoetidae	0	0	-	0	0	0	77	(41.0)	17	94	0	47	(36.4)	23	70
Dolphin	<i>Coryphaena hippurus</i>	0	0	-	0	0	0	2	(1.1)	0	2	0	0	-	0	0
Pacific pomfret	<i>Brama japonica</i>	1	1	(25.0)	0	2	1	7	(3.7)	0	8	0	1	(0.8)	0	1
Pacific mackerel	<i>Scomber japonicus</i>	0	0	-	0	0	0	0	-	0	0	0	1	(0.8)	0	1
Skipjack tuna	<i>Katsuwonus pelamis</i>	0	0	-	0	0	0	1	(0.5)	0	1	2	0	-	0	2
Albacore	<i>Thunnus alalunga</i>	0	0	-	0	0	0	0	-	0	0	0	2	(1.6)	0	2
Short-tailed shearwater	<i>Puffinus tenuirostris</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Leach's storm petrel	<i>Oceanodroma leucorhoa</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Horned puffin	<i>Fratercula corniculata</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0

(%) indicates % of total numeric catch by C-gear gillnet in each station.

Table 5-(3) Data on number of organisms caught by drift gillnet during the *Oshoro maru* Cruise # 137

Station		OSG 0311					OSG 0312					OSG 0313				
Common name	Scientific name	Gear				Total	Gear				Total	Gear				Total
		A	C	(%)	F		A	C	(%)	F		A	C	(%)	F	
Sockeye salmon	<i>Oncorhynchus nerka</i>	0	0	-	0	0	0	0	-	0	0	43	76	(45.2)	2	121
Chum salmon	<i>Oncorhynchus keta</i>	0	0	-	0	0	9	15	(5.3)	0	24	42	47	(28.0)	0	89
Pink salmon	<i>Oncorhynchus gorbuscha</i>	0	0	-	0	0	41	142	(49.8)	0	183	14	25	(14.9)	0	39
Coho salmon	<i>Oncorhynchus kisutch</i>	0	0	-	0	0	29	25	(8.8)	0	54	1	3	(1.8)	0	4
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	0	0	-	0	0	1	2	(0.7)	0	3	1	0	-	0	1
Steelhead	<i>Oncorhynchus mykiss</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Boreal clubhook squid	<i>Onychoteuthis borealijaponicus</i>	0	0	-	9	9	10	20	(7.0)	0	30	0	0	-	0	0
Eight-armed squid	<i>Gonatopsis borealis</i>	0	0	-	0	0	0	3	(1.1)	1	4	0	17	(10.1)	6	23
Neon flying squid	<i>Ommastrephes bartramii</i>	1	7	(11.5)	6	14	0	0	-	0	0	0	0	-	0	0
Luminous flying squid	<i>Eucleoteuthis luminosa</i>	0	0	-	2	2	0	0	-	0	0	0	0	-	0	0
Blue shark	<i>Prionace glauca</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Cookiecutter shark	<i>Isistius brasiliensis</i>	2	5	(8.2)	0	7	0	0	-	0	0	0	0	-	0	0
Paperbones	Notosudidae	0	0	-	0	0	0	0	-	0	0	0	0	-	3	3
Lanternfishes	Myctophidae	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Daggertooth	<i>Anotopterus pharao</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	1	1
Pacific saury	<i>Cololabis saira</i>	0	0	-	0	0	0	56	(19.6)	1749	1805	0	0	-	0	0
Flyingfishes	Exocoetidae	0	5	(8.2)	10	15	0	0	-	0	0	0	0	-	0	0
Sticklebacks	Gasterosteidae	0	0	-	0	0	0	0	-	0	0	0	0	-	1	1
Barracudas	Sphyrnidae	0	0	-	1	1	0	0	-	0	0	0	0	-	0	0
Pilotfish	<i>Naucrates ductor</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Pacific pomfret	<i>Brama japonica</i>	0	1	(1.6)	0	1	9	22	(7.7)	0	31	0	0	-	0	0
Remoras	Echeneidae	0	2	(3.3)	0	2	0	0	-	0	0	0	0	-	0	0
Shortbill spearfish	<i>Tetrapturus angustirostris</i>	0	1	(1.6)	0	1	0	0	-	0	0	0	0	-	0	0
Bullet mackerel	<i>Auxis rochei</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Skipjack tuna	<i>Katsuwonus pelamis</i>	31	38	(62.3)	3	72	0	0	-	0	0	0	0	-	0	0
Albacore	<i>Thunnus alalunga</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Snake mackerels	Gempylidae	0	2	(3.3)	0	2	0	0	-	0	0	0	0	-	0	0
Japanese butterflyfish	<i>Hyperoglyphe japonica</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Ocean sunfish	<i>Mola mola</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0
Sooty shearwater	<i>Puffinus griseus</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0

(%) indicates % of total numeric catch by C-gear gillnet in each station.

Table 5-(3) Continued.

Common name	Scientific name	OSG 0314					OSG 0315					OSG 0316					
		Gear				Total	Gear				Total	Gear				Total	
		A	C	(%)	F		A	C	(%)	F		A	C	(%)	F		
Sockeye salmon	<i>Oncorhynchus nerka</i>	18	36	(32.1)	0	54	0	0	-	0	0	0	0	0	-	0	0
Chum salmon	<i>Oncorhynchus keta</i>	12	53	(47.3)	0	65	0	0	-	0	0	0	0	0	-	0	0
Pink salmon	<i>Oncorhynchus gorbuscha</i>	0	0	-	0	0	0	0	-	0	0	0	0	0	-	0	0
Coho salmon	<i>Oncorhynchus kisutch</i>	5	8	(7.1)	0	13	0	0	-	0	0	0	0	0	-	0	0
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	0	2	(1.8)	0	2	0	0	-	0	0	0	0	0	-	0	0
Steelhead	<i>Oncorhynchus mykiss</i>	3	6	(5.4)	0	9	0	0	-	0	0	0	0	0	-	0	0
Boreal clubhook squid	<i>Onychoteuthis borealijaponicus</i>	0	0	-	0	0	1	81	(77.1)	0	82	0	0	-	0	0	0
Eight-armed squid	<i>Gonatopsis borealis</i>	0	3	(2.7)	12	15	0	0	-	0	0	0	0	-	0	0	0
Neon flying squid	<i>Ommastrephes bartramii</i>	0	0	-	0	0	4	12	(11.4)	0	16	1	175	(92.6)	25	201	
Luminous flying squid	<i>Eucleoteuthis luminosa</i>	0	0	-	0	0	0	0	-	0	0	0	1	(0.5)	0	1	
Blue shark	<i>Prionace glauca</i>	0	0	-	0	0	0	0	-	0	0	0	2	(1.1)	0	2	
Cookiecutter shark	<i>Isistius brasiliensis</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	
Paperbones	Notosudidae	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	
Lanternfishes	Myctophidae	0	0	-	0	0	0	0	-	1	1	0	0	-	0	0	
Daggertooth	<i>Anotoperus pharao</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	
Pacific saury	<i>Cololabis saira</i>	0	4	(3.6)	9	13	0	0	-	1450	1450	0	0	-	825	825	
Flyingfishes	Exocoetidae	0	0	-	0	0	0	0	-	0	0	0	1	(0.5)	0	1	
Sticklebacks	Gasterosteidae	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	
Barracudas	Sphyraenidae	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	
Pilotfish	<i>Naucrates ductor</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	1	1	
Pacific pomfret	<i>Brama japonica</i>	0	0	-	0	0	4	3	(2.9)	0	7	1	1	(0.5)	0	2	
Remoras	Echeneididae	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	
Shortbill spearfish	<i>Tetrapturus angustirostris</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	
Bullet mackerel	<i>Auxis rochei</i>	0	0	-	0	0	0	0	-	0	0	1	7	(3.7)	0	8	
Skipjack tuna	<i>Katsuwonus pelamis</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	
Albacore	<i>Thunnus alalunga</i>	0	0	-	0	0	0	8	(7.6)	0	8	1	1	(0.5)	0	2	
Snake mackerels	Gempylidae	0	0	-	0	0	0	0	-	0	0	0	0	-	0	0	
Japanese butterfish	<i>Hyperoglyphe japonica</i>	0	0	-	0	0	0	0	-	0	0	0	1	(0.5)	0	1	
Ocean sunfish	<i>Mola mola</i>	0	0	-	0	0	0	0	-	0	0	0	0	-	1	1	
Sooty shearwater	<i>Puffinus griseus</i>	0	0	-	0	0	0	1	(1.0)	0	1	0	0	-	0	0	

(%) indicates % of total numeric catch by C-gear gillnet in each station.

Table 6. Data on tagged salmonids caught by surface longline during the *Oshoro maru* Cruise #137

Station	Species	F.L. (mm)	Tag No.	
			FAJ	FRI
OSSL 0301	Pink	472	AA1301	LL4701
	Coho	562	AA1302	LL4702
	Coho	563	AA1303	LL4703
OSSL 0303	Chum	386	AA1304	LL4704
	Chum	474	AA1305	LL4705

Station: Details are shown in Table 4.

F.L.: Fork Length

FAJ: Petersen tag designed by Fisheries Agency, Japan

FRI: Petersen tag designed by Fisheries Research Institute, U.S.A.

Table 7. Data on salmonids lacking an adipose fin in the *Oshoro maru* Cruise #135, #136, and :

Station	Species	Fork Length (mm)	Body Weight (g)	Sex	Gonad Weight (g)	Age
OSG 0314	Steelhead	621	2780	M	52	1 1
OSG 0314	Steelhead	641	3000	F	32	1 1
OSG 0314	Steelhead	616	2760	M	15	X 1
OSG 0314	Steelhead	659	3050	M	7	1 1

Station: Details are shown in Table 2.

Sex - "F": Female Sex - "M": Male

Age: Designation according to Gillbert-Rich's formula