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# Results of 2012 Salmon Research by the *Oshoro maru*

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## Abstract

In order to accumulate oceanographic and biological data (including salmonids) and to clarify the oceanic structure and marine ecosystem, the T/V *Oshoro maru* conducted oceanographic observations and fishing surveys in the western North Pacific (along the 155°E longitude line) and eastern North Pacific (along the 150°W longitude line). The survey was conducted during the Cruise #242 in May, and the Cruise #243-Leg2 July 2012.

Nine oceanographic observations and three drift gillnet surveys were conducted along the 155°E during the Cruise #242 in May. The Polar Front was observed in the vicinity of 43°N. The Subarctic Boundary observed in surface (0-100 db) at nearby 39°-30'N. Pink salmon was dominant species at 43°-16.0'N and 42°-57.4'N. Chum salmon was collected at 43°-16.0'N and 42°-57.4'N. A few salmon were caught at 39°-25.2'N. The fork lengths (F.L.) of chum salmon collected by C-gear gillnet ranged between 420-640 mm, and those of pink salmon ranged between 300-510 mm, 86.9% of chum salmon were adult fish. A total of 64 Chum and 690 Pink salmon were collected.

Seven oceanographic observations and three drift gillnet surveys were conducted along the 150°W during the Cruise #243-Leg2 in July. Seasonal thermal stratification observed until 100 db, thereunder Alaskan gyre were observed in the vicinity of 51°N. At 42°-49.9'N, no salmon collected, but at other two stations total of 14 Sockeye, 38 Chum, four Pink, 10 Coho salmon and one Steelhead were collected by C-gear gillnet. F.L. of Chum salmon ranged between 360-550 mm, 5.3% of chum salmon were adult fish. F.L. of Coho salmon ranged between 490-660 mm, and all Coho salmon were adult fish. F.L. of Sockeye salmon ranged between 330-600 mm, 21.4% of Sockeye salmon were adult fish.

To collect salmon samples extensively and to collect fresh salmon blood and various tissues, two surface long-line and three hook-and-line gear samplings were conducted during the Cruise #242 and #243-Leg2.

## INTRODUCTION

The *Oshoro maru* has continued to study the oceanic structure and marine biology in the North Pacific Ocean and Bering Sea (infrequently in the Chukchi Sea) every summer since 1953. Collected data has been published annually since 1957 (Hokkaido University, 1957-2012).

Salmon researches were conducted during two cruises in May 2012: the Cruise #242 in the western North Pacific and in July 2012: the Cruise #243-Leg2 in eastern North Pacific.

Primary salmon research objects during two cruises were

1. To collect oceanographic and biological data continuously along 155°E longitude line in May and along 150W longitude line in July.
2. To collect salmon samples as extensively as possible during the cruises periods in order to study their food habits, growth and stock identification etc. .

This document reports the preliminary results about those researches during the cruises.

## MATERIAL AND METHODS

### *Survey Area and Cruise Schedule*

The *Oshoro maru* (1,792 gross ton) departed Hakodate on May 10, 2012 and started the Cruise #242. Oceanographic observations, gillnet surveys, surface long-line and hook-and-line samplings were conducted along the 155°E longitude between 43°-16'N and 39°-25'N latitude from May 14 to 18, and returned to Hakodate on May 23. The Cruise #243 was started on June 8 when she left Hakodate. But no salmon research activity was conducted during the Cruise #243-Leg1 and Leg3. The Cruise #243-Leg2 was started on July 2 when she left Dutch Harbor. Salmon research activities were conducted from July 11 to July 16. Oceanographic observations, gillnet surveys, and hook-and-line samplings were conducted along the 150°W longitude from 42°-50'N to 51°-17N latitude. [Fig.1-(1), (2), Table 1].

### *Oceanographic observation*

Nine oceanographic observations were conducted at least 45 nautical miles intervals from 44°N to 38°-45'N along the 155°E, in May. Seven oceanographic observations were conducted along the 150°W from 42°-50'N to 50°-01'N in July. [Fig.1-(1), (2), Table 1]. The temperature and salinity data at each station were collected by using CTD or XCTD. Temperature and salinity data from surface to 500 db pressure along the 155°E and 150°W were used to plot temperature and salinity sections about each transect [Fig.2-(1), (2)].

### Drift Gillnet Research

A drift gillnet was used to collect salmonids and the other organisms at each three stations along the 155°E in May and along the 150°W in July [Figs.1-(1), (2), Table 1]. The gillnet configuration at each station is as follows:

Stations	net	A-Gear				C-gear										F-Gear						Total	
	Mesh size (mm)	112	115	118	121	48	55	63	72	82	93	106	121	138	157	19	22	25	29	33	37		42
OSG1201-02	Number of tan	3	3	3	3	3	3	3	6	5	5	3	3	3	3	-	-	-	-	-	-	-	49
OSG1203		3	3	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-	-	-	-	0.5	42.5
OSG1204		4	6	3	6	3	3	3	3	3	3	3	3	3	3	-	-	-	-	-	-	-	49
OSG1205-06		1	6	3	9	3	3	3	3	3	3	3	3	3	3	-	-	-	-	-	-	-	49

The net was total 49 tans except for one station (OSG1203) which comprised of 30 or 37 tans of C-Gear gillnet (non-selective varied research mesh, Takagi, 1975), and 12 or 19 tans of A-Gear gillnet (commercial mesh). This year not using F-Gear gillnet (special mesh). Each tan was 50 m long. Gillnet gear was set in the evening, allowed to soak overnight, and retrieved the following morning. The catch was sorted and counted by mesh size and species. The Catch per Unit Effort (CPUE) values of C-Gear gillnet by species at each station were calculated as catch number per one tan of C-Gear gillnet.

Details about each gillnet operation are shown in Table 2.

### Surface Long-line Research

Two surface long-line researches were conducted to collect salmonids in the western North Pacific during the Cruise #242 and three times in the eastern North Pacific during the Cruise #243-Leg2 [Fig.1-(1), Table 1].

The long-line consisted of 20 baskets (hachi). One basket was 110.68 m long with 49 hooks baited with Japanese common squid (*Todarodes pacificus*). The catch was sorted by species and counted.

Details about each surface long-line operation are shown in Table 3.

### Hook-and-Line Sampling

To collect fresh salmon blood and various tissues, hook-and-line gears were used at seven research stations during the Cruise #242 and #243-Leg2 [Fig.1-(1), (2), Table 1].

Three to ten anglers were engage in the work. Those samplings were conducted mainly around the same time that oceanographic observation was operating. The catch was sorted by species and counted.

### Fish Examination

The Catch was processed soon after removal from the fishing gear. Biological data were recorded per each sampling gear at every station. Biological data for salmonids consisted of F.L. (mm), body weight (g), sex and gonad weight (g). Scale samples were collected from the International North Pacific Fisheries Commission (INPFC) preferred body area (Davis et al., 1990) and placed on gummed cards for verification of species

identification, and for age, growth and stock origin studies.

Additional research activities included collection of salmonids stomachs, muscle and fin tissues, blood samples and egg samples for studies of food habits, growth, stock identification and female-specific serum proteins.

Chum salmon (*Oncorhynchus keta*) was classified as mature or immature based on their gonad weight (Takagi, 1961).

Body length and body weight were determined for non-salmonid fish, squid, and other organisms up to a maximum of 30 per species by mesh size. A few were frozen for taxonomic and ecological studies.

## RESULTS AND DISCUSSION

Details of oceanographic data and biological data collected during the cruises will publish in the “*DATA RECORDE OF OCEANOGRAPHIC OBSERVATIONS AND EXPLORATORY FISHING NO.56*” by Hokkaido University in 2013.

*Along the 155°E Longitude Line: during the Cruise #242 in May 2012*

### *Oceanographic Conditions*

Temperature and salinity sections (0-500db) along the 155°E transect are shown in Figure 2-(1).

The geographic positions of the Polar Front, the Transition Domain and the Subarctic Boundary along the 155°E transect (Dodimead et al., 1963, Favorite et al., 1976, Roden, 1991) were observed following locations.

The Polar Front which is indicated by the vertical 4°C isotherm at 100 db was observed in the vicinity of 43°N clearly. The Subarctic Boundary indicated by the vertical 34.0 psu isohaline was observed at 39°-30°N.

### *Distribution and Abundance of Organisms Caught by Drift Gillnet*

The numbers of organisms caught by drift gillnet and the CPUE values of C-gear gillnet at each station along the 155°E are shown in Table 4.

Three drift gillnet surveys were conducted along the 155°E during the cruise #242 in May 2012 [Fig.1-(1), Tables 1, 2]. A total of 64 chum salmon, 690 pink salmon (*Oncorhynchus gorbuscha*) were collected at 43°-16.0'N (OSG1201), 42°-57.4'N (OSG1202) and 39°-25.2'N (OSG1203). The C-gear's CPUE value of chum salmon was clearly higher at 42°-57.4'N, and that of pink salmon was higher 42°-57.4'N, too. Non-salmonid fishes caught by C-gear gillnet were shown in Table 4. Boreal clubhook squid (*Onychoteuthis borealijaponicus*) (n=261) were abundant in the catch. In addition, 12 eight-armed squid (*Ommastrephes bartramii*), two spiny dogfish (*Squalus acanthias*), 23 pacific pomfret (*Brama japonica*) and one tufted puffin (*Fratercula cirrhata*).

### *Biological Characteristics of Salmonids*

F.L. frequency distributions of chum salmon and pink salmon caught by C-gear gillnet along the 155°E are shown in Fig.3-(a), (b).

A total of 64 chum salmon were collected by C-gear gillnet. Their F.L. ranged between 420-640 mm. Mean  $\pm$  SD of them was  $488.3 \pm 72.8$  mm, and median of them was 504.0 mm. Mature fish occupied 86.9%.

A total of 690 pink salmon were collected by C-gear gillnet. Their F.L. ranged between 290-510 mm. Mean  $\pm$  SD of them was  $391.4 \pm 32.5$  mm, and median was 390.0 mm.

### *Along the 150°W Longitude Line: during the Cruise #243-Leg2 in July 2012*

#### *Oceanographic Conditions*

Temperature and salinity sections (0-500db) along the 155°E transect are shown in Figure 2-(2).

Seasonal thermal stratification observed until 100db, thereunder Alaskan gyre were observed in the vicinity of 51°N.

#### *Distribution and Abundance of Organisms caught by Drift Gillnet*

The numbers of organisms caught by drift gillnet and the CPUE values of C-gear gillnet at each station along the 150°W are shown in Table 5.

Three drift gillnet surveys were conducted along the 150°W during the cruise #243-Leg2 in July 2012 [Fig. 1-(2), Tables 1, 2]. Four pink salmon were collected at 42°-49.9°N (OSG1206), and one steelhead at 46°-45.4°N(OSG1205). A total of 14 sockeye salmon, 38 chum salmon, 10 coho salmon were collected at 46°-45.4°N(OSG1205) and 51°-16.7°N(OSG1206). The most non-salmonids species caught by C-gear was flying squid (*Ommastrephes bartramii*) (n=36) and Pacific pomfret (*Brama japonica*) (n=44). Five boreal clubhook squid (*Onychoteuthis borealijaponicus*), three eight-armed squid (*Gonatopsis borealis*), nine blue shark (*Prionace glauca*), one salmon shark (*Lamna ditropis*) three yellowtail (*Seriola lalandi*), four albacore (*Thunnus alalunga*) and seven small eye squaretail (*Tetragonurus atlanticus*) were collected.

### *Biological Characteristics of Salmonids*

F.L. frequency distributions of chum, coho salmon and sockeye salmon caught by C-gear gillnet along the 150°W are shown in Fig.4-(a), (b), (c).

A total of 38 chum salmon were collected by C-gear gillnet. Their F.L. ranged between 360-550 mm. Mean  $\pm$  SD of them was  $449.8 \pm 94.8$  mm, and median of them was 429.0 mm. Mature fish occupied 5.3%.

A total of 10 coho salmon were collected by C-gear gillnet. Their F.L. ranged between 490-660 mm. Mean  $\pm$  SD of them was  $570.4 \pm 51.9$  mm, and median was 554.0 mm. Mature fish occupied 100%.

A total of 14 sockeye salmon were collected by C-gear gillnet. Their F.L. ranged between 330-600 mm. Mean  $\pm$  SD of them was  $446.3 \pm 79.1$  mm, and median was 446.0 mm. Mature fish occupied 21.4%.

#### *Surface Long-line Research and Hook-and-Line Samplings*

The catch number of salmonids at each station by hook-and-line gear and surface long-line is shown in Table 6.

A total of 19 chum, 624 pink salmon and one Steelhead were collected by hook-and-line gear and surface long-line at 155°E research line during the Cruise #242 (OSHL1201-03, OSSL1201 and 1202). A total of 20 Sockeye, seven Chum, 23 Pink, seven Coho salmon and 12 Steelhead were collected by hook-and-line gear and surface long-line at 150°W research line during the Cruise #243-Leg2 (OSHL1205-07, OSSL1203, 1204).

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### **REFERENCES**

- Davis, N. D., K. W. Myers, R. V. Walker, and C. Harris. 1990: The Fisheries Research Institute's high-seas salmonids tagging program and methodology for scale pattern analysis. *Am. Fish. Soc. Symp.*, 7: 863-879.
- Dodimead, A.J., F. Favorite, T. Hirano. 1963: Salmon of the North Pacific Ocean. Part II. Review of oceanography of the subarctic Pacific region. *Int. North Pacific Fish. Comm. Bull.* 13: 1-195.
- Favorite, F., A.J. Dodimead, K. Nasu. 1976: Oceanography of the Subarctic Pacific region. *Int. North Pacific Fish. Comm. Bull.* 33: 1-187.
- Hokkaido University. 1957-2010. *Data Record of Oceanographic and Exploratory Fishing Numbers 1-55 (1957-2012)*. Faculty of Fisheries, Hokkaido University, Hakodate, Japan.
- Meguro, T., Kajiwarra, Y., Takagi, S., Kamei, Y., Sakaoka, K., and Kimura J. 2004: Results of 2003 Salmon Research Cruise of the *Oshoro maru*. *NPAFC. Doc.* 748: 15p
- Roden, G.I. 1991: Subarctic-Subtropical Transition Zone of the North Pacific: Large-Scale Aspects and Mesoscale Structure. In *Biology Oceanography and Fisheries of the North Pacific Transition Zone and Subarctic Frontal Zone*, ed. by

- J.A. Wetherall, *NOAA Tech. Rep.*, 105:1-38.
- Takagi, K. 1975: A non-selective salmon gillnet for research operation. *Bull. Int. North Pacific. Fish. Comm.*, 32, 13-41.
- Takagi, K. 1961: The seasonal change of gonad weight of sockeye and chum salmon in the North Pacific Ocean, especially with reference to mature and immature fish. *Bull. Hokkaido Reg. Fish. Res. Lab.* 23, 17-34.



Table 1. List of salmon research stations, positions and date during the Oshoro maru Cruise #242 and #243-Leg2, 2012.

Station Name				Position		Date	
Oceanographic	Gillnet	Hook-and-Line	Surface longline	Latitude	Longitude	S.M.T.*1	T.D.*2
Cruise #242							
OS 12015				44-00.0N	154-59.7E	May 14	+10h
OS 12016	OSG 1201	OSHL 1201	OSSL1201	43-14.0N	155-02.3E	May 14-15	
OS 12017				42-30.6N	155-00.4E	May 15	
OS 12018	OSG 1202	OSHL 1202	OSSL1202	42-56.8N	155-00.8E	May 15-16	
OS 12019				41-45.4N	155-00.0E	May 16	
OS 12020				41-00.0N	155-00.0E	May 16	
OS 12021				40-15.3N	154-58.8E	May 17	
OS 12022	OSG 1203	OSHL 1003		39-26.3N	154-52.9E	May 17-18	
OS 12023				38-45.1N	155-00.5E	May 18	
Cruise #243 - Leg 2							
		OSHL 1004		47-28.6N	160-27.5W	Jul 6	-10h
OS 12102	OSG 1204		OSSL1203	42-50.1N	150-00.4W	July 11-12	
OS 12103				42-51.1N	149-59.0W	Jul 11	
OS 12104	OSG 1205	OSHL 1205	OSSL1204	46-45.0N	150-00.5W	Jul 13	
OS 12105		OSHL 1206		50-01.1N	149-59.5W	Jul 14	
OS 12106	OSG 1206	OSHL 1207		51-15.0N	150-00.1W	Jul 15	
OS 12107			OSSL1205	53-00.1N	150-02.2W	Jul 16	
OS 12108				54-59.9N	150-00.0W	Jul 17	

\*1 S.M.T. : Ship's Mean Time.

\*2 T.D. : Time Difference between Greenwich Mean Time (G.M.T.) and Ship's Mean Time (S.M.T.).

Table 2. Position and research conditions of surface drift gillnet sampling at each station during the Oshoro maru Cruise #242 and #243-Leg2, 2012.

Station	Date and Time (S.M.T.*1)				T.D.*2	Set Position		D.S.*3	Wr*4	Wind (Force)
	Net set		Net haul			Lat.	Long.			
Cruise #242										
OSG 1201	May 14	1900-1930	May 15	0450-0537	+10h	43-16.0N	155-00.1 E	160	o	NNW-5
OSG 1202	May 15	1756-1722	May 16	0452-0547	+10h	42-57.4N	155-01.0 E	340	bc	NNE-3
OSG 1203	May 17	1752-1814	May 18	0439-0518	+10h	39-25.2N	154-58.8 E	230	bc	WSW-4
Cruise #243 - Leg 2										
OSG 1204	July 11	1747-1814	July 12	0500-0554	-10h	42-49.9 N	149-59.7 W	090	o	WSW-4
OSG 1205	July 13	1750-1815	July 14	0500-0555	-10h	46-45.4 N	149-59.9 W	020	f	SSE-2
OSG 1206	July 15	1745-1810	July 16	0430-0520	-10h	51-16.7 N	150-01.9 W	090	c	West-2

\*1 S.M.T. : Ship's Mean Time

\*2 T.D. : Time Difference between Greenwich Mean Time (G.M.T.) and Ship's Mean Time(S.M.T.)

\*3 D.S. : Direction of net set

\*4 Wr : Weather (o: 100% clouded, d: drizzling rain, c: 75-99% clouded, f: fog).

Table 3. Position and research conditions of surface longline sampling at each station during the Oshoro maru Cruise #242 and #243-Leg 2 ,2012.

Station	Date and Time (S.M.T.*1)				T.D.*2	Set Position		D.S.*3	Number of baskets	Wr*4	Wind (Force)
	Line set		Line haul			Lat.	Long.				
Cruise #242											
OSSL 1201	May 15	0400-0418	May 15	0615-0715	+10h	43-10.6N	155-04.9E	325	10	o	NW-5
OSSL 1202	May 16	0400-0430	May16	0530-0720	+10h	42-58.1N	155-08.0E	315	19	bc	SSE-3
Cruise #243 - Leg 2											
OSSL 1203	July 12	0425-0445	July 12	0636-0703	-10h	42-51.1N	149-55.6W	200	10	d	SSW-3
OSSL 1204	July 14	0415-0435	July 14	0631-0710	-10h	46-49.2N	149-54.4W	190	15	f	SSW-4
OSSL 1205	July 16	1435-1513	July 16	1933-2042	-10h	52-59.2N	150-00.1W	045	25	o	SSE-2

\*1 S.M.T. : Ship's Mean Time

\*2 T.D. : Time Difference between Greenwich Mean Time (G.M.T.) and Ship's Mean Time (S.M.T.)

\*3 D.S. : Direction of line set

\*4 Wr : Weather (o: 100% clouded, f: fog)

Table 4. The number of organisms caught by drift gillnet along the 155°E during the Oshoro maru Cruise # 242, in May, 2012. CPUE and (%) indicate numerical catch per one tan and percentage of total catch by C-gear gillnet at each station.

Common name	Scientific name	Gear	OSG 1201			OSG 1202			OSG 1203					
			C		A	C		A	C		A	F	Total	
			CPUE (%)	Total	CPUE (%)	Total	CPUE (%)	Total	CPUE (%)	Total	CPUE (%)	Total		
Sockeye salmon	<i>Oncorhynchus nerka</i>		0	0	0	0	0	0	0	0	0	0	0	0
Chum salmon	<i>Oncorhynchus keta</i>		11	26	37	51	34	85	2	7	9	2	7	9
Pink salmon	<i>Oncorhynchus gorbuscha</i>		187	4	191	501	1	502	2	1	3	2	1	3
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>		42	0	42	138	0	138	3.7	0	81	2.7	0	81
Eight-armed squid	<i>Gonatopsis borealis</i>		0	1	1	8	0	8	0.2	0	4	0.1	0	4
Salmon shark	<i>Lamna ditropis</i>		0	0	0	0	0	0	0.0	0	0	0.0	2	2
Spiny dogfish	<i>Squalus acanthias</i>		1	0	1	1	0	1	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	3
Pacific pomfret	<i>Brama japonica</i>		0	0	0	0	0	0	0.0	0	23	0.8	9	32
Ancient murrelet	<i>Synthliboramphus antiquus</i>		0	1	1	0	0	0	0.0	0	0	0.0	0	0
Tufted puffin	<i>Fratercula cirrhata</i>		1	0	1	0	0	1	0.0	0	1	0.0	0	1

Table 5. The number of organisms caught by drift gillnet during the Oshoro maru Cruise #243 in July, 2012. CPUE and (%) indicate numerical catch per tan and percentage of total catch by C-gear gillnet at the station, respectively.

Common name	Scientific name	Station				OSG 1204				OSG 1205				OSG 1206			
		Gear	C		A	Total	C		A	Total	C		A	Total			
			CPUE (%)				CPUE (%)				CPUE (%)						
Sockeye salmon	<i>Oncorhynchus nerka</i>		0	0.0 (0.0)	0	0	0	0	0	0.0 (6.7)	1	2	13	0.4 (21.0)	5	18	
Chum salmon	<i>Oncorhynchus keta</i>		0	0.0 (0.0)	0	0	0	0	0	0.1 (13.3)	1	3	36	1.2 (58.1)	14	50	
Pink salmon	<i>Oncorhynchus gorbusha</i>		0	0.0 (0.0)	0	0	0	0	0	0.0 (0.0)	2	2	4	0.1 (6.5)	12	16	
Coho salmon	<i>Oncorhynchus kisutch</i>		0	0.0 (0.0)	0	0	0	0	0	0.1 (26.7)	4	8	6	0.2 (9.7)	8	14	
Chinook salmon	<i>Oncorhynchus tshawytscha</i>		0	0.0 (0.0)	0	0	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 (6.7)	0	1	1	0.0 (1.6)	2	3	
Boreal clubhook squid	<i>Onychoteuthis borealijaponicus</i>		1	0.0 (1.0)	0	1	4	0.1 (26.7)	0	4	0	0.0 (0.0)	0	0	0	0	
Eight-armed squid	<i>Gonatopsis borealis</i>		0	0.0 (0.0)	0	0	1	0.0 (6.7)	0	1	2	0.1 (3.2)	0	2	0	2	
Flying squid	<i>Ommastrephes bartramii</i>		36	1.2 (35.0)	54	90	0	0.0 (0.0)	0	0	0	0.0 (0.0)	0	0	0	0	
Blue shark	<i>Prionace glauca</i>		9	0.3 (8.7)	23	32	0	0.0 (0.0)	0	0	0	0.0 (0.0)	0	0	0	0	
Salmon shark	<i>Lamna ditropis</i>		0	0.0 (0.0)	0	0	1	0.0 (6.7)	0	1	0	0.0 (0.0)	0	0	0	0	
Yellowtail	<i>Seriola lalandi</i>		3	0.1 (2.9)	0	3	0	0.0 (0.0)	0	0	0	0.0 (0.0)	0	0	0	0	
Pacific pomfret	<i>Brama japonica</i>		44	1.5 (42.7)	46	90	0	0.0 (0.0)	0	0	0	0.0 (0.0)	0	0	0	0	
Albacore	<i>Thunnus alalunga</i>		4	0.1 (3.9)	7	11	0	0.0 (0.0)	0	0	0	0.0 (0.0)	0	0	0	0	
Northern bluefin tuna	<i>Thunnus thynnus</i>		0	0.0 (0.0)	3	3	0	0.0 (0.0)	0	0	0	0.0 (0.0)	0	0	0	0	
Smalleye squaretail	<i>Tetragonurus atlanticus</i>		6	0.2 (5.8)	0	6	1	0.0 (6.7)	0	1	0	0.0 (0.0)	0	0	0	0	

Table 6. The catch number of each salmonid at each station where salmonids were collected by hook-and-line gear and surface longline in the Oshoro maru Cruise # 242 and #243-Leg2, 2012.

Station Name	Sampling gear	Species name						Total
		Sockeye	Chum	Pink	Coho	Chinook	Stellhead	
Cruise #242								
OSHL 1201	Hook-and-line	0	3	79	0	0	0	82
OSSL 1201	Surface longline	0	1	55	0	0	1	57
OSHL 1202	Hook-and-line	0	2	460	0	0	0	462
OSSL 1202	Surface longline	0	9	29	0	0	0	38
OSHL 1203	Hook-and-line	0	4	1	0	0	0	5
Subtotal		0	19	624	0	0	1	644
Cruise #243- Leg 2								
OSHL 1204	Hook-and-line	0	1	0	1	0	0	2
OSSL 1203	Surface longline	0	0	0	0	0	0	0
OSHL 1205	Hook-and-line	1	1	4	3	0	0	9
OSSL 1204	Surface longline	2	1	1	0	0	1	5
OSHL 1206	Hook-and-line	2	0	2	0	0	0	4
OSHL 1207	Hook-and-line	4	3	1	2	0	1	11
OSSL 1205	Surface longline	11	2	15	2	0	10	40
Subtotal		20	8	23	8	0	12	71

(N)

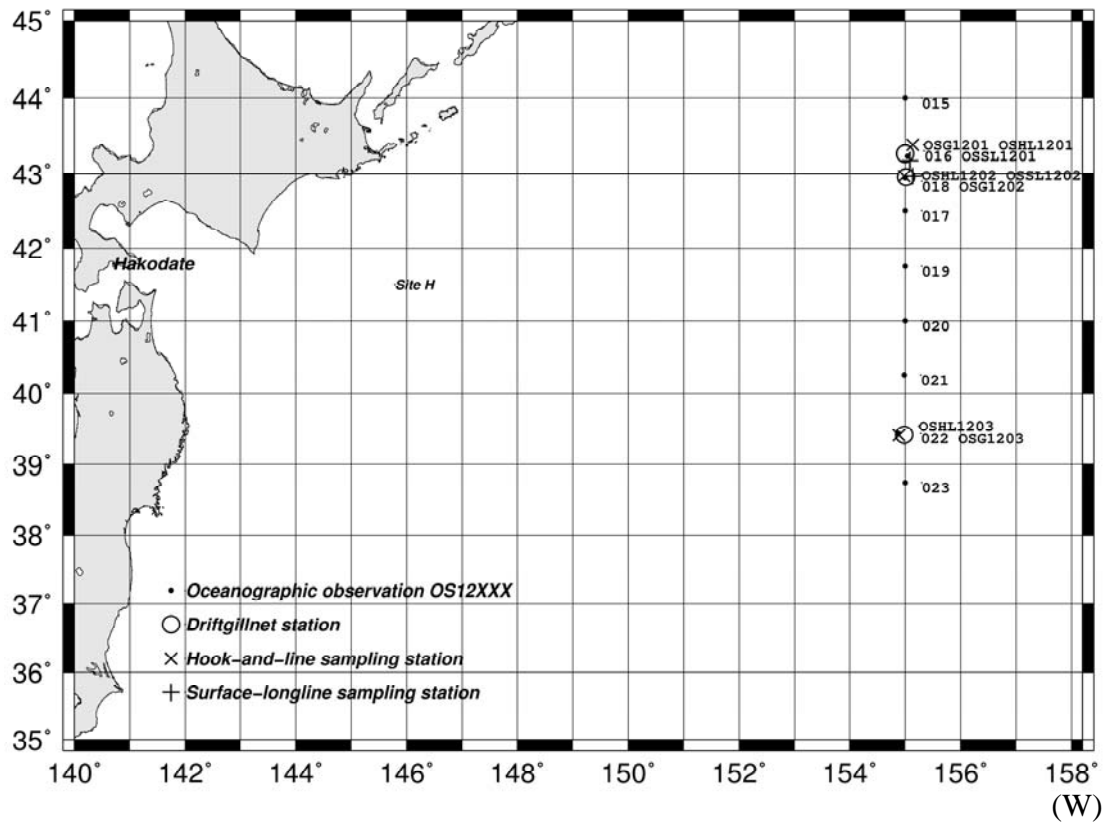


Fig.1-(1). Salmon research stations during the *Oshoro maru* Cruise #242 in May, 2012. Details about each station are shown in Table 1.

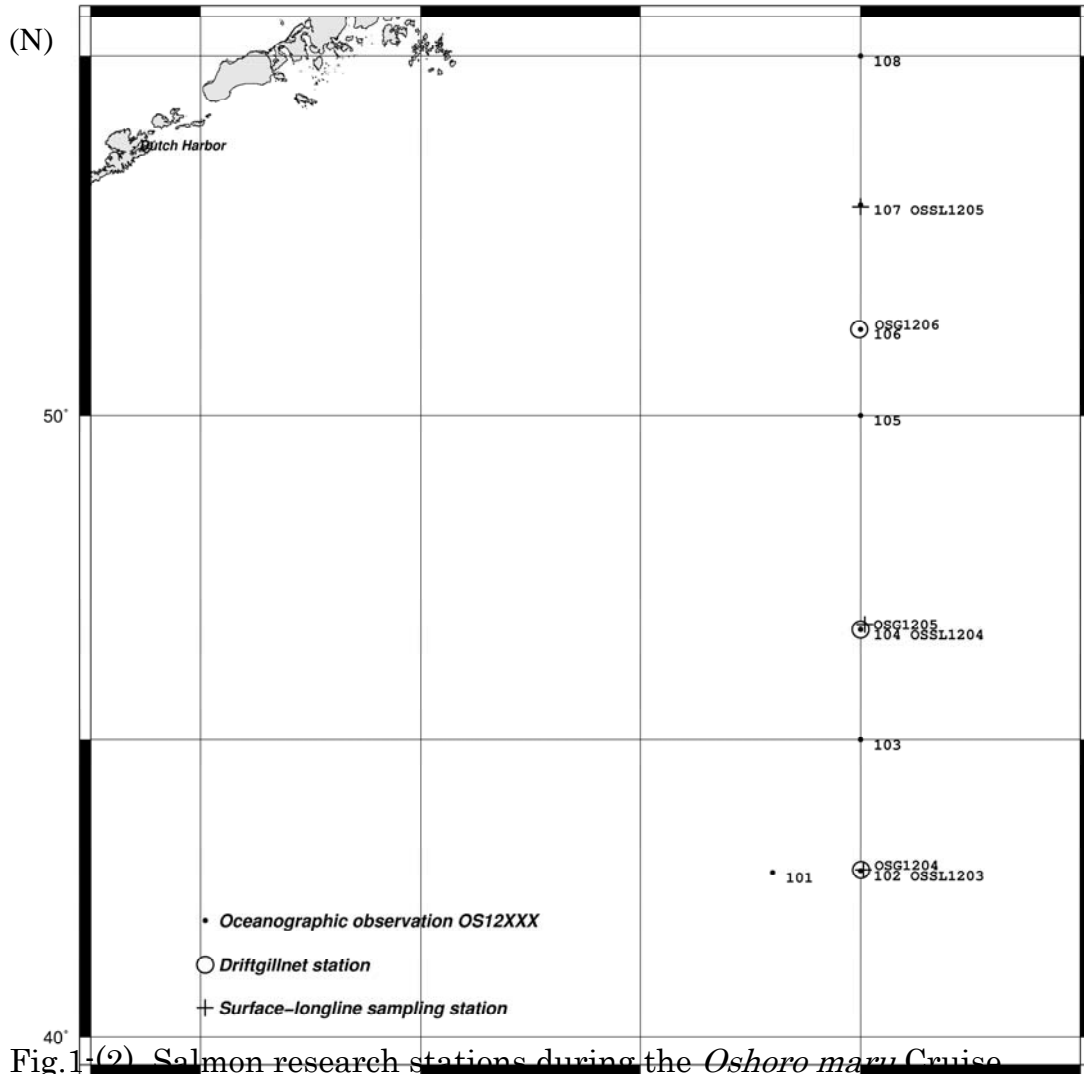


Fig.1-(2) Salmon research stations during the *Oshoro maru* Cruise #229-Leg5 in May, 2011. Details about each station are shown in Table 1.

Fig.1-(2). Salmon research stations during the *Oshoro maru* Cruise #243 in July, 2012. Details about each station are shown in Table 1.

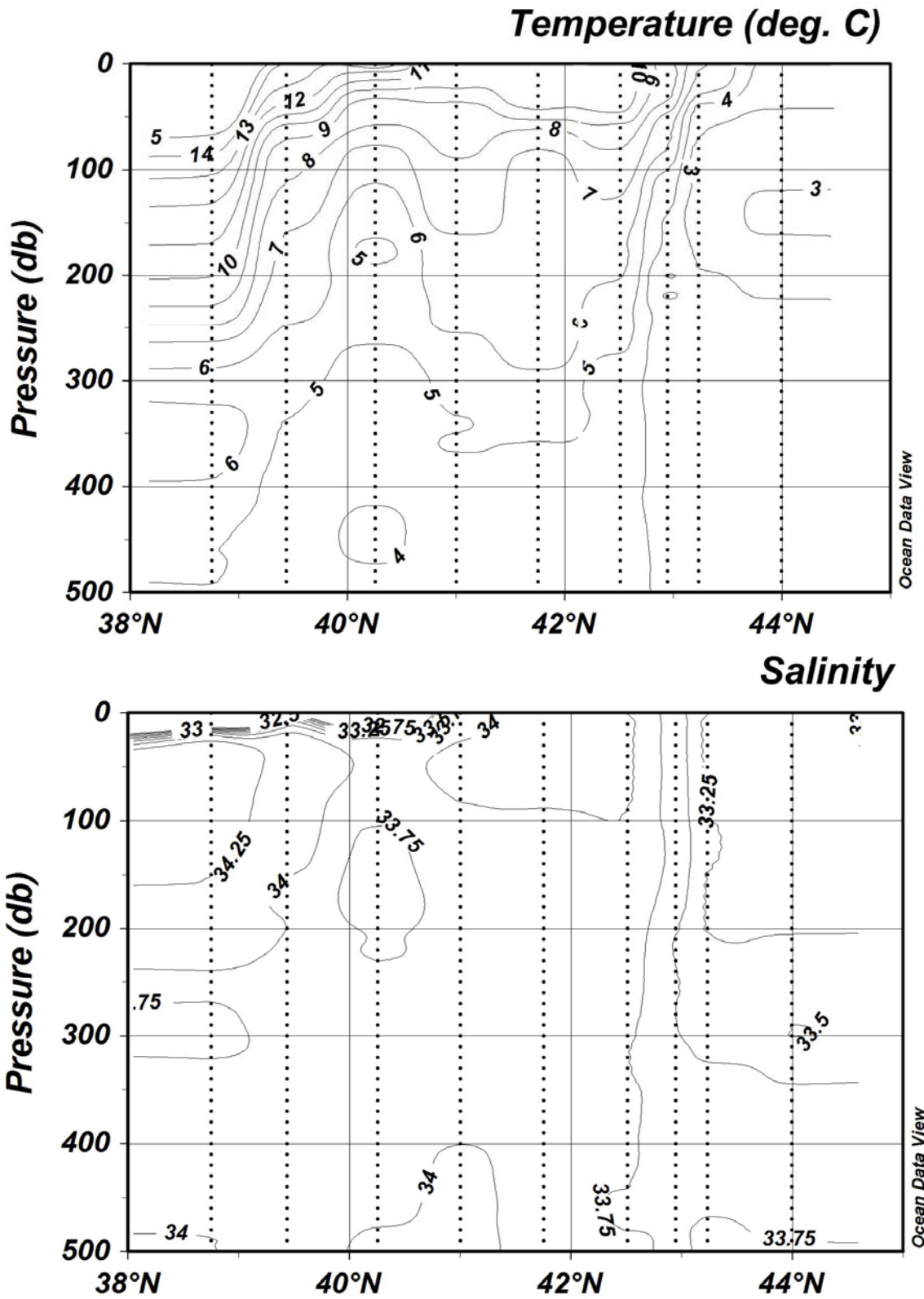


Fig. 2-(1). Temperature and salinity from surface to 500 db pressure along the 155°E transect during the *Oshoro maru* Cruise #242 in May, 2012.



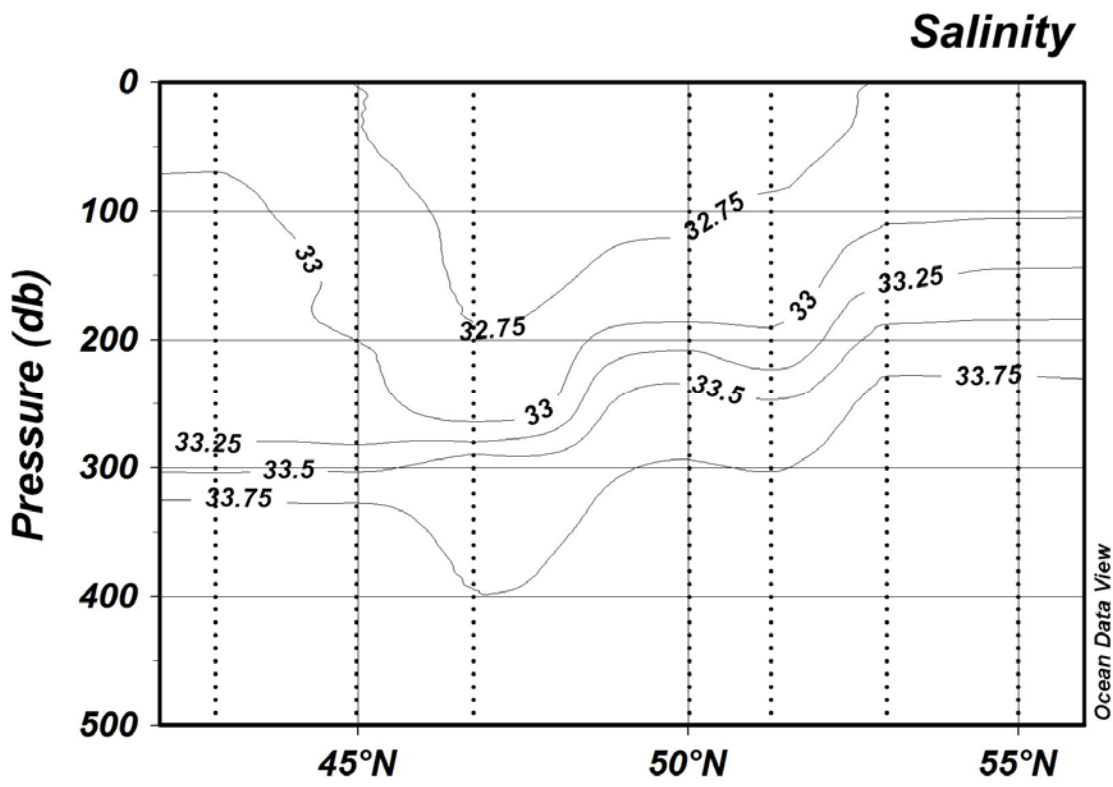
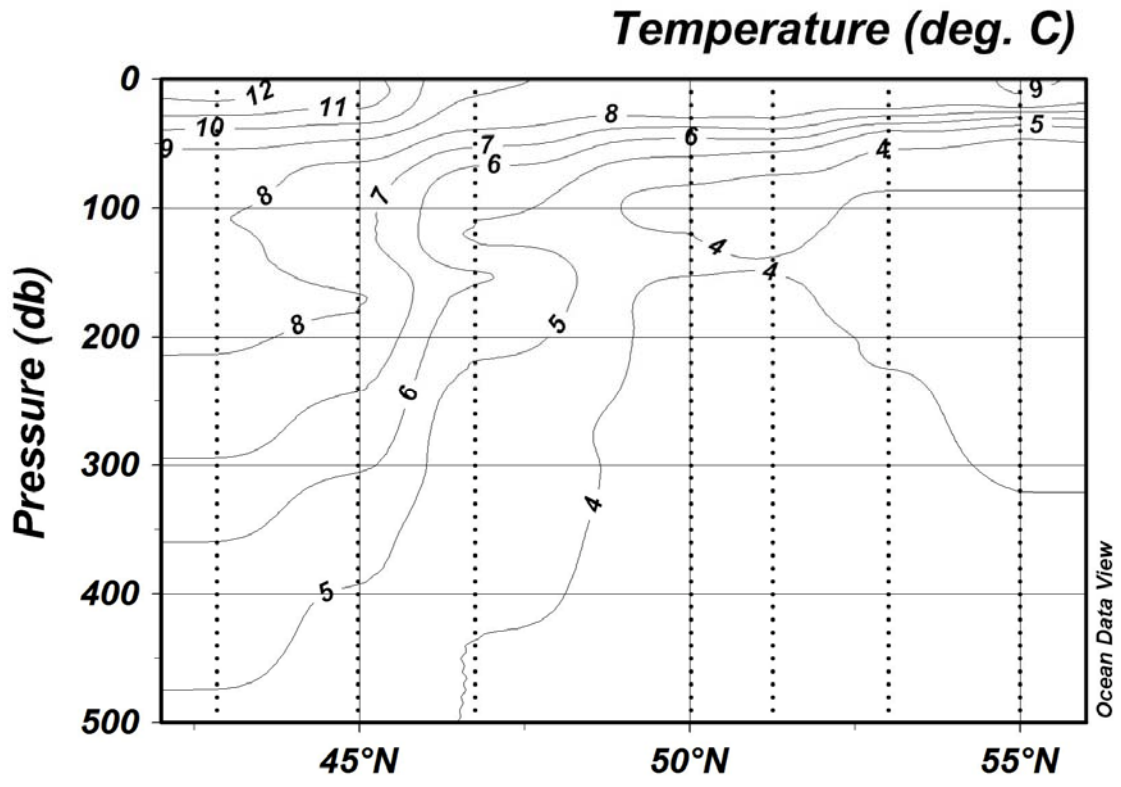


Fig. 2-(2). Temperature and salinity from surface to 500 db pressure along the 150°W transect during the *Oshoro maru* Cruise #243 in July, 2012.

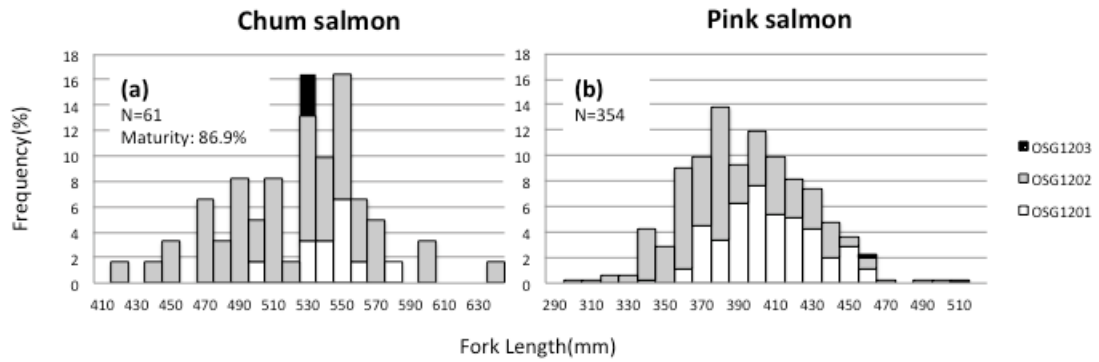
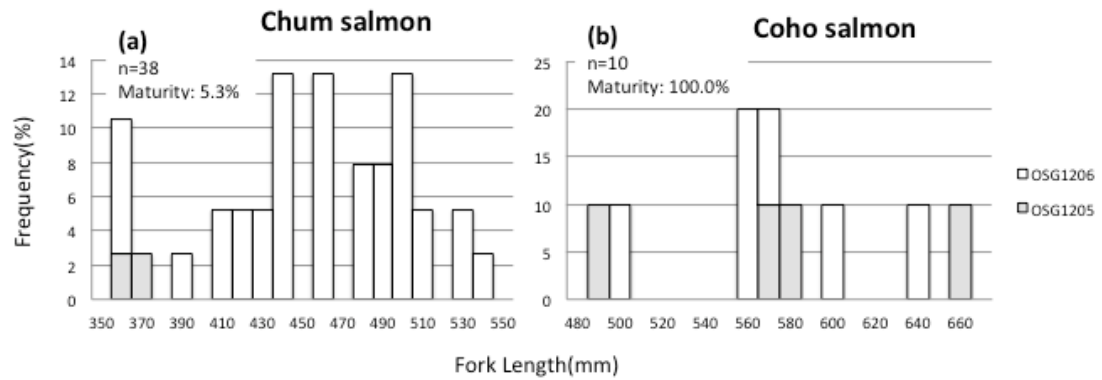


Fig. 3. Fork length frequency of chum salmon (a) and pink salmon (b) caught by C-gear gillnet along the 155°E longitude line during the Oshoro maru Cruise #242 in May 2012.



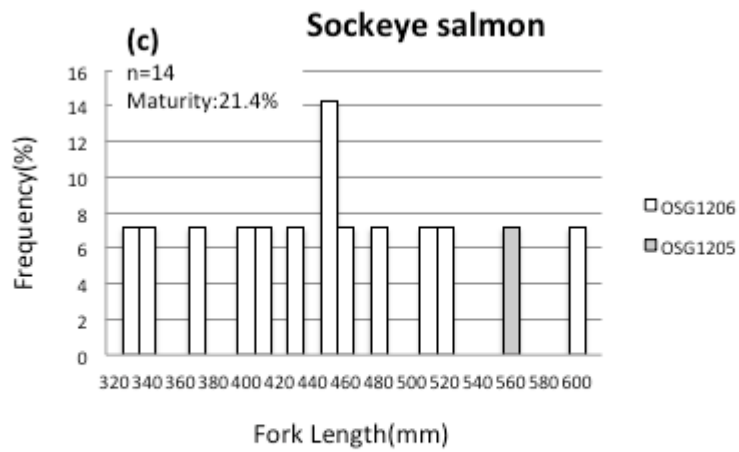


Fig. 4. Fork length frequency of chum salmon (a), coho salmon (b) and sockeye salmon (c) caught by C-gear gillnet along the 150°W longitude line during the Oshoro maru Cruise #243 in July 2012.