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Results of 2014 Salmon Research by the *Oshoro maru*

by

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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). The survey was conducted during the Cruise #269 in May 2013.

Twelve oceanographic observations and one drift gillnet survey were conducted along the 155°E during the Cruise #269 in May. The Polar Front was observed in the vicinity of 43°N which were shifted south slightly and not clear than the location in previous years. A total of 515 salmonids was caught by gillnet surveys, including 488 Pink and 27 Chum salmon. Pink salmon was the dominant species. The fork lengths (F.L.) of chum salmon collected by C-gear gillnet ranged between 474-648 mm F.L., and those of pink salmon ranged between 297-470 mm F.L.. 88.6% of chum salmon caught along 155°E were adult fish.

To collect salmon samples extensively and to collect fresh salmon blood and various tissues, three surface long-line and three hook-and-line gear samplings were conducted during the Cruise #269. Almost all of caught by these gears were Pink salmon but restricted the north point (OSSL1401), caught one Sockeye salmon and Chum salmon was the dominant species. A total of one Sockeye, fourteen Chum, and 48 Pink salmon were collected during the Cruise #269.

Keywords: salmon, gillnet, 155°E longitude line

INTRODUCTION

The *Oshoro maru* has continued to study the oceanic structure and marine biology in the North Pacific Ocean every summer and Bering Sea (infrequently in the Chukuchi Sea) almost every summer since 1953. Collected data has been published annually since 1957 (Hokkaido University, 1957-2014).

Salmon researches were conducted during a cruise in May 2014: the *Oshoro maru* Cruise #269 in the western North Pacific.

Primary salmon research objects during a cruises were

1. To collect oceanographic and biological data continuously along 155°E longitude line in May.
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 cruise.

MATERIAL AND METHODS

Survey Area and Cruise Schedule

The *Oshoro maru* (1,998 gross ton) departed Hakodate on May 8, 2014 and started the Cruise #269. Oceanographic observations, gillnet surveys, surface long-line and hook-and-line samplings were conducted along the 155°E longitude between 44°N and 41°-03’N latitude from May 11 to 13, and returned to Hakodate on May 19. [Table 1, 2, Fig.1]

Oceanographic observation

Twelve oceanographic observations were conducted from 44°N to 39°-30’N along the 155°E longitude line. [Fig.1 Table3] The temperature and salinity data at each station were collected by using CTD. Temperature and salinity data from surface to 500db along the 155°E longitude line were used to plot temperature and salinity sections about each transect during the Cruise #269. [Fig.2]

Drift Gillnet Research

One set of a drift gillnet was used to collect salmonids and the other organisms at the station along the 155°E longitude line. [Fig.1, Table1] The gillnet configuration at the station was as follows:

Stations	net	A-Gear		C-gear										Total
	Mesh size (mm)	112	115	48	55	63	72	82	93	106	121	138	157	
OSG1401	Number of tan	6	6	3	3	3	5	6	5	3	3	3	3	49

The net was total 49 tans which comprised of 37 tans of C-Gear gillnet (non-selective varied research mesh, Takagi, 1975) and 12 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 was calculated as catch number per one tan of C-Gear gillnet.

Details about each gillnet operation are shown in Table 1.

Surface Long-line Research

Three surface long-line researches were conducted to collect salmonids from the 44°N to 41°N along the 155°E longitude line during the Cruise #269. [Fig.1]

The long-line consisted of 10 or 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 2.

Hook-and-Line Sampling

To collect fresh salmon blood and various tissues, hook-and-line gears were used at three research stations during the Cruise #269 [Fig.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.

Details about each hook-and-line operation are shown in Table 2.

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. For the salmon which had a clipped fin, its snout was

removed, salted, and frozen for later potential recovery of the coded-wire tag (CWT) by researchers at NOAA NMFS, Auke Bay Laboratories (ABL).

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

Along the 155°E Longitude Line: during the Cruise #269 in May 2014

Oceanographic Conditions

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

The geographic positions of the Polar Front and the Subarctic Boundary along the 155°E longitude line transect (Dodimead et al., 1963,; Favorite et al., 1976,; Roden, 1991) were observed following locations in May 2014.

The Polar Front which is indicated by the vertical 4°C isotherm at 100 db observed in the vicinity of 43°N, it was shifted south slightly and not clear than the location in previous years. The Subarctic Boundary indicated by the vertical 34.0 psu isohaline was observed in the vicinity of 42°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 the station along the 155°E longitude line are shown in Table 4.

A drift gillnet survey was conducted along the 155°E during the cruise #269 in May 2014 [Fig.1, Tables 1]. A total of 27 chum salmon (*Oncorhynchus keta*) and 488 pink salmon (*Oncorhynchus gorbuscha*) were collected at 41°-55.4’N (OSG1401). The CPUE value of pink salmon was high at this position. Non-salmonid fishes caught by C-gear gillnet were shown in Table 4. One Tufted Puffin (*Fratercula cirrhata),* Three Boreal clubhook squid (*Onychoteuthis borealijaponicus*) were caught.

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 total of 10 chum salmon were collected by C-gear gillnet. Their F.L. ranged between 476-534 mm. Mean ± SD of them was 505.2 ± 13.9 mm, and median of them was 506.0 mm. Mature fish occupied 77.8%.

A total of 481 pink salmon were collected by C-gear gillnet. Their F.L. ranged between 297-470 mm. Mean ± SD of them was 393.7 ± 28.5 mm, and median was 396.5 mm.

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 5.

A total of one Sockeye, fourteen chum and 48 pink salmon were collected by surface long-line and hook-and-line gear at 155°E research line during the Cruise #269 (OSSL1401-03, OSHL1401-03).

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Table 1. Position and research conditions of surface drift gillnet sampling at each station during the *Oshoro maru* Cruise #269, 2014.

Station	Date and Time (S.M.T.*1)				T.D.*2	Set Position		D.S.*3	bottom	Wr*4	Wind	S.T.*5
	Net set		Net haul			Lat.	Long.		depth(m)		(Force)	(℃)
OSG 1401	May 12	1827-1850	May 13	0524-0635	+10h	41-55.4N	155-00.3 E	210	5455	o	NNW-4	6.9

Table 2. Position and research conditions of surface long-line and hook-and-line sampling at each station during the *Oshoro maru* Cruise #269, 2014.

Station	Date and Time (S.M.T.*1)				T.D.*2	Set Position		D.S.*3	Number of	bottom	Wr*4	Wind	S.T.*5
	Line set		Line haul			Lat.	Long.		baskets	depth(m)		(Force)	(℃)
C269													
OSSL1401	May 11	0757-08-25	May 11	1455-1550	+10h	43-58.9N	154-54.5N	080	20	5337	f	ENE-4	4.8
OSSL1402	May 13	0453-0503	May 13	0715-0750	+10h	41-47.9N	155-04.5E	108	10	5480	o	Calm	8.5
OSSL1403	May 13	1340-1353	May 13	1627-1648	+10h	41-03.1N	154-59.8E	215	10	5584	c	SW-4	9.5
OSHL1401	May 11	2130	May 11	2340	+10h	43-30.1N	154-59.7E	-	-	5472	f	NW-4	5.0
OSHL1402	May 12	0100	May 12	0400	+10h	43-16.2N	155-00.3E	-	-	5500	o	NNW-4	5.1
OSHL1403	July 12	2110	July 12	0330	+10h	42-00.2N	155-00.0E	-	-	5465	o	North-2	6.0

Table 3. List of oceanographic station during the *Oshoro maru* Cruise #269, 2014.

Station	Date and Time (S.M.T.*1)		T.D.*2	Set Position		Remark	CTD
				Lat.	Long.	CTD	depth(db)
C269							
OS 14078	May 09	1508	+10h	41-59.3N	145-29.5E	Sea-Bird SBE 9	1500
OS 14079	May 11	0907	+10h	44-00.1N	155-00.0E	Sea-Bird SBE 9	5000
OS 14080	May 11	1624	+10h	44-00.0N	155-00.1E	Sea-Bird SBE 9	800
OS 14081	May 11	1743	+10h	44-00.0N	155-00.5E	Sea-Bird SBE 9	200
OS 14082	May 11	2054	+10h	43-30.1N	154-59.7E	Sea-Bird SBE 9	500
OS 14083	May 12	0807	+10h	43-14.9N	155-00.0E	Sea-Bird SBE 9	1500
OS 14084	May 12	1353	+10h	42-30.1N	155-00.3E	Sea-Bird SBE 9	1500
OS 14085	May 12	1931	+10h	41-52.6N	154-59.5E	Sea-Bird SBE 9	1500
OS 14086	May 13	0836	+10h	41-45.0N	155-00.0E	Sea-Bird SBE 9	1500
OS 14087	May 13	1424	+10h	41-00.6N	154-59.4E	Sea-Bird SBE 9	1500
OS 14088	May 13	2121	+10h	40-15.2N	154-59.9E	Sea-Bird SBE 9	1500
OS 14089	May 13	0302	+10h	39-30.0N	155-00.1E	Sea-Bird SBE 9	1500
OS 14090	May 13	0500	+10h	39-30.2N	155-00.2E	Sea-Bird SBE 9	200

*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 or line set.

*4 Wr. : Weather (c: 75-99% clouded, o: 100% clouded, f: fog).
*5 S.T. : Surface temperature

Table 4. The number of organisms caught by drift gillnet during the *Oshoro maru* Cruise # 269, in May, 2014. CPUE and (%) indicate mumerical catch per tan and percentage of total catch by C-gear gillnet at the station, respectively.

Common name	Station / Gear / Scientific name	OSG 1401				
		C			A	Total
			CPUE	(%)		
Sockeye salmon	*Oncorhynchus nerka*	0	0.0	(0.0)	0	0
Chum salmon	*Oncorhynchus keta*	10	0.3	(2.0)	17	27
Pink salmon	*Oncorhynchus gorbuscha*	481	16.0	(97.2)	7	488
Coho salmon	*Oncorhynchus kisutch*	0	0.0	(0.0)	0	0
Chinook salmon	*Oncorhynchus tshawytscha*	0	0.0	(0.0)	0	0
Steelhead	*Oncorhynchus mykiss*	0	0.0	(0.0)	0	0
						0
Tufted Puffin	*Fratercula cirrhata*	1	0.0	(0.2)	0	1
Boreal clubhook squid	*Onychoteuthis borealijaponicus*	3	0.1	(0.6)	1	4

Table 5. The catch number of each salmonid at each station where salmonids were collected by hook-and-line gear, surface long-line in the *Oshoro maru* Cruise # 269, 2014.

Station Name	Sampling gear	Species name						Total
		Sockeye	Chum	Pink	Coho	Chinook	Stellhead	
C269								
OSSL 1401	Surface longline	1	12	3	0	0	0	16
OSSL 1402	Surface longline	0	0	14	0	0	0	14
OSSL 1403	Surface longline	0	0	5	0	0	0	5
OSHL 1401	Hook-and-line	0	0	0	0	0	0	0
OSHL 1402	Hook-and-line	0	0	0	0	0	0	0
OSHL 1403	Hook-and-line	0	2	26	0	0	0	28
Total		1	14	48	0	0	0	63

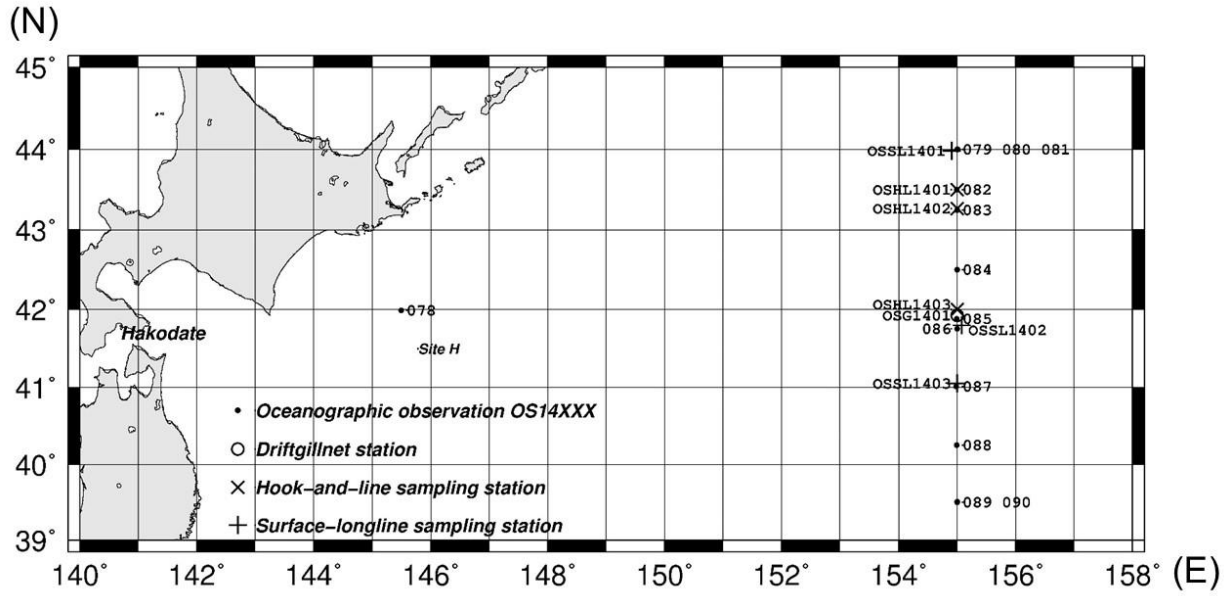
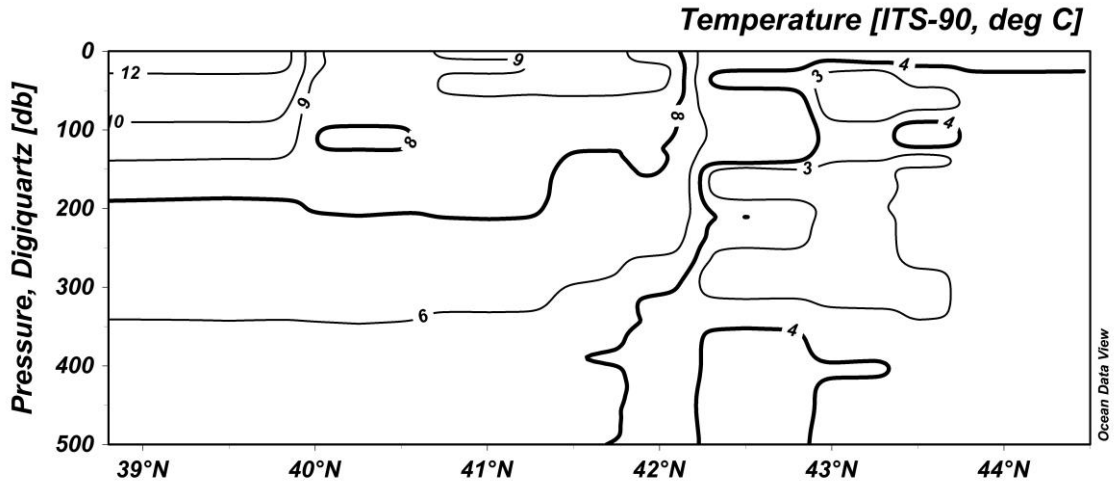
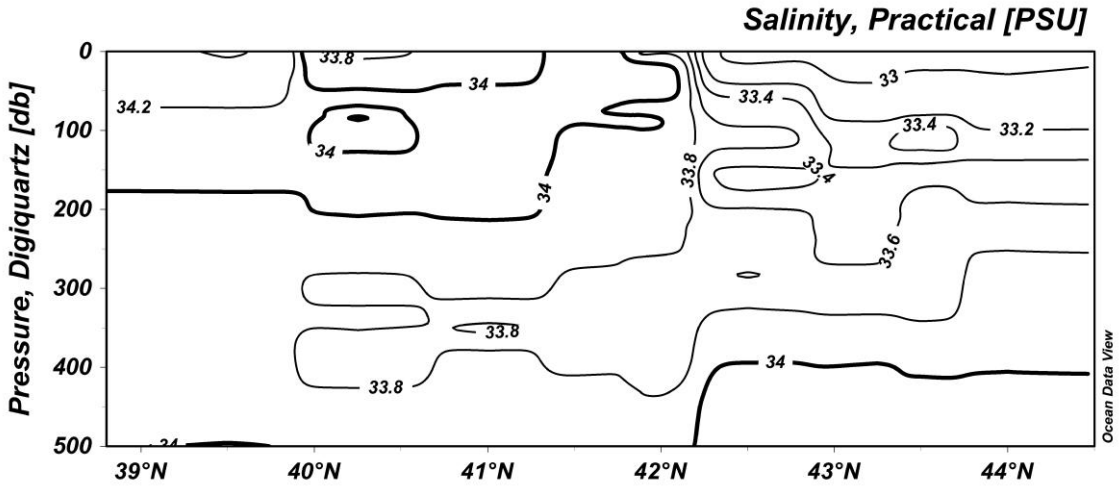


Fig.1 Salmon research stations during the *Oshoro maru* Cruise #269 May, 2014.
Details about each station are shown in Table 1.-2.-3.

Fig.2 Temperature and salinity from surface to 500 db pressure along the 155°E transect during the *Oshoro maru* Cruise #269 in May, 2014.





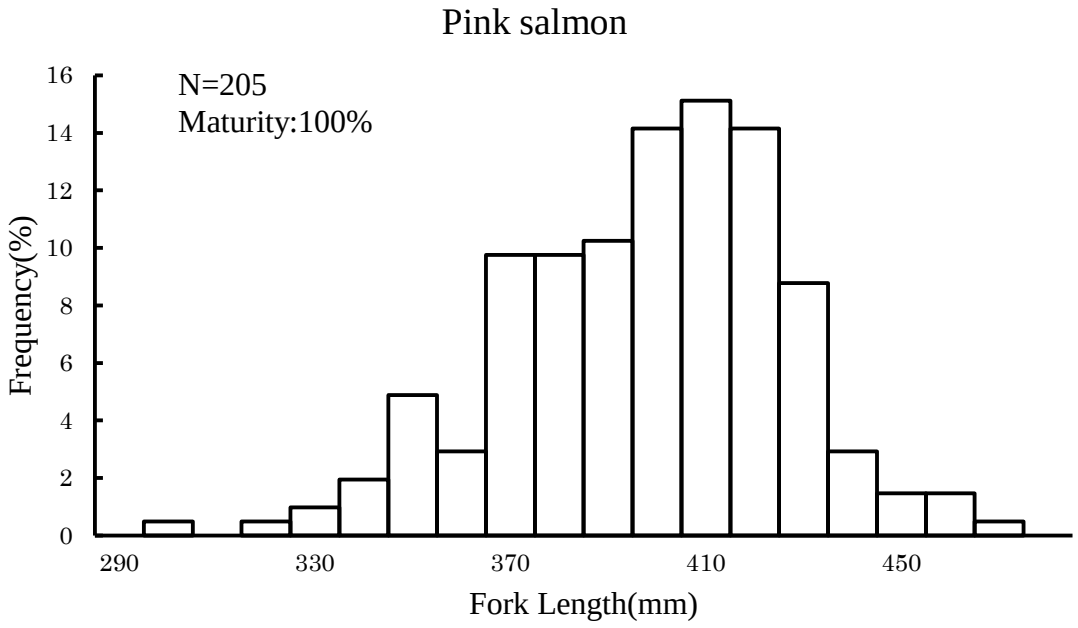


Fig.3 Fork length frequency of pink salmon caught by C-gear gillnet along the 155°E during the *Oshoro maru* Cruise #269 in May, 2014.