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2008 T/V *Oshoro-maru* Salmon Research Cruises

Keiichiro Sakaoka, Yoshihiko Kamei, Shogo Takagi,
Yoshiyuki Kajiwara , Jun-ichi Kimura, and Toshimi Meguro,

T/V “*Oshoro maru*”

Graduate School of Fisheries Sciences & Faculty of Fisheries, Hokkaido University
3-1-1 Minato-cho, Hakodate, Hokkaido 041-8611, Japan

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ABSTRACT

In order to clarify the oceanic structure and marine ecosystem, oceanographic observations and fishing surveys (including for salmonids) were conducted in the Northwest Pacific Ocean (along 155°E), in the Central North Pacific Ocean (along 170.3°E), around the Aleutian Islands, in the Bering Sea and in the Chukuchi Sea. Each survey was conducted during the Cruise #189 in May and the Cruise #190 from June to July, 2008.

Sea surface temperature along 155°E in May, 2008 was about 1.0°C warmer than 2007. The Polar Front was located between 44°N and 43°N and the Subarctic Boundary was located between 40°N and 39°N which were similar to the location in previous years. Four drift gillnet surveys were conducted along 155°E in May during the Cruise #189. A total 268 chum and 641 pink salmon were caught by gillnet. Catch ratio of salmonids was decreasing to the south. CPUE value of chum salmon was the lowest at 42.5°N on the other hand, that of pink salmon was the highest at 42.5°N.

One drift gillnet, one surface long-line and two hook-and-line gear samplings were conducted along the 170.3°E, four surface long-lines and 13 hook-and-line gear samplings were conducted around the Aleutian Islands in during the Cruise #190 -Leg 1.

A total of 65 sockeye, 33 chum, 32 pink and nine coho salmon were collected by every sampling gear.

Four surface long-line, five hook-and-line gear samplings and eight otter trawl surveys were conducted in the Bering Sea. A total of five sockeye, four chum and nine pink salmon were collected by surface long-line and hook-and-line gear surveys in the Bering Sea during the Cruise #190-Leg 2. All salmon were collected in the southeast Bering Sea area.

No salmonids were collected by any and every sampling gear in the Chukuchi Sea during the Cruise #190-Leg 3.

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 Chukuchi Sea) every summer since 1953. Collected data has been published annually since 1957 (Hokkaido University, 1957-2008).

Since 1978, several transects have been repeatedly sampled to study long-term changes in the North Pacific Ocean.

The fish sampling areas including salmonids were divided roughly following four research areas during two cruises (Cruise #189 and #190) in 2008.

1. In the Northwest Pacific along the 155°E longitude line in May during the Cruise #189.

2. In the Central North Pacific along the 170.3°E longitude line in June during the Cruise #190 (Leg 1).
3. Around the Aleutian Islands in June during the Cruise #190 (Leg 1).
4. In the Bering Sea and the Chukuchi Sea from late June to early July during the Cruise #190 (Leg 2,3: *Oshoro maru* 2008 International Polar Year (IPY) Research Cruise).

Primary objects for above research areas were

1. To collect oceanographic and biological data continuously along 155°E longitude line.
2. To collect oceanographic and biological data along the 170.3°E longitude line.
3. To collect oceanographic and biological data around the Aleutian Islands.
4. To collect oceanographic and biological data in the Bering Sea and Chukuchi Sea for the *Oshoro maru* research cruises during the International Polar Year (IPY) 2007-2008.

This document reports the preliminary results about those research areas during the cruises.

MATERIAL AND METHODS

Cruise Schedule and Salmon Research Area

Oceanographic observations and gillnet surveys were conducted along the 155°E from May 10 to 16 during the Cruise #189. Oceanographic observations and gillnet, surface long-line and hook-and-line surveys were conducted along the 170.3°E longitude line in the area near the Emperor Seamounts and around the Aleutian Islands from June 8 to 20 during the Cruise #190-Leg 1. Oceanographic observations and surface long-line, hook-and-line and bottom otter trawl surveys were conducted in the Bering Sea from June 24 to July 3 during the Cruise #190-Leg 2 and in the Chukuchi Sea from July 7 to 13 during the Cruise #190-Leg 3 (Fig. 1, Table 1).

Oceanographic Observation

Eight oceanographic observations were conducted at 45 nautical mile intervals from 44°N to 38.75°N along 155°E in the Cruise #189, and data collected by CTD instruments were used to plot the temperature and salinity. Three oceanographic observations at salmon sampling stations were conducted from 39°N to 43.5°N along 170.3°E line, and 14 observations were conducted around the Aleutian Islands in the Cruise #190-Leg 1. 16 observations (in the Bering Sea) and nine observations (in the Chukuchi Sea) were conducted in the Cruise #190-Leg 2 and 3 (Fig. 1, Table 1).

Drift Gillnet Sampling

One set of drift gillnet was used to collect salmonids and the other organisms at

five stations (Figs. 1-(1), (2), Table 1). The gillnet configuration is as follows:

| Net | A-Gear | | C-Gear | | | | | | | | | | F-Gear | | | | | | Total | | |
|----------------|--------|-----|--------|----|----|----|----|----|-----|-----|-----|-----|--------|----|----|----|----|----|-------|----|----|
| Mesh size (mm) | 115 | 121 | 48 | 55 | 63 | 72 | 82 | 93 | 106 | 121 | 138 | 157 | 19 | 22 | 25 | 29 | 33 | 37 | | 42 | |
| Number of tan | 6 | 6 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 49 |

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 seven 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 in the following morning. The number of organisms caught was counted by species for each mesh size. Catch per unit effort (CPUE) values were calculated as the number of fish caught by C-gear gillnet per tan.

Biological measurements data were recorded from a maximum 60 fishes for each species per mesh size.

Details about each operation are shown in Table 2.

Surface Long-line sampling

Five surface long-line samplings were operated during the Cruise #190-Leg 1. Four samplings were operated in the Bering Sea during the Cruise #190-Leg 2. Two samplings were operated in the Chukuchi Sea during the Cruise #190-Leg 3 (Figs. 1-(2), (3), (4), Table 1).

Ten baskets (hachi) were used except two stations (OSSL 0803 and OSSL 0804 were used five baskets). One basket was comprised of main line with 34 branch lines. Main line was 127m long. Branch line with a hook attached to main line at 3m intervals. Fishing depth was about 2m. Salted anchovies were used as bait. The catch was sorted by species and counted.

Details about each operation are shown in Table 3.

Hook-and-Line Sampling

To collect salmonids, hook-and-line gears were used along 170.3°E line and around the Aleutian Islands in the North Pacific (15 stations) and in the Bering Sea (five stations) during the Cruise #190-Leg 1 and 2 (Figs. 1-(2), (3), Table 1).

Five to ten anglers were engage in the work. These samplings were mainly conducted with other observations when ship was under drifting. The catch was sorted by species and counted.

Trawl Sampling

Fifteen bottom otter trawl surveys were conducted in the Bering Sea (seven stations) and the Chukuchi Sea (nine stations) during the Cruise #190-Leg 2 and 3

(Figs. 1-(3), (4), Table 1).

These surveys were conducted in daytime. Towing speed was about 4 knots. Diameter of the net mouth was ca. 5m. In order to collect salmonids, net was held on five minutes when warps were paid out 50m long from otter board and towed from surface to mid-layer. No salmonids were collected by trawl surveys.

Details about each operation are shown in Table 4.

Fish Examination for Salmonids

Salmonids were processed soon after removal from the fishing gear. Biological data were recorded per each sampling gear at every station. Biological data included fork length (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.

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

RESULTS AND DISCUSSION

Details of oceanographic data and biological data collected during the cruises were published in the “*DATA RECORDE OF OCEANOGRAPHIC OBSERVATIONS AND EXPLORATORY FISHING NO. 52*” of Hokkaido University in May 2009.

Cruise #189 along the 155°E in the Northwest Pacific

Oceanographic Conditions

Sea surface temperature along 155°E in May, 2008 was about 1.0°C warmer than 2007. Temperature and salinity sections (0-500db) along the 155°E transect in the Cruise #189 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 observed following locations in May 2008.

The Polar Front which is indicated by the vertical 4°C isotherm at 100m depth observed in the vicinity of 43.5°N, but small warm core was observed from the north of 42.5°N. The Subarctic Boundary indicated by the vertical 34.0 psu isohaline was observed in the vicinity of 39.5°N.

Distribution and abundance of organisms caught by drift gillnet

The numbers of organisms caught by the drift gillnet and CPUE values at each

station are shown in Table 5.

Two drift gillnet surveys (at 44°N) was conducted in the Subarctic Waters and two drift gillnet surveys (at 42.5°N and 41°N) were conducted in the Transition Domain (Dodimead et al., 1963) during this cruise (Figs. 1, 2, Table 2).

A total of 268 chum salmon, 641 pink salmon (*Oncorhynchus gorbuscha*) were collected along 155°E in May.

Catch ratio of salmonids was decreasing to the south. CPUE value of chum salmon was the lowest at 42.5°N on the other hand, that of pink salmon was the highest at 42.5°N.

Biological characteristics of salmonids

A total of 88 chum salmon was collected by C-gear gillnet. Their fork lengths ranged between 490-638mm F.L. (mean \pm STD: 559.5 \pm 37.64mm, Median: 560.0mm,) and 98.9% were mature fish. From these results, their ocean ages were thought to be almost over 3 years (Meguro et. al., 2004).

A total of 630 pink salmon was collected by C-gear gillnet (475 pink salmon was measured). Their fork lengths ranged between 304-500mm F.L. (mean \pm STD: 407.8 \pm 24.49mm, Median: 408.0mm), (Fig. 3).

Cruise #190-Leg 1 along the 170.3°E and around the Aleutian Islands.

The only one gillnet survey was conducted at station “OSG 0805”: [39.0°N, 170.3°E] in early June during the Cruise #190-Leg 1 owing to the bad weather. The number of organisms caught by the drift gillnet are shown in Table 6. This survey was conducted in the Subtropical Waters and no salmonids were collected at OSG0805.

The most non-salmonids species caught by C-gear gillnet was pacific pomfret (*Brama japonica*: n = 72). In addition 13 Blue shark (*Prionace glauca*), seven Neon flying squid (*Ommastrephes bartramii*), one Smalleye squaretail (*Tatagonurus vuvieri*) was collected.

One surface long-line and two hook-and-line gear samplings were conducted along the 170.3°E. The catch number of salmonids by the surface long-line and hook-and-line are shown in Table 7. A total of seven pink salmon and nine coho salmon were collected by those gear samplings along the 170.3°E. Fork lengths of pink salmon distributed between 426-476mm F.L. (mean \pm STD: 458.4 \pm 16.08mm, Median: 464.0mm). Coho salmon distributed between 462-522 mm F.L. (mean \pm STD: 502.6 \pm 19.78mm, Median: 510.0mm).

Four surface long-lines and 13 hook-and-line gear samplings were conducted around the Aleutian Islands as substitute for the drift gillnet surveys. The catch number of salmonids by the surface long-line and hook-and-line are shown in Table 7. A total of 65 Sockeye, 33 chum salmon and 25 pink salmon were collected by those gear samplings around the Aleutian Islands. Fork lengths of sockeye salmon

distributed between 412-663 mm F.L. (mean \pm STD: 569.9 \pm 54.53mm, Median: 576.0mm) and 86.7% were mature fish. Chum salmon distributed between 380-662 mm F.L. (mean \pm STD: 507.9 \pm 64.82mm, Median: 503.0mm) and 48.5% were mature fish. Pink salmon distributed between 414-544mm F.L. (mean \pm STD: 451.6 \pm 29.08mm, Median: 445.0mm).

Cruise #190-Leg 2 in the Bering Sea and Cruise #190-Leg 3 in the Chukuchi Sea

A total of five sockeye, four chum and nine pink salmon were collected by every sampling gear (Table 7). All salmonids were collected in the southeast Bering Sea area.

Five sockeye ranged between 514-652mm F.L. were all adult fish. Four Chum salmon distributed between 562-616 mm F.L. (mean \pm STD: 591 \pm 23.62mm, Median: 593.0mm) and 50.0% were mature fish. Nine pink salmon distributed between 418mm and 467mm F.L.

No salmonids were collected by any and every sampling gear in the Chukuchi Sea during this research period.

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Table 1. List of salmon research stations. Positions in which multiple surveys were conducted are adopted those of oceanographic stations by deputy.

| Station Name | | | | | Position | | Date | | |
|---------------------|----------|---------------|------------------|-----------|----------|-----------|------------|--------|--------|
| Oceanographic | Gillnet | Hook-and-Line | Surface longline | Trawl | Latitude | Longitude | *S.M.T. | **T.D. | |
| Cruise #189 | | | | | | | | | |
| OS 08044 | OSG 0801 | / | / | / | 43-59.8N | 154-59.6E | May 10-11 | +10h | |
| OS 08044 | OSG 0802 | | | | 43-58.5N | 155-02.9E | May 11-12 | | |
| OS 08045 | | | | | 43-15.0N | 155-00.0E | May 12 | | |
| OS 08046 | OSG 0803 | | | | 42-30.0N | 155-00.1E | May 14-15 | | |
| OS 08047 | | | | | 41-45.0N | 155-00.0E | May 15 | | |
| OS 08048 | OSG 0804 | | | | 41-00.0N | 155-00.4E | May 15-16 | | |
| OS 08049 | | | | | 40-15.0N | 155-00.0E | May 15 | | |
| OS 08050 | | | | | 39-30.0N | 155-00.0E | May 15 | | |
| OS 08051 | | | | | 38-45.0N | 155-00.0E | May 16 | | |
| Cruise #190 - Leg 1 | | | | | | | | | |
| OS 08057 | OSG 0805 | | OSSL 0801 | | 39-00.9N | 170-20.5E | June 8-9 | +11h | |
| OS 08064 | | OSHL 0801 | | | 42-00.4N | 170-19.9E | June 10 | | |
| OS 08067 | | OSHL 0802 | | | 43-31.3N | 170-20.9E | June 10 | | |
| OS 08073 | | OSHL 0803 | | | 50-20.0N | 175-18.1E | June 12 | | |
| OS 08075 | | OSHL 0804 | | | 51-00.0N | 175-54.0E | June 12 | | |
| OS 08077 | | OSHL 0805 | | | 51-39.9N | 176-30.1E | June 13 | | |
| OS 08078 | | OSHL 0806 | | | 53.25.0N | 178-00.0E | June 13 | | |
| OS 08080 | | OSHL 0807 | | | 53.25.0N | 179-00.0E | June 13 | | |
| OS 08086 | | OSHL 0808 | | | 53-25.0N | 178-00.0W | June 13 | | |
| OS 08087 | | OSHL 0809 | OSSL 0802 | | 53-26.1N | 177-00.5W | June 14 | | -12h |
| OS 08090 | | | OSSL 0803 | | 50-25.0N | 179-50.0W | June 16 | | |
| OS 08091 | | OSHL 0810 | | | 50-05.0N | 179-55.0W | June 16-17 | -11h | |
| OS 08093 | | OSHL 0811 | | | 49-30.0N | 180-00 | June 17 | | |
| OS 08095 | | OSHL 0812 | OSSL 0804 | | 50-20.0N | 172-00.0W | June 19 | -10h | |
| OS 08098 | | OSHL 0813 | | | 51-20.0N | 172-00.0W | June 19 | | |
| OS 08099 | | OSHL 0814 | | | 51-40.0N | 172-00.0W | June 19-20 | -9h | |
| OS 08100 | | OSHL 0815 | OSSL 0805 | | 51-45.0N | 172-00.0W | June 20 | | |
| Cruise #190 - Leg 2 | | | | | | | | | |
| OS 08102 | / | OSHL 0816 | | | 55-00.0N | 166-00.0W | June 24 | -8h | |
| OS 08105 | | OSHL 0817 | | | 56-00.0N | 167-00.0W | June 25 | | |
| OS 08106 | | | | OST 0801 | 55-58.9N | 168-02.6W | June 25 | | |
| OS 08111 | | | | OST 0802 | 56-31.1N | 166-04.9W | June 26 | | |
| OS 08112 | | | | OSSL 0806 | 56-59.0N | 166-00.0W | June 26 | | |
| OS 08114 | | | OSHL 0818 | | 57-00.0N | 168-00.0W | June 27 | | |
| OS 08117 | | | OSHL 0819 | | 56-30.0N | 169-00.0W | June 28 | | |
| OS 08118 | | | OSHL 0820 | | 57-00.0N | 169-00.0W | June 28 | | |
| OS 08120 | | | | OST 0803 | 57-30.0N | 168-00.0W | June 28 | | |
| OS 08122 | | | | OSSL 0807 | 57-28.6N | 165-57.8W | June 28 | | |
| OS 08126 | | | | OST 0804 | 61-51.4N | 173-23.7W | June 30 | | |
| OS 08128 | | | | OST 0805 | 62-09.3N | 174-08.1W | June 30 | | |
| OS 08131 | | | | OSSL 0808 | OST 0806 | 62-56.0N | 173-17.3W | | July 1 |
| OS 08132 | | | | | OST 0807 | 63-30.0N | 172-50.0W | | July 1 |
| OS 08136 | | | | | OST 0808 | 62-38.4N | 171-14.8W | | July 2 |
| OS 08139 | | | | OSSL 0809 | | 63-52.0N | 167-44.8W | | July 3 |

Table 1. continued

| Station Name | | | | | Position | | Date | |
|---------------------|---------|---------------|------------------|-----------|----------|-----------|---------|--------|
| Oceanographic | Gillnet | Hook-and-Line | Surface longline | Trawl | Latitude | Longitude | *S.M.T. | **T.D. |
| Cruise #190 - Leg 3 | | | | | | | | |
| OS 08150 | / | | OSSL 0810 | | 66-10.0N | 168-40.0W | July 7 | -8h |
| OS 08154 | | | | OST 0809 | 69-54.2N | 168-29.8W | July 8 | |
| OS 08159 | | | | OST 0810 | 70-42.9N | 166-35.1W | July 9 | |
| OS 08165 | | | | OST 0811 | 70-24.8N | 163-29.6W | July 10 | |
| OS 08167 | | | | OST 0812 | 70-05.8N | 164-57.6W | July 10 | |
| OS 08170 | | | | OST 0813 | 69-29.5N | 166-57.2W | July 11 | |
| OS 08171 | | | | OST 0814 | 68-31.2N | 168-28.5W | July 12 | |
| OS 08177 | | | | OSSL 0811 | 66-46.9N | 167-16.8W | July 13 | |
| OS 08178 | | | | OST 0815 | 66-37.9N | 168-28.5W | July 13 | |

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

**T.D.: Time Difference between Greenwich mean time and Ship's mean time.

Table 2. Position and research conditions of surface drift gillnet sampling at each station during the *Oshoro maru* Cruise #189 and #190-Leg 1, 2008.

| 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. (N) | Long. (E) | | | |
| Cruise #178 | | | | | | | | |
| OSG 0801 | May 10 17:55-18:24 | May 11 04:25-05:35 | +10h | 43-59.8 | 154-59.6 | 220 | o | WNW-4 |
| OSG 0802 | 11 17:55-18:25 | 12 04:20-05:25 | | 43-58.5 | 155-02.9 | 140 | c | WSW-5 |
| OSG 0803 | 14 17:50-18:18 | 15 04:25-05:25 | | 42-30.0 | 155-00.1 | 230 | c | Calm |
| OSG 0804 | 15 17:51-18:17 | 16 05:05-06:12 | | 41-00.0 | 155-00.4 | 0 | o | SSE-4 |
| Cruise #180 - Leg 1 | | | | | | | | |
| OSG 0805 | June 8 17:52-18:20 | June 9 04:30-05:35 | +11h | 39-00.4 | 170-20.4 | 310 | c | SE-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, c: over 75-99% clouded).

Table 3. Position and research conditions of surface longline sampling at each station during the *Oshoro maru* Cruise #190-Leg 1, Leg 2, and Leg 3, 2008.

| 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 #190 - Leg 1 | | | | | | | | | |
| OSSL 0801 | June 9 03:53-04:10 | June 9 06:07-06:30 | +11h | 39-00.9N | 170-20.5E | 085 | 10 | c | SE-2 |
| OSSL 0802 | June 14 00:15-00:30 | June 14 05:00-05:20 | -12h | 53-26.1N | 177-00.5W | 030 | 10 | d | South-4 |
| OSSL 0803 | June 16 18:16-18:50 | June 16 20:34-20:54 | -12h | 50-25.0N | 179-50.0W | 000 | 5 | f | South-4 |
| OSSL 0804 | June 19 01:48-01:55 | June 19 06:30-06:41 | -10h | 50-20.0N | 172-00.0W | 030 | 5 | d | South-3 |
| OSSL 0805 | June 20 03:58-04:22 | June 20 05:53-06:15 | -9h | 51-45.0N | 172-00.0W | 200 | 10 | f | NE-3 |
| Cruise #190 - Leg 2 | | | | | | | | | |
| OSSL 0806 | June 26 19:01-19:20 | June 26 21:06-21:34 | -8h | 56-59.0N | 166-00.0W | 000 | 10 | c | NNW-4 |
| OSSL 0807 | June 28 20:30-20:46 | June 28 23:58-00:25 | | 57-28.6N | 165-57.8W | 130 | 10 | f | WNW-2 |
| OSSL 0808 | July 1 06:30-06:48 | July 1 10:51-11:18 | | 62-56.0N | 173-17.3W | 300 | 10 | f | SE-4 |
| OSSL 0809 | July 3 03:58-04:18 | July 3 06:52-07:23 | | 63-52.0N | 167-44.8W | 020 | 10 | o | NNE-3 |
| Cruise #190 - Leg 3 | | | | | | | | | |
| OSSL 0810 | July 7 04:45-05:08 | July 7 08:17-08:49 | -8h | 66-10.0N | 168-40.0W | 010 | 10 | c | SSE-4 |
| OSSL 0811 | July 13 04:45-05:08 | July 13 08:17-08:49 | | 66-46.9N | 167-16.8W | 180 | 10 | d | North-3 |

*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 (c: over 75-99% clouded, o: 100% clouded, d: drizzling rain, f: fog).

Table 4. Position and research conditions of bottom trawl sampling at each station during the *Oshoro maru* Cruise #190-Leg 2 and Leg 3, 2008.

| Station | Date and Time of net tow (*S.M.T.) | | Position | | Towing direction | Bottom depth (m) | **Wr | Wind (Force) |
|---------------------|------------------------------------|-------------|----------|-----------|------------------|------------------|------|--------------|
| | | | Lat. (N) | Long. (W) | | | | |
| Cruise #190 - Leg 2 | | | | | | | | |
| OST 0801 | June 25 | 10:02-10:22 | 55-58.9 | 168-02.6 | 210 | 140 | o | North-3 |
| OST 0802 | 26 | 12:56-13:26 | 56-31.1 | 166-04.9 | 180 | 86 | o | North-5 |
| OST 0803 | 28 | 12:45-13:05 | 57-33.8 | 168-06.2 | 150 | 65 | r | NNW-3 |
| OST 0804 | 30 | 11:30-11:40 | 61-49.1 | 173-16.1 | 300 | 63 | o | SSE-4 |
| OST 0805 | 30 | 16:30-16:40 | 62-04.7 | 174-04.6 | 338 | 64 | o | SE-3 |
| OST 0806 | July 1 | 09:38-09:48 | 62-56.5 | 173-16.3 | 310 | 66 | o | ESE-3 |
| OST 0807 | 1 | 14:33-14:43 | 63-24.6 | 172-53.3 | 15 | 63 | o | ESE-4 |
| OST 0808 | 2 | 09:24-09:34 | 62-38.6 | 171-15.4 | 120 | 42 | o | NNE-2 |
| Cruise #190 - Leg 3 | | | | | | | | |
| OST 0809 | July 8 | 1427-1437 | 69-53.9 | 168-40.0 | 170 | 42 | o | South-5 |
| OST 0810 | 9 | 1418-1428 | 70-44.2 | 166-35.9 | 170 | 41 | bc | South-4 |
| OST 0811 | 10 | 0821-0836 | 70-24.1 | 163-27.1 | 030 | 31 | f | SW-2 |
| OST 0812 | 10 | 1457-1512 | 70-05.8 | 164-57.8 | 270 | 37 | c | SE-2 |
| OST 0813 | 11 | 1322-1337 | 69-30.1 | 167-02.7 | 118 | 44 | c | SSE-2 |
| OST 0814 | 12 | 1244-1259 | 68-30.8 | 168-32.7 | 085 | 50 | r | East-4 |
| OST 0815 | 13 | 1315-1330 | 66-39.5 | 168-28.2 | 180 | 35 | f | North-2 |

*S.M.T. : Ship's Mean Time. (Time difference from Greenwich Mean Time is -8 hours.)

** Wr : Weather (bc: 25-75% clouded, c: over 75-99% clouded, o: 100% clouded, c: over 75-99% clouded, r: rain, f: fog).

Table 5. The number of organisms caught by drift gillnet along 155° E in the Northwest Pacific Ocean during the *Oshoro maru* Cruise # 189, 2008. (%) indicates % of total numeric catch by C-gear gillnet at each station.

| Station | | OSG 0801+0802 | | | | | | OSG 0803 | | | | | |
|-------------------------|---------------------------------------|---------------|-----|---|------|--------|-------|----------|-----|---|------|--------|-------|
| Common name | Scientific name | Gear | | | | | Total | Gear | | | | | Total |
| | | A | C | F | CPUE | (%) | | A | C | F | CPUE | (%) | |
| Chum salmon | <i>Oncorhynchus keta</i> | 127 | 51 | 0 | 0.9 | (19.5) | 178 | 13 | 9 | 0 | 0.3 | (2.9) | 22 |
| Pink salmon | <i>Oncorhynchus gorbuscha</i> | 5 | 204 | 0 | 3.4 | (77.9) | 209 | 4 | 278 | 0 | 9.3 | (90.3) | 282 |
| | | | | | | | | | | | | (0.0) | 0 |
| Boreal clubhook squid | <i>Onychoteuthis borealijaponicus</i> | 0 | 0 | 0 | 0.0 | (0.0) | 0 | 0 | 17 | 0 | 0.6 | (5.5) | 17 |
| Eight-armed squid | <i>Gonatopsis borealis</i> | 0 | 7 | 3 | 0.1 | (2.7) | 10 | 0 | 2 | 0 | 0.1 | (0.6) | 2 |
| Spiny dogfish | <i>Squalus acanthias</i> | 0 | 0 | 0 | 0.0 | (0.0) | 0 | 0 | 1 | 0 | 0.0 | (0.3) | 1 |
| Waryfish | <i>Scopelosaurus smithii</i> | 0 | 0 | 1 | 0.0 | (0.0) | 1 | 0 | 0 | 0 | 0.0 | (0.0) | 0 |
| Lanternfishes | <i>Myctophidae</i> | 0 | 0 | 3 | 0.0 | (0.0) | 3 | 0 | 0 | 3 | 0.0 | (0.0) | 3 |
| Japanese Anchovy | <i>Engraulis japonicus</i> | 0 | 0 | 0 | 0.0 | (0.0) | 0 | 0 | 0 | 0 | 0.0 | (0.0) | 0 |
| Pacific Macckereel | <i>Scomber japonicus</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 | 0.0 | (0.0) | 0 | 1 | 1 | 0 | 0.0 | (0.3) | 2 |
| | | | | | | | | | | | | (0.0) | 0 |
| Short-tailed shearwater | <i>Puffinus tenuirostris</i> | 0 | 0 | 0 | 0.0 | (0.0) | 0 | 0 | 0 | 0 | 0.0 | (0.0) | 0 |
| Fulmar | <i>Fulmarus glacialis</i> | 0 | 1 | 0 | 0.0 | (0.4) | 1 | 0 | 0 | 0 | 0.0 | (0.0) | 0 |
| Tufted Puffin | <i>Fraterecula cirrhata</i> | 1 | 1 | 0 | 0.0 | (0.4) | 2 | 0 | 0 | 0 | 0.0 | (0.0) | 0 |

| Station | | OSG 0804 | | | | | |
|-------------------------|---------------------------------------|----------|-----|---|------|--------|-------|
| Common name | Scientific name | Gear | | | | | Total |
| | | A | C | F | CPUE | (%) | |
| Chum salmon | <i>Oncorhynchus keta</i> | 39 | 29 | 0 | 1.0 | (11.1) | 68 |
| Pink salmon | <i>Oncorhynchus gorbuscha</i> | 2 | 148 | 0 | 4.9 | (56.5) | 150 |
| | | | | | | | (0.0) |
| Boreal clubhook squid | <i>Onychoteuthis borealijaponicus</i> | 0 | 5 | 0 | 0.2 | (1.9) | 5 |
| Eight-armed squid | <i>Gonatopsis borealis</i> | 0 | 0 | 0 | 0.0 | (0.0) | 0 |
| Spiny dogfish | <i>Squalus acanthias</i> | 0 | 0 | 0 | 0.0 | (0.0) | 0 |
| Waryfish | <i>Scopelosaurus smithii</i> | 0 | 0 | 0 | 0.0 | (0.0) | 0 |
| Lanternfishes | <i>Myctophidae</i> | 0 | 0 | 3 | 0.0 | (0.0) | 3 |
| Japanese Anchovy | <i>Engraulis japonicus</i> | 0 | 0 | 9 | 0.0 | (0.0) | 9 |
| Pacific Macckereel | <i>Scomber japonicus</i> | 0 | 4 | 0 | 0.1 | (1.5) | 4 |
| Pacific pomfret | <i>Brama japonica</i> | 1 | 10 | 0 | 0.3 | (3.8) | 11 |
| | | | | | | | (0.0) |
| Short-tailed shearwater | <i>Puffinus tenuirostris</i> | 0 | 6 | 0 | 0.2 | (2.3) | 6 |
| Fulmar | <i>Fulmarus glacialis</i> | 0 | 0 | 0 | 0.0 | (0.0) | 0 |
| Tufted Puffin | <i>Fraterecula cirrhata</i> | 0 | 1 | 0 | 0.0 | (0.4) | 1 |

Table 6. The number of organisms caught by drift gillnet at [39.0° N, 170.33° E] in the Central North Pacific Ocean during the *Oshoro maru* Cruise # 190-Leg 1, 2008. (%) indicates % of total numeric catch by C-gear gillnet at the station.

| Station | | OSG 0805 | | | | |
|---------------------|-------------------------------|----------|----|--------|---|-------|
| Common name | Scientific name | Gear | | | | Total |
| | | A | C | (%) | F | |
| Neon flying squid | <i>Ommastrephes bartramii</i> | 5 | 2 | (2.5) | 0 | 7 |
| Blue shark | <i>Prionace glauca</i> | 5 | 8 | (10.0) | 0 | 13 |
| Smalleye squaretail | <i>Tetragonurus cuvieri</i> | 0 | 1 | (1.3) | 0 | 1 |
| Pacific pomfret | <i>Brama japonica</i> | 3 | 69 | (86.3) | 0 | 72 |

Table 7. The catch number of each salmonid at each station where salmonids were collected by hook-and-line gear, surface longline in the *Oshoro maru* Cruise # 190-Leg 1-2, 2008.

| | Station Name | Sampling gear | Species name | | | | Total |
|-------------------|---------------|------------------|--------------|------|------|------|-------|
| | | | Sockeye | Chum | Pink | Coho | |
| Cruise #190 Leg 1 | OSHL 0801 | Hook-and-line | 0 | 0 | 2 | 7 | 9 |
| | OSHL 0802 | Hook-and-line | 0 | 0 | 5 | 2 | 7 |
| | OSHL 0803 | Hook-and-line | 1 | 0 | 0 | 0 | 1 |
| | OSHL 0804 | Hook-and-line | 5 | 9 | 3 | 0 | 17 |
| | OSHL 0805 | Hook-and-line | 0 | 1 | 0 | 0 | 1 |
| | OSHL 0806 | Hook-and-line | 0 | 0 | 1 | 0 | 1 |
| | OSHL 0807 | Hook-and-line | 16 | 0 | 4 | 0 | 20 |
| | OSHL 0808 | Hook-and-line | 0 | 2 | 1 | 0 | 3 |
| | OSSL 0802 | Surface longline | 1 | 1 | 0 | 0 | 2 |
| | OSHL 0809 | Hook-and-line | 30 | 4 | 6 | 0 | 40 |
| | OSHL 0810 | Hook-and-line | 2 | 2 | 2 | 0 | 6 |
| | OSHL 0811 | Hook-and-line | 0 | 2 | 0 | 0 | 2 |
| | OSHL 0812 | Hook-and-line | 3 | 10 | 2 | 0 | 15 |
| | OSHL 0813 | Hook-and-line | 1 | 1 | 0 | 0 | 2 |
| | OSHL 0814 | Hook-and-line | 3 | 1 | 6 | 0 | 10 |
| OSHL 0815 | Hook-and-line | 3 | 0 | 0 | 0 | 3 | |
| | Subtotal | | 65 | 33 | 32 | 9 | 139 |
| Cruise #190 Leg 2 | OSHL 0816 | Hook-and-line | 0 | 1 | 0 | 0 | 1 |
| | OSHL 0817 | Hook-and-line | 0 | 0 | 2 | 0 | 2 |
| | OSSL 0806 | Surface longline | 0 | 1 | 0 | 0 | 1 |
| | OSHL 0818 | Hook-and-line | 1 | 2 | 0 | 0 | 3 |
| | OSHL 0819 | Hook-and-line | 0 | 0 | 2 | 0 | 2 |
| | OSHL 0820 | Hook-and-line | 4 | 0 | 5 | 0 | 9 |
| | | Subtotal | | 5 | 4 | 9 | 0 |
| | | | | | | | |
| | Total | | 70 | 37 | 41 | 9 | 157 |

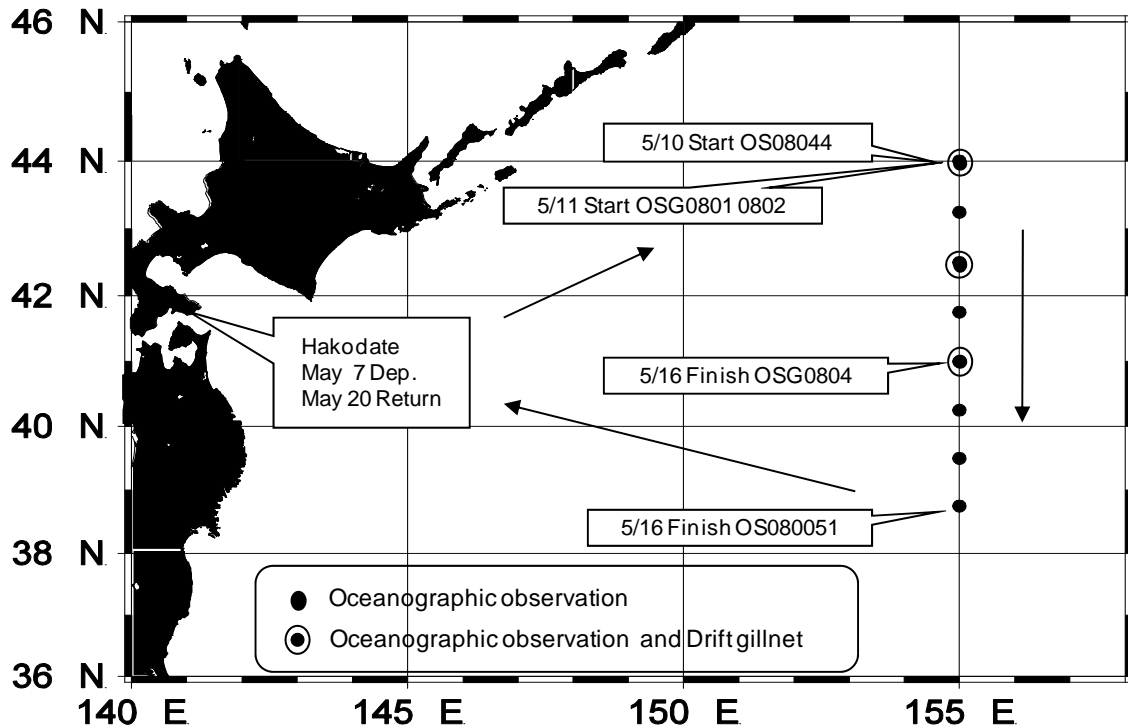


Fig.1-(1). Cruise #189.

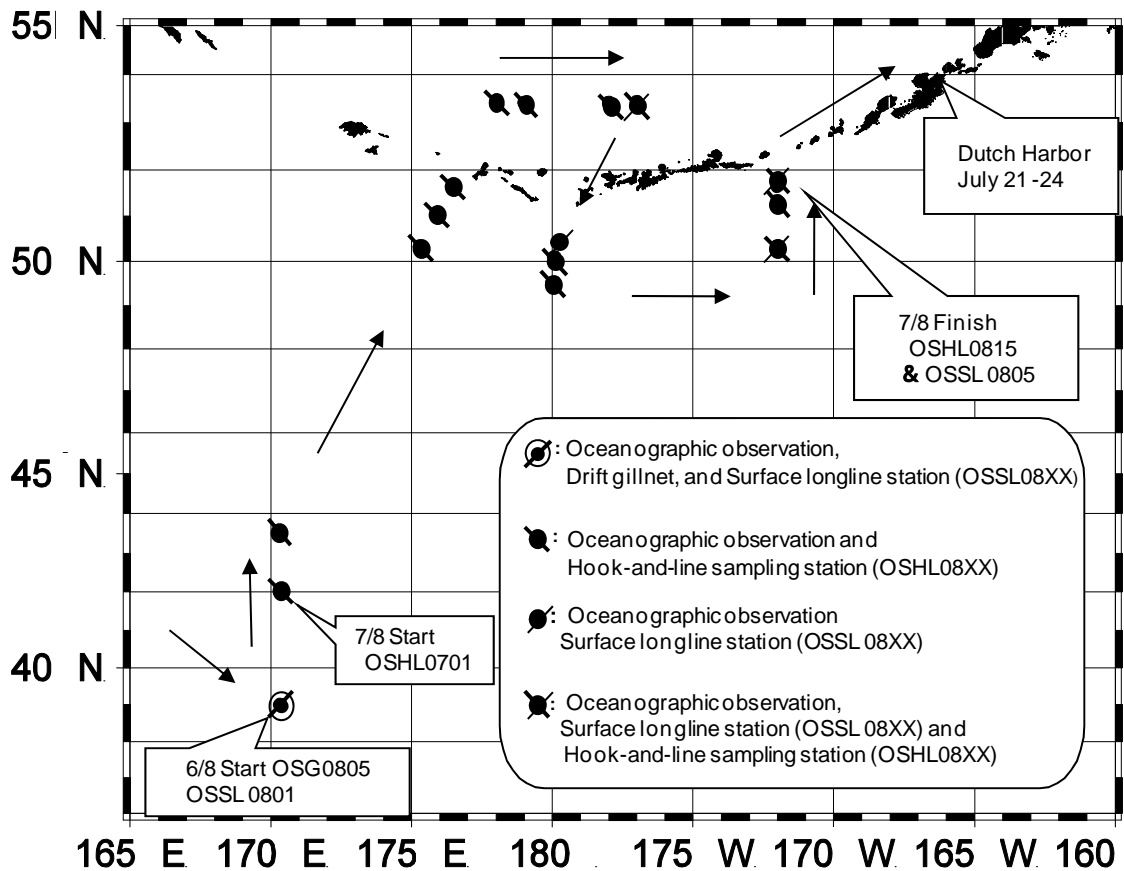


Fig.1-(2). Cruise #190-Leg 1.

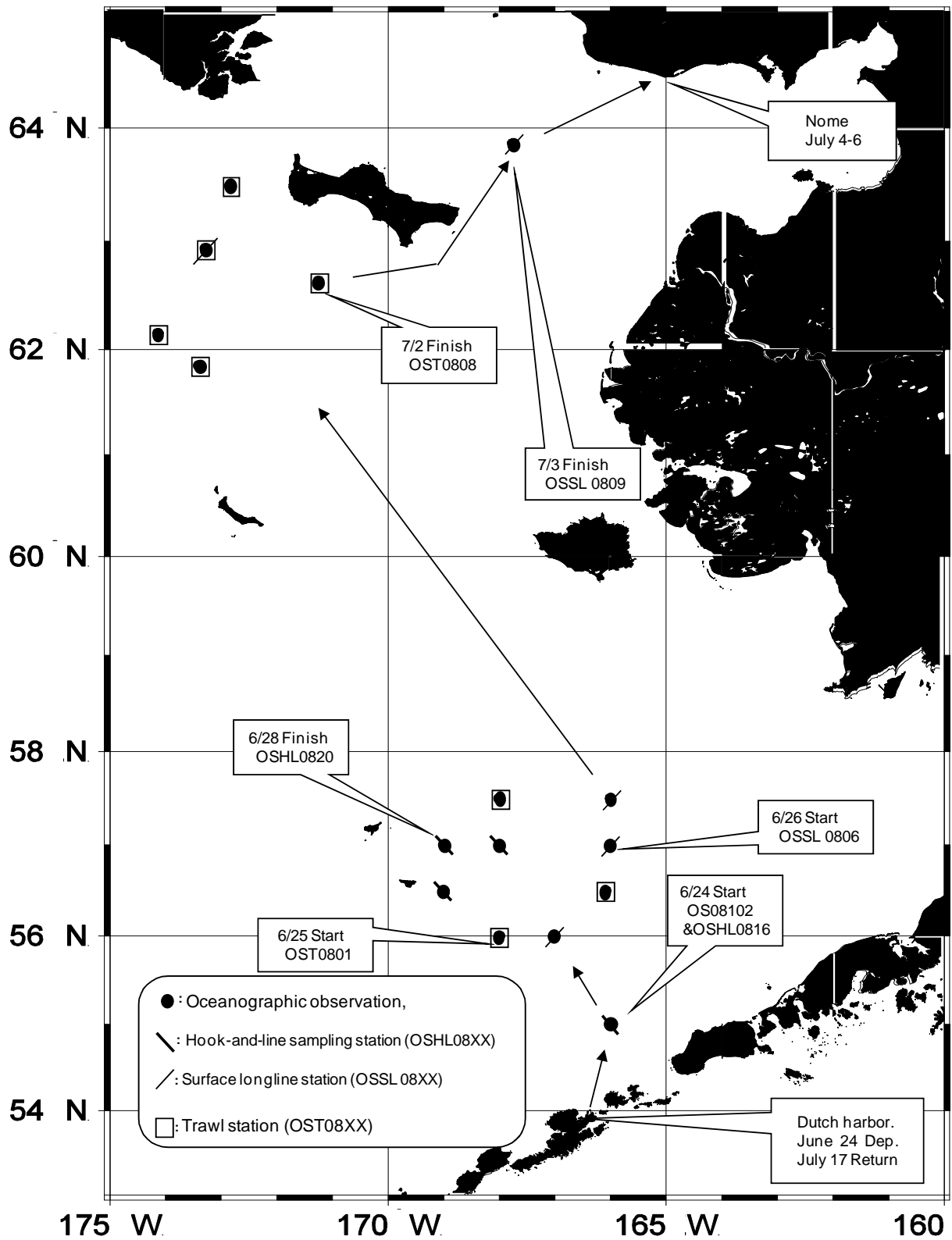


Fig.1-(3). Cruise #190-Leg 2.

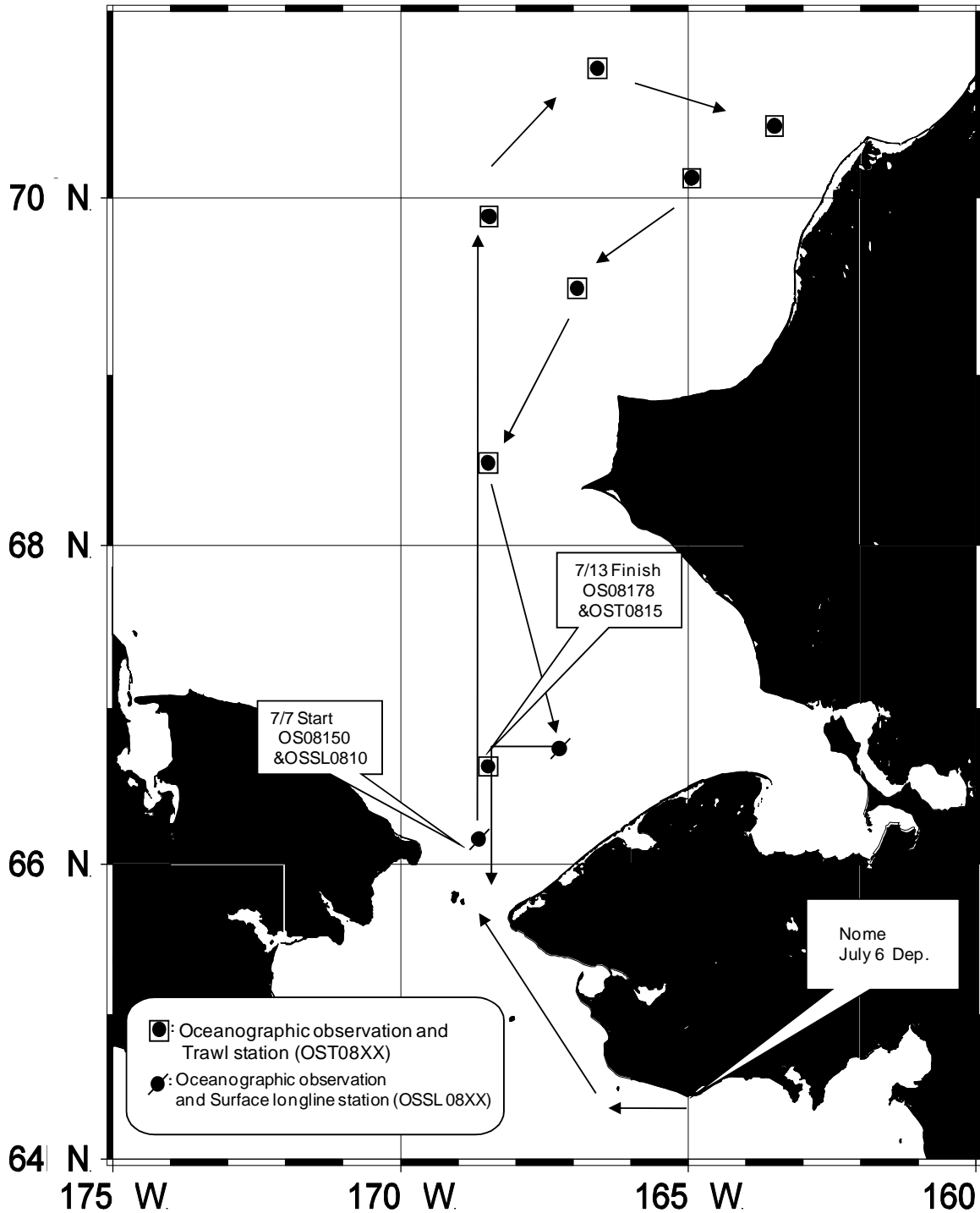


Fig.1-(4). Cruise #190-Leg 3.

Fig.1. Cruise schedule and salmon research stations during the *Oshoro maru* Cruise #189: (1) and Cruise #190-Leg 1: (2), Leg 2:(3), and Leg 3: (4) in 2008. Details about each station are shown in Table 1.

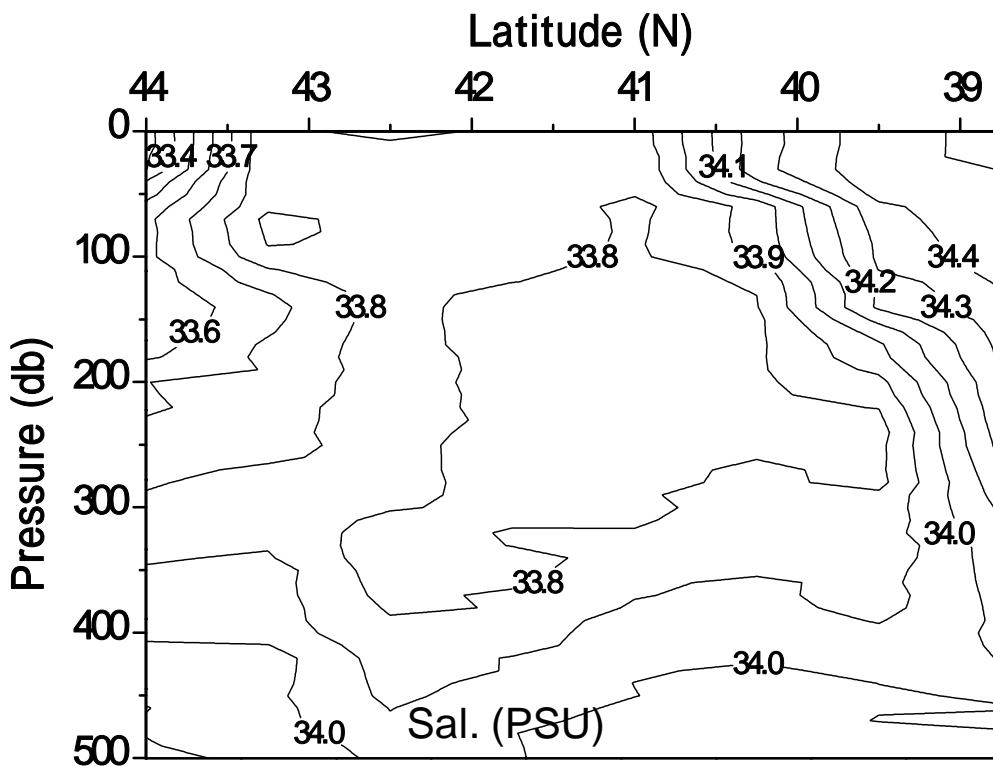
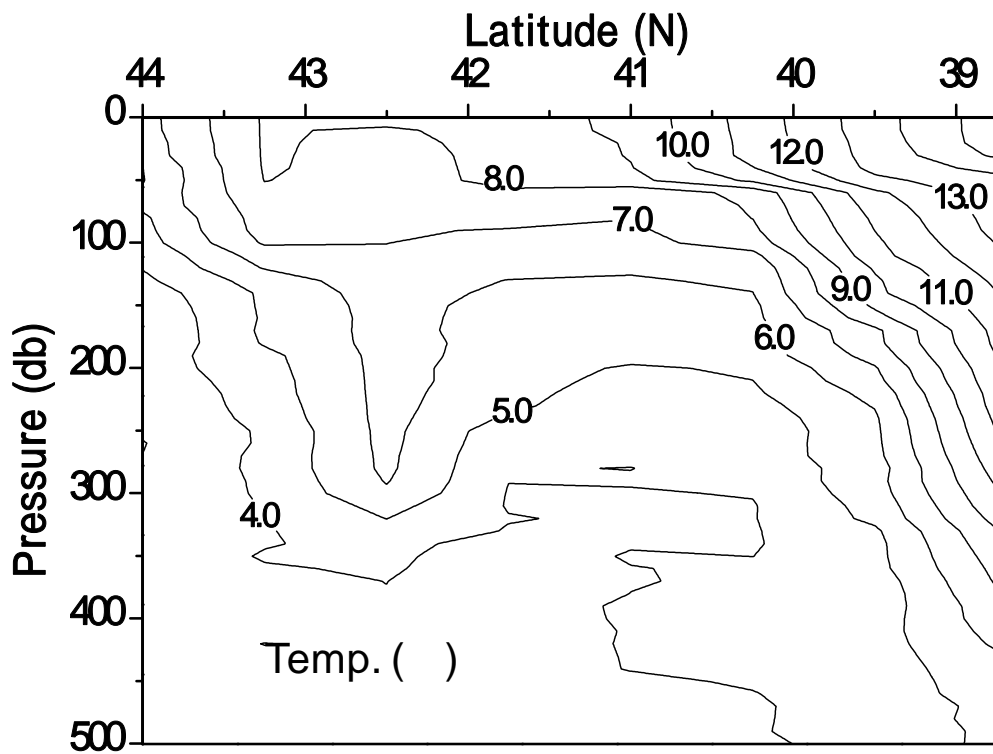


Fig. 2. Temperature and Salinity from surface to 500db pressure along the 155°E transect in the *Oshoro maru* Cruise #189, 2008.

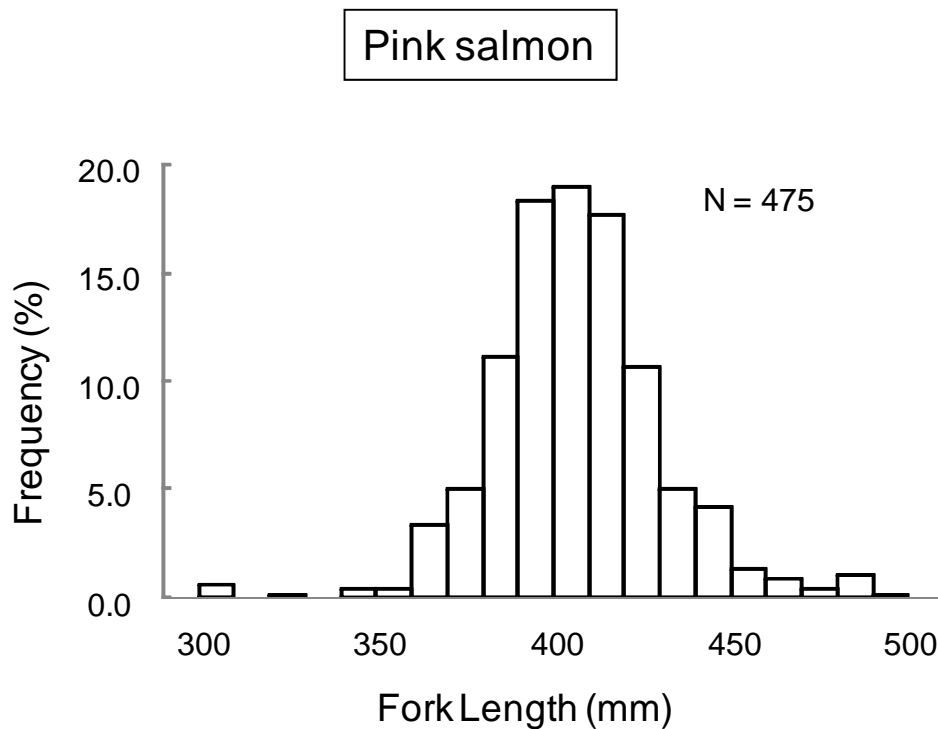
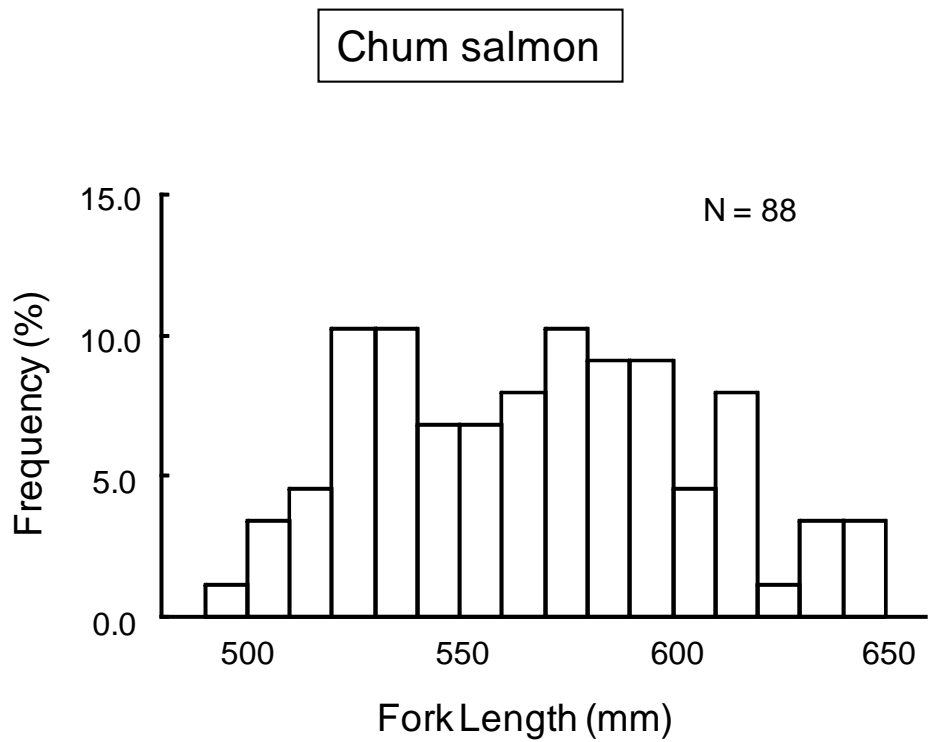


Fig. 3 Fork length frequency distribution of chum salmon and pink salmon caught by C-gear gillnet along the 155° E longitude line during the *Oshoro maru* Cruise #189 in May 2008.