



HOKKAIDO UNIVERSITY

Title	Exploratory Gillnetting from the Oshoro-maru for Juvenile Salmonids off Southeastern Alaska, 24-25 July 1982
Author(s)	JAENICKE, Herbert W.; ジャニックー, ハーバート W.; BRODEUR, Richard D. et al.
Citation	北海道大學水産學部研究彙報, 35(3), 154-160
Issue Date	1984-08
Doc URL	https://hdl.handle.net/2115/23857
Type	departmental bulletin paper
File Information	35(3)_P154-160.pdf



Exploratory Gillnetting from the Oshoro-maru for Juvenile Salmonids off Southeastern Alaska, 24-25 July 1982

by

Herbert W. JAENICKE*, Richard D. BRODEUR** and Takeji FUJII***

Abstract

One hundred and forty-six juvenile salmon (*Oncorhynchus* spp.) were gillnetted from the Oshoro-Marui during one night and one day set 17 km off southeastern Alaska, U.S.A., on 24-25 July 1982. The juvenile salmon (age -0) catch consisted mostly of coho salmon (*O. kisutch*) followed by chum salmon (*O. keta*), pink salmon (*O. gorbuscha*), sockeye salmon (*O. nerka*) and chinook salmon (*O. tshawytscha*). More juvenile salmon were caught at night than during the day. Most salmon gillnetted at night were males; however, neither sex predominated in the catch during the day. The direction the juvenile salmon were migrating differed between the night and day sets. Coho salmon were caught deeper in the net and were eating larger foods than the other species. Four juvenile coho salmon with coded-wire tags were recovered, and all originated from southeastern Alaska hatcheries. This preliminary study demonstrates the potential use of gillnets for future studies on juvenile salmon at sea.

Introduction

During a joint Japanese-United States study, scientists and the crew aboard the research vessel Oshoro-Marui of the Faculty of Fisheries, Hossaido University, made two sets with a small mesh experimental gillnet in the coastal waters of southeastern Alaska, U.S.A., 24-25 July 1982. The purpose of the study was to sample and learn more about juvenile salmon (*Oncorhynchus* spp.) during their first few months at sea, a time of high mortality (Parker, 1968; Ricker, 1976). This study represents the first time gillnets were used in sampling juvenile salmon off southeastern Alaska.

In this report, we demonstrate that gillnets are useful in sampling juvenile salmon at sea. We describe the number and proportion of each species of salmon caught, size of the fish, sex ratio, direction the salmon were moving, depth the fish were captured, and their foods. We also report release and recovery data on four coded-wire tagged (CWT, see Jefferts et al., 1963) juvenile salmon caught during the study. The CWT is a small magnetic wire tag injected into the snouts of smolts before they are released from hatcheries.

* Northwest and Alaska Fisheries Center Auke Bay Laboratory, National Marine Fisheries Service, Auke Bay, Alaska 99821, U.S.A.

(北米西アラスカ漁業センターオークベイ研究所)

** School of Oceanography, Oregon State University, Marine Science Center, Newport, Oregon 97365, U.S.A.

(オレゴン州立大学海洋学部海洋科学センター)

*** Faculty of Fisheries, Hokkaido University, Hakodate, Hokkaido.

(北海道大学水産学部)

Materials and Methods

The fish were gillnetted at 56°30' N, 135°19' W, approximately 17 km west of Whale Bay, Baranof Island (Fig. 1). The surface gillnet was set perpendicular to the coast along a 70° (true bearing) transect. The monofilament gillnet was 1,000 m long, 6 m deep, and had four mesh sizes (29-, 33-, 37- and 42-mm stretch mesh). Each 250-m section had a different mesh size. The net was set at night at 2308 h (Pacific Daylight Savings Time) on 24 July and was retrieved at 0545 h the next day. The net was again set during daylight on 25 July at 1058 h and retrieved at 1734 h. Wind direction and speed, sea-surface conditions, and the position of the net during the set and retrieval were recorded.

As the net was retrieved, size of the mesh was recorded, and juvenile salmon were numbered consecutively as they were brought aboard. Observers determined the direction each fish had entered the net (either toward the north or toward the south) and the depth the fish was caught in the net (the top, middle, or bottom 2 m of the net). Each fish was tentatively identified, and its fork length and weight

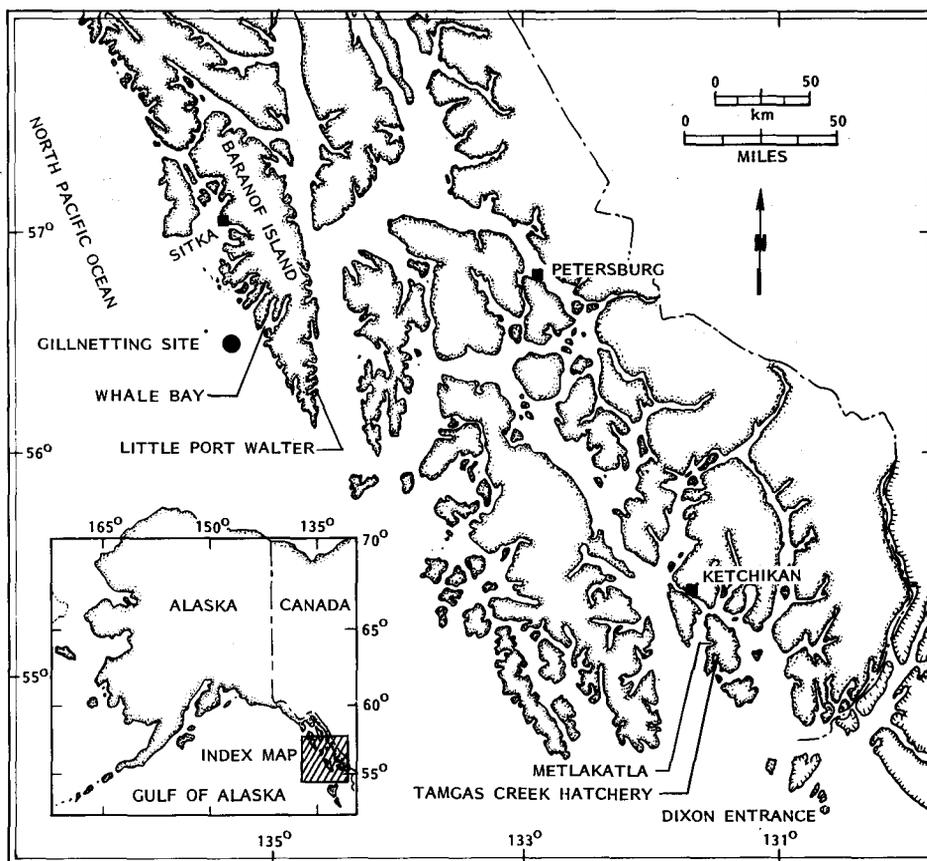


Fig. 1. Site of gillnetting from Oshoro-Maru near Whale Bay, Alaska, 24-25 July 1982.

recorded. Scales were removed from a few rows just above and below the lateral line in a section bounded by the dorsal and adipose fins. All fish were inspected for missing adipose fins, which may be an indication of a CWT fish. The heads of fin-clipped fish were frozen and processed ashore by the National Marine Fisheries Service for the presence and decoding of the CWT's. All other fish were labelled and frozen for later processing.

In the laboratory, the species, sex, and stomach contents of each juvenile salmon were determined. The fish were identified from morphological and scale characteristics. Sex of the fish was determined, when possible, by examining the gonads under a dissecting microscope. Stomach contents were also examined under the dissecting microscope, and the proportions of the total volume of food made up by each major taxonomic category (such as, Euphausiacea and Copepoda) were visually estimated.

Results

Catches

A total of 146 juvenile salmon, 5 adult salmon, and several hundred Pacific herring (*Clupea harengus pallasii*) were caught in the two sest. The juvenile salmon catch consisted of 107 coho salmon (*Oncorhynchus kisutch*), 17 chum salmon (*O. keta*), 14 pink salmon (*O. gorbusca*), 5 sockeye salmon (*O. nerka*), and 3 chinook salmon (*O. tshawytscha*). All of the juvenile salmon had spent less than one year at sea and thus are designated age -0 fish, according to the nomenclature of Koo (1962). More juvenile salmon were caught at night than during the day (Table 1). The species composition of the fish from the two sets was similar. The 42-mm mesh

Table 1. Number of juvenile salmon, by species, caught in four mesh size of gillnet fished near Whale Bay, Alaska, during the night of 24 July and the day of 25 July 1982

Species	Catch by mesh size (stretch measure, mm)					
	29	33	37	42	Total	Percent
Night						
Coho salmon	1	—	6	87	94	72.9
Chum salmon	10	4	2	—	16	12.4
Pink salmon	10	1	2	—	13	10.1
Sockeye salmon	3	—	—	—	3	2.3
Chinook salmon	—	—	3	—	3	2.3
Total	24	5	13	87	129	100.0
Day						
Coho salmon	—	—	—	13	13	76.4
Chum salmon	1	—	—	—	1	5.9
Pink salmon	—	1	—	—	1	5.9
Sockeye salmon	—	—	1	1	2	11.8
Total	1	1	1	14	17	100.0

size caught most of the coho salmon ; the smaller mesh (29-37 mm) caught the other salmon (Table 1).

Sex Ratio

Males predominated in the juvenile salmon catches at night, particularly among the coho salmon, chum salmon, and pink salmon caught (Table 2). Of the 129 young salmon caught in the night set, 121 could be sexed. A chi-square analysis of these sexed fish (82 males, 39 females) indicated a highly significant ($P < 0.001$) proportion of males in the catch. Of the 17 juvenile salmon caught in the day (all were sexed), no significant trend toward a certain sex was evident (Table 2).

Table 2. Size and sex composition, direction of movement and depth of capture of juvenile salmon caught in an experimental gillnet near Whale Bay, Alaska, 24-25 July 1982

Species	Fork length (mm)			Males (No.)	Females (No.)	Direction of Movement		Catch at each depth of net		
	No.	Mean	Range			North (No.)	South (No.)	0-2 m	2-4 m	4-6 m
Catch during night										
Coho salmon	94	195	148-225	60	34	32	26	12	20	26
Chum salmon	16	145	116-179	13	1	12	3	6	8	1
Pink salmon	13	140	119-165	6	1	9	4	9	4	—
Sockeye salmon	3	134	123-142	2	1	3	—	1	2	—
Chinook salmon	3	180	169-192	1	2	2	1	—	3	—
Total	129	—	—	82	39	58	34	28	37	27
Catch during day										
Coho salmon	13	199	189-211	7	6	1	12	1	5	7
Chum salmon	1	137	137	7	—	—	1	1	—	—
Pink salmon	1	153	153	—	1	—	1	0	1	—
Sockeye salmon	2	178	151-205	2	—	—	2	1	1	—
Total	17	—	—	10	7	1	16	3	7	7

Direction of Movement and Depth of Capture

The similar appearance and size of the salmon and Pacific herring caught at night caused some confusion, and we were unable to determine the direction of movement and swimming depth of 36 coho salmon and 1 chum salmon. We were, however, able to determine the direction of movement of the other 92 fish (Table 2): 63% were moving north ; and the rest were moving south. In contrast, only 6% of the fish were moving north during the day (Table 2). During both sets, the wind was from the north, and the net drifted 4 km southward. The seas were calmer at night (1.5-2.4 m, wave height) than during the day (2.4-3.7 m).

Coho salmon were caught deeper in the net than the other species (Table 2). About half the coho salmon from both the night and day sets were caught in the 4-6 m deep section of the net. The other species of salmon were caught closer to the surface, and only one fish was caught deeper than 4 m.

Food Habits

Generally, most of the stomach contents were well digested, especially those from fish caught at night, and it was often difficult to assign the contents to any one major prey category. Juvenile chum salmon, pink salmon, and sockeye salmon ate similar kinds and proportions of foods, primarily larval euphausiids (furcilia stage), hyperiid amphipods, and copepods (Table 3). Small amounts of chaetognaths and crab zoeae were also found in chum salmon stomachs. Only one of three chinook salmon captured had recognizable food in its stomach: most of the food (95%, by volume) was euphausiids, and the rest was hyperiid amphipods.

Coho salmon consumed larger prey than the other species possibly because the coho salmon were larger (Table 2). Euphausiids (subadults and adults), fishes (mostly larval and juvenile gadids and *Ammodytes* sp.), and hyperiid amphipods were the major food items identified from coho salmon stomachs. Crab megalops, pteropods, and gelatinous zooplankton were also consumed but in smaller quantities (Table 3).

Table 3. Occurrence and volume of prey in stomachs of juvenile salmon collected by gillnet off Whale Bay, 24-25 July 1982

Prey	Coho				Chum (n=17)		Pink (n=14)		Sockeye (n=5)	
	Day(n=13)		Night (n=32)		Occ.	Vol.	Occ.	Vol.	Occ.	Vol.
	Occ.	Vol.	Occ.	Vol.						
Euphausiids	76.9	37.1	34.4	14.5	47.1	24.4	42.9	25.0	60.0	63.8
Fishes	69.2	55.0	28.1	21.1	—	—	—	—	—	—
Hyperiid amphipods	61.5	7.1	28.1	5.0	47.1	6.5	35.7	4.9	20.0	1.2
Copepods	—	—	—	—	11.8	5.3	21.4	9.2	20.0	10.0
Decapod larvae	—	—	15.6	2.9	5.9	1.2	7.1	0.3	—	—
Chaetognaths	—	—	—	—	5.9	0.6	—	—	—	—
Pteropods	7.7	0.8	—	—	—	—	—	—	—	—
Gelatinous zooplankton	—	—	9.4	3.8	—	—	—	—	—	—
Unidentified contents	—	—	68.7	52.7	70.6	62.0	71.4	60.6	20.0	25.0

Data for chum salmon, pink salmon and sockeye salmon are combined for day and night sets.
Occ. = percent occurrence; Vol. = percent volume.

Coded-wire Tagged Fish

All four of the juvenile coho salmon with CWT's were from southeastern Alaska hatcheries. Three of them were from a hatchery at Little Port Walter, Baranof Island, and the other was from the Tamgas Creek Hatchery near Metlakatla (Fig. 1, Table 4). The fish had travelled north into the Gulf of Alaska from their release sites, had been at sea 55-75 days and, on the average, had nearly doubled their length and more than quintupled their weight.

Table 4. Release and recovery data for coded-wire tagged juvenile coho salmon caught in a gillnet near Whale Bay, Alaska. All of the fish were released in Alaska

Tagging Agency	Release site	Release date	Release length ³⁾ (mm)	Release weight ³⁾ (g)	Recovery length (mm)	Recovery weight (g)	Days since release
NMFS ¹⁾	Little Port Walter	31 May 1982	113	17.7	190	85	55
NMFS	Little Port Walter	31 May 1982	113	17.7	211	106	55
NMFS	Little Port Walter	31 May 1982	113	17.3	201	105	55
MIC ²⁾	Tamgas Creek Hatchery Metlakatla	11 May 1982	115	18.2	208	99	75

¹⁾ National Marine Fisheries Service

²⁾ Metlakatla Indian Community

³⁾ Mean size of marked fish at the time of release

Discussion

Catches from experimental small-mesh gillnets, as described in this report, can provide useful information on salmon during their first year at sea. Age -0 salmon migrate in a restricted band along the southeastern Alaska coast (up to 37 km off shore) and are most abundant in July and August (Hartt 1980). Thus, we sampled the juvenile salmon when they were most abundant in the nearshore waters of southeastern Alaska.

The large proportion of juvenile coho salmon in the gillnets (73%) is in contrast to the composition of juvenile salmon seined off southeastern Alaska at about the same of the year in 1964-1968. At that time, coho salmon made up only 21% of the -0 age salmon, whereas, sockeye salmon and pink salmon made up most of the catches (Hartt and Dell, in press). These catches indicate the gillnets fished off Whale Bay probably intercepted a large school of juvenile coho salmon.

Results of our limited study indicate behavioral and ecological differences for different species of age -0 salmon. The gillnet was more effective in sampling juvenile salmon during darkness than during daylight. We caught significantly more male than female salmon in the upper 6 m of water at night, which suggests a different migratory pattern for the two sexes. Our observation of a strong southward migration of juvenile salmon during 1 day is opposite to the general northward movement of young salmon determined by directional purse seining in the same general area during daylight (see Hartt, 1980). Changes in the migration direction of the fish during the day may, however, be related to feeding activities of these fish.

Nearly 3% of the juvenile salmon caught during this study contained CWT's. Hundreds of thousands of young salmon are marked each year with coded-wire tags and released from United States and Canadian hatcheries and rivers. Recovery of these tagged fish increases our understanding of the migration routes, timing, and growth of specific stocks along the the Pacific coast.

Future gillnetting studies on juvenile salmon could also include determining the width of their migration path off the Alaska coast in relation to known oceanographic features such as the Alaskan Coastal Current (Royer, 1981) and the Glacier Bay plume (Wing, 1979). Furthermore, gillnets can be useful for studying diel feeding of the juvenile salmon because the nets can be fished equally well at night or during the day.

Acknowledgements

We are deeply indebted to the scientists and crew of the Oshoro-Maru for assistance in sampling the juvenile salmon. J.E. Bailey, M.L. Dahlberg, W.R. Heard, W.G. Pearcy, and A.C. Wertheimer made helpful comments on the manuscript. W.G. Pearcy assisted in initiating the study and arranging for the use of the small-mesh gillnets.

References

- Hartt, A.C. 1980. Juvenile salmonids in the oceanic ecosystem—the critical first summer. p. 25-27. In W.J. McNeil and D.C. Himsforth (eds.), *Salmonid ecosystems of the North Pacific*, 331p. Oregon State University Press, Corvallis, Oreg.
- Hartt, A.C. and Dell, M.B. 1984. Migrations and growth of juvenile salmon and steelhead trout during the first summer in the open sea. *Bull. Int. North Pac. Fish. Comm.* (In press).
- Jefferts, K.B., P.K. Bergman and Fiscus, H.F. (1963). A coded wire identification system for macro-organisms. *Nature* 198, 460-462.
- Koo, T.S.Y. (1962). Age designation in salmon. p. 37-48. In Koo, T.S.Y. (ed.), *Studies of Alaska red salmon*, 449p. University of Washington press, Seattle, Wash.
- Parker, R.R. (1968). Marine mortality schedules of pink salmon of the Bella Coola River, central British Columbia. *J. Fish. Res. Board Can.* 25, 757-794.
- Ricker, W.E. (1976). Review of the rate of growth and mortality of Pacific salmon in salt water, and non-catch mortality caused by fishing. *J. Fish. Res. Board Can.* 33, 1483-1524.
- Royer, C. (1981). Baroclinic transport in the Gulf of Alaska Part II. A fresh water driven coastal current. *J. Mar. Res.* 39, 251-266.
- Wing, B. (1979). Satellite observations of the Glacier Bay Plume. *Coastal Oceanogr. Climatology News* 2 (1), 8-9.