Assessment of Nearshore Fish around Unalaska Using Beach Seines During July 1999.

by

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Abstract

We sampled nearshore fishes around Unalaska during July 1999 using a beach seine. We visited 11 different beaches and collected a total of 7,185 fish and 5 invertebrates comprising 16 species (including two invertebrate species) from a total of 11 sets. Of these species, 9 were represented by their juvenile stage. Little South American and Captain's Bay were dominated by juvenile pink salmon (*Oncorhynchus gorbuscha*) and walleye pollock (*Theragra chalcogramma*), whereas the Dutch Harbor location was depauperate of fish. Juveniles of several key commercial fish use the nearshore regions around Unalaska including walleye pollock and various salmonids (*Oncorhynchus* spp.).

Introduction

Inshore habitats are routinely used by a variety of small schooling (forage) fish (e.g., sand lance *Ammodytes hexapterus*). Furthermore, they act as nursery areas for many other marine fish species (Poxton *et al.*, 1983; Orsi and Landingham, 1985; Bennett, 1989; Blaber *et al.*, 1995; Dalley and Anderson, 1997) including several of commercial importance (e.g., Pacific salmon [*Oncorhynchus spp*.], walleye pollock, and herring [*Clupea pallasi*]). The distribution and health of marine predator populations depends on the abundance and distribution of their prey species. Declines in a variety of predator populations in the Gulf of Alaska have been linked to shifts in abundance and composition of small schooling (forage) fish stocks over the past 45 years (Anderson and Piatt, 1999). The waters around Unalaska host a variety of marine predators including mammals and commercial fish. The distribution and abundance of forage species around Unalaska may well affect the status of these predators, but little is known about spatial patterns of forage species in this area. This study was established to provide some baseline data on the nearshore distribution of different fish species around Unalaska. Furthermore, we focused our research on three specific areas that were proposed for a new harbor location: Little South America, Dutch Harbor, and Captain's Bay.

Methods

Study Area

Unalaska, located in the eastern Aleutian Islands (Fig. 1) has been the site of shelter for native peoples for thousands of years. Use by westerners started with the first Russians explorers in 1759. Since that time, supply ships for the Alaska gold rush, herring fishermen in the 1930s, and the U.S. military during World War II, have used the Unalaska area for shelter and logistics. Fishing booms have come and gone for a variety of fish and crab species; current usage is dominated by the pollock industry. At present, about 4,000 people live in Unalaska. This port's deep, ice-free harbor and location near some of the best fishing grounds in the world continue to make it the center of Bering Sea industry and the hub of the Aleutians.

Increased population and industrialization of the Unalaska area has lead to increased numbers of vessels and industries. This project focuses on three locations that have been proposed as alternatives for an additional harbor.

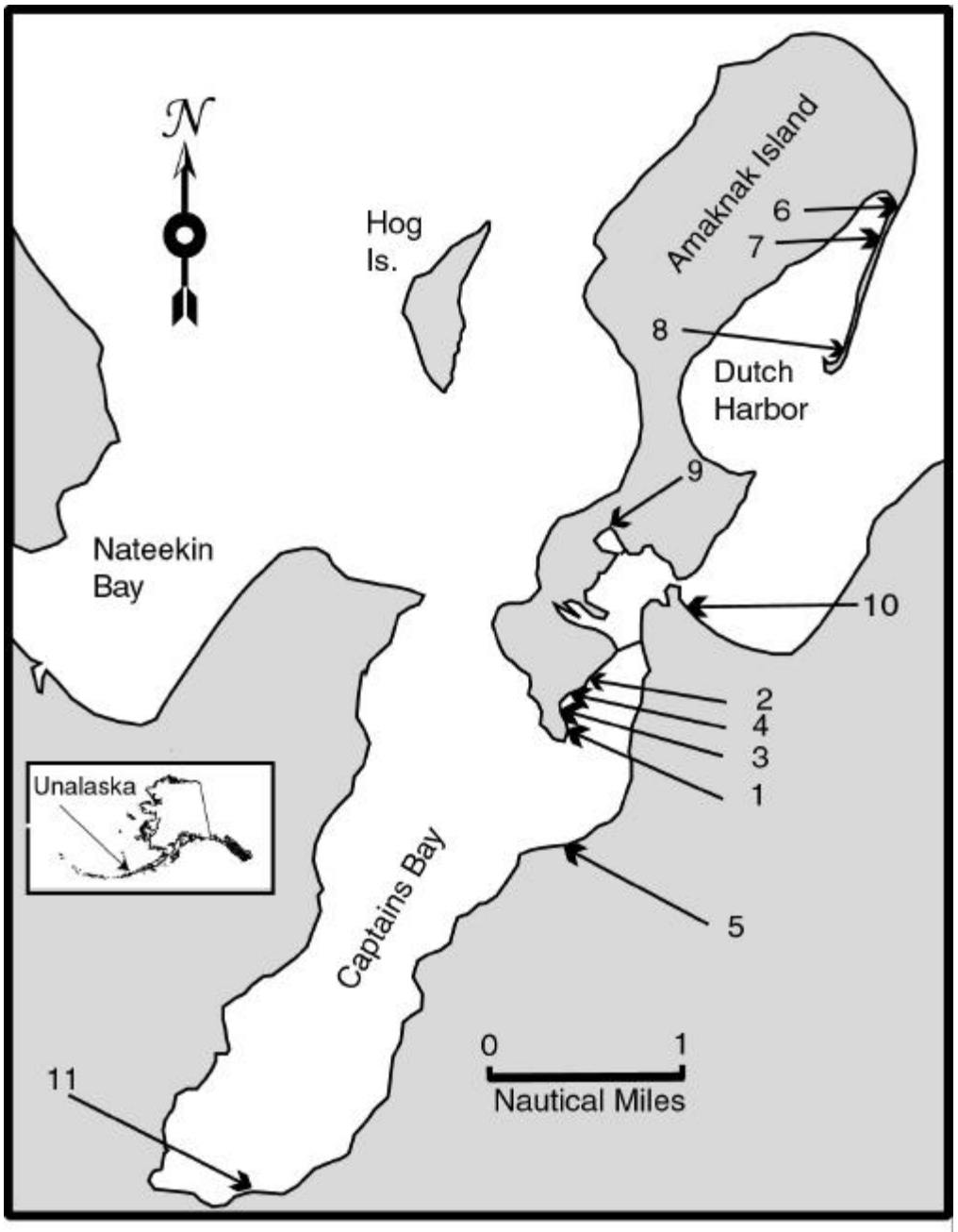


Figure 1. Location of beach seine sample sites around Unalaska.

Fishing Protocol

We used beach seines to sample nearshore fish communities between 20 July and 22 July 1999. This fishing method effectively and non-selectively samples shallow, inshore waters with sandy or smooth bottoms (Cailliet *et al.*, 1986). Our variable-mesh net was 37 m long. The wings were tapered from 2.4 m in the middle to 0.5 m at the wing using 28 mm knotless nylon stretch mesh. The seine was equipped with a 6 mm stretch mesh bag located in the middle of the seine. Thirty meters of rope were attached to the ends for deployment. The net was set parallel to shore about 15 m from the beach as described by Cailliet *et al.* (1986).

We sampled 11 sites around Unalaska (Fig. 1, Appendix 1). Sites 1-4 (Fig. 1) were representative of the proposed Little South America dock location, site 5 of the Captain's Bay location, and sites 6-8 of the Dutch Harbor location. Sites 9-11 were additional sets made for comparison. As the tidal range is very small in this area we sampled indiscriminate to tide. A single set was made as this usually provides good representation of species richness and dominant species rank (Allen *et al.*, 1992; Robards *et al.*, 1999a). Fish were sorted by species, counted, and subsampled individuals were weighed and measured.

Results and Discussion

Beach seines were effective at catching fish. From the 11 sets made in the Unalaska area during our investigation, a total of 7,185 fish and 5 invertebrates comprising 16 species (including two invertebrate species) were caught (Appendix 1 and 2). The resultant catch-per-unit-effort (CPUE) of 653 was high compared to beach seines made in other areas of Alaska. For example, CPUEs of 305-511 were recorded in Kachemak Bay (Robards *et al.*, 1999a), 57 in Glacier Bay (Robards *et al*., 1999b), and 28 in Clam Lagoon (Adak; Hancock, 1975). Of the species caught, nine were represented by their juvenile stage. Juvenile pink salmon dominated the nearshore community at most of the sites, and juvenile pollock were also abundant at Captain's Bay. Marked differences in abundance existed between the three main study areas (Fig. 2). Dutch Harbor in particular was depauperate of fish. Captain's Bay (#5, Fig. 1) was only sampled once, as very little suitable terrain for beach seines was available. Margaret's Bay and Front Beach were sampled for comparison with the main study areas. Similar to Little South America and Captain's Bay, salmonids and pollock dominated these areas although in greater abundance. Finally, for comparison at the head of Captain's Bay we found relatively large numbers of juvenile Pacific Cod, which were not found at any of the other study sites.

Most of the fish caught were young-of-the-year and correspondingly small in size (Fig 3).

Figure 2. Catch-per-unit-effort and Species Composition for the three study sites around Unalaska. Comparative sites that are located relatively close and more distant are also shown.

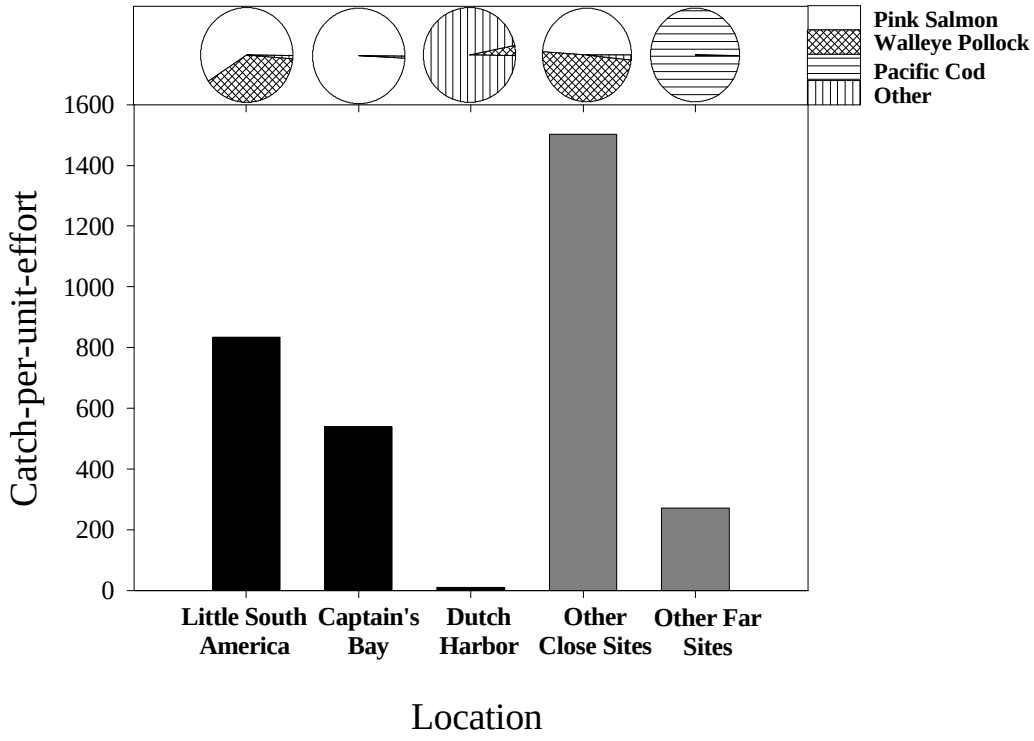
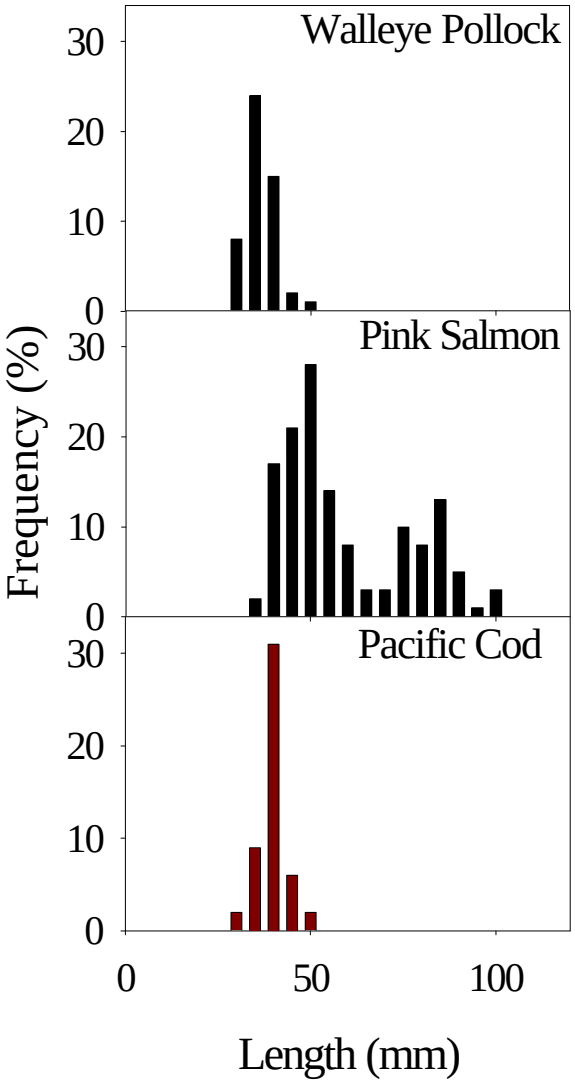


Figure 3. Size frequency of the most abundant species found during the Unalaska Survey



The overall diversity of species in Unalaskan waters (16 species) appeared somewhat depauperate compared to other subarctic areas of Alaska. Isakson *et al.* (1971) caught 40 species in the nearshore waters of Amchitka Island, Robards *et al*., (1999a) found 50 species in Lower cook Inlet, and Orsi and Landingham (1985) found 42 species at a southeast Alaskan site (Auke Bay). However, our short sampling period and limited numbers of seines probably missed species that are only seasonally present at other times.

Apart from the Dutch Harbor site where few fish were caught, catches were dominated by only one or two species, which accounted for over 99 percent of the fish caught. In estuarine, inshore, and bay habitats in the northeastern Pacific, it is typical for five or fewer species to account for more than 75% of the individuals in local fish communities, even though the total number of species comprising these communities may be much larger (e.g., Allen and Horn, 1975; Hancock, 1975; Horn, 1980; Allen, 1982; Gordon and Leavings, 1984; Orsi and Landingham, 1985). As might be expected from these patterns of relative abundance, these fish were predominantly juveniles (Gibson *et al.*,1996) and typically low in the trophic web (Allen, 1982). The general size of fish caught in the nearshore reflected this, as most were less than 100 mm in length (Figure 3).

Recommendations

High-latitude fish assemblages, particularly those found in shallow water habitats, are subjected to large seasonal variations in temperature and day length. These physical factors impart a strong natural seasonality to community structure (Nash, 1988). Some fish species move from shallow water habitats to deeper waters in winter when thermal tolerances are exceeded (Allen and Horn, 1975; Allen, 1982; Bennett, 1989). Decreases in catch size between spring and fall peaks have also been observed by many investigators (e.g., Livingston, 1976; Horn, 1980; Allen, 1982; Thorman, 1986; Methven and Bajdik, 1994; Robards *et al.*, 1999a). These other studies highlight the need for seasonal sampling to establish a full picture of both the species assemblage within an area as well as how abundance changes through a season.

As mentioned earlier, our sampling of the nearshore is restricted to suitable substrates for beach seining. Areas of rocky terrain (which existed within all study areas) or kelp may support other fish species.

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Appendix 1. Catch statistics for beach seines conducted around Unalaska between 7/20/99 and 7/22/99

Set	Date	Site	Time	Pink Salmon	Coho Salmon	Sockeye Salmon	Dolly Varden	Walleye Pollock	Pacific Cod	Atka Mackerel	Sand Lance	Threespine Stickleback	Kelp Greenling	Silverspotted Sculpin	Great Sculpin	Rock Sole	English Sole	Shrimp sp.	Helmet Crab	**Total Catch**
1	7/20/99	Little South America	10:40	322			1	4						2	15					344
2	7/20/99	Little South America	11:00	472				1004							5					1481
3	7/22/99	Little South America	09:00	481				160		1	1				3	2			2	650
4	7/22/99	Little South America	09:30	713			1	149							3				2	868
5	7/20/99	Captain's Bay	11:40	535											3	1				539
6	7/20/99	Dutch Harbor North	12:45												4					4
7	7/20/99	Dutch Harbor North	13:20					1							2					3
8	7/20/99	Dutch Harbor North	14:00												14	9		1		24
9	7/20/99	Margaret Bay	15:50	1672	8							24			9	1				1714
10	7/21/99	Front Beach	11:30			1	1	1268					1		14	3	4			1292
11	7/21/99	Captain's Bay	10:15						271											271

Appendix 2: Common and scientific names for the species caught.

Common Name	*Scientific Name*
Pink Salmon	*Oncorhynchus gorbuscha*
Coho Salmon	*O. kisutch*
Sockeye Salmon	*O. nerka*
Dolly Varden	*Salvelinus malma*
Walleye Pollock	*Theragra chalcogramma*
Pacific Cod	*Gadus macrocephalus*
Atka mackerel	*Pleurogrammus monopterygius*
Sand Lance	*Ammodytes hexapterus*
Threespine Stickleback	*Gasterosteus aculeatus*
Kelp Greenling	*Hexagrammos decagrammus*
Silverspotted Sculpin	*Blepsias cirrhosus*
Great Sculpin	*Myoxocephalus polyacanthocephalus*
Rock Sole	*Lepidopsetta bilineata*
English Sole	*Parophrys vetulus*
Shrimp Spp.	Shrimp spp.
Helmet Crab	*Telmessus cheiragonus*