

43. NEARSHORE FISH AND INVERTEBRATES

43.1 Introduction

The study of nearshore fish and macroinvertebrates was undertaken to collect baseline data on the abundance, distribution, and seasonality of major aquatic species in Iliamna and Iniskin bays (the Iniskin/Iliamna Estuary or IIE) on the western side of Cook Inlet. See Figure 1-4. The studies had four principal objectives:

- Build on the limited knowledge available from past studies to gain a broader understanding of the nearshore ecology of the Iliamna/Iniskin Estuary.
- Describe specific fish habitats of each sampling station.
- Document the food web and ecological relationships among key species of the marine ecosystem.
- Investigate local spawning by Pacific herring.

Marine investigations under this study occurred over the 5-year period from 2004 through 2008. The study included numerous sampling events of fish and macroinvertebrate populations in the Iliamna/Iniskin Estuary in all seasons but mid-winter, when ice and weather conditions prevent safe access. Reconnaissance surveys were first conducted during August and September 2004. Monthly surveys were conducted in 2005 (May-August), 2006 (April, May, and September), 2007 (September and October), and 2008 (March-November).

Several sampling methods were used and included beach seines, gill nets, and trammel nets in littoral areas and bottom trawling in subtidal areas. The sampling targeted fish and macroinvertebrate populations that may use the Iliamna/Iniskin Estuary. Herring spawn surveys were conducted in the intertidal zone by direct observation at minus tidal elevations during known spawning periods. Food web and fish dietary studies were conducted by collecting and analyzing stomach contents of several ecologically important fish species in the Iliamna/Iniskin Estuary.

43.2 Results and Discussion

The Iliamna/Iniskin Estuary is a complex marine ecosystem with numerous fish and macroinvertebrate species that use the area for juvenile rearing, refuge, adult residence, migration, foraging, staging, and reproduction. The array of marine habitats available includes cobble/sand and rocky intertidal areas, intertidal and subtidal mud/sand flats, intertidal and subtidal reefs, and intertidal lagoons. Over 50 species of fish were captured over the course of the study.

One ecological function of the Iliamna/Iniskin Estuary is as a rearing area for juvenile Pacific herring. Herring was the dominant fish species and young-of-the-year and 1-year-olds were the

dominant life stages found from March through November in the several sampling years, with peak occurrences noted during the summer. The range of sizes in young-of-the-year herring suggests that herring from different areas of Cook Inlet may recruit to the Iliamna/Iniskin Estuary annually, in addition to the progeny derived from Iliamna/Iniskin Estuary spawning. Substantial rearing of herring occurs in the nearshore environment for at least 1 year after the fish hatch, followed by an offshore movement as fish reach approximately 100 millimeters in length. Juvenile herring had a distinct preference among the areas sampled for inner Iliamna Bay, and extremely high catch rates of juveniles were observed there at times during the summer. Analysis of data suggests that this preference may be related to the availability of sheltered habitats in the inner bay. Substantially lower use was observed in nearly all areas studied in the Iliamna/Iniskin Estuary. Herring in the nearshore Iliamna/Iniskin Estuary fed heavily on copepods.

Adult herring spawned in Iniskin Bay in 2008 from late May through mid-June, the first documented spawn deposition on beaches in the study area since 1994. Herring spawned in two general areas in the Iliamna/Iniskin Estuary: along the western shore of outer Iniskin Bay near Knoll Head, and along the outer shorelines of Scott Island and adjacent islands, islets, and reefs of eastern Iniskin Bay (Figure 1-3c in Chapter 1). Trace amounts to low densities of spawn were observed along eastern, outer Iniskin Bay near Scott Island and adjacent reefs. Trace to moderate amounts were observed along the western shore of the bay. Historically, herring spawned annually in Kamishak Bay (south of the Iliamna/Iniskin Estuary), expanding into reaches of the Iliamna/Iniskin Estuary during large biomass years. It is not known whether herring spawn detected in 2008 represents a long-term recolonization of the study area by spawning fish. Areas used by spawning fish in 2008 were generally the same areas most consistently used between 1979 and 1991 (Otis et al. 1998). The presence of spawning fish was confirmed by the capture of gravid adults in floating gill-net sets in May 2008.

The nearshore area of the Iliamna/Iniskin Estuary also is a rearing area for juvenile salmon, which as a group, were second to herring in abundance. Juvenile pink and chum salmon were the most abundant salmonid species and showed a typical spring and summer outmigration as young-of-the-year fish. Juvenile chum displayed a short outmigration period during May and June, while juvenile pink salmon remained in the Iliamna/Iniskin Estuary into August. Both species were largely gone by September. Juvenile pink salmon were significantly more abundant in Iniskin Bay, while juvenile chum preferred Iliamna Bay. Both species fed heavily on copepods and terrestrial insects, and juvenile chum also fed on small snails. More than one cohort of juvenile sockeye salmon also used the nearshore Iliamna/Iniskin Estuary during the spring and summer, though at much lower abundances than chum and pink. Very few juvenile coho and Chinook salmon were captured in the Iliamna/Iniskin Estuary.

Multiple cohorts of subadult and adult Dolly Varden were moderately abundant over most of the nearshore Iliamna/Iniskin Estuary from spring through late summer, with a distinct preference for beaches in outer Iniskin Bay. Adult chum and pink salmon were present in the Iliamna/Iniskin Estuary principally in July and August, likely in preparation for freshwater spawning migrations. These species spawn in several streams that drain into Iliamna, Cottonwood, or Iniskin bays. No other salmon species are known to spawn in these streams, although coho salmon have been documented in small numbers in Y Valley Creek.

Nearshore Fish and Invertebrates—Cook Inlet

Several other forage-fish species, including surf smelt, longfin smelt, and Pacific sand lance, use nearshore areas of the Iliamna/Iniskin Estuary, but at much lower abundances than juvenile herring or salmonids. Starry flounder were commonly found along shorelines (in beach seine catches) in inner Iliamna Bay.

Bottom-trawl surveys found that demersal fish assemblages farther from shore in the Iliamna/Iniskin Estuary were substantially different from assemblages caught in littoral areas with beach seines. Snake prickleback was the most abundant species identified in the bottom-trawl surveys. Yellowfin sole, juvenile halibut and several other flatfish species, whitespotted greenling, juvenile walleye pollock, and several species of sculpin were also common in bottom-trawl tows. Based on analysis of stomach contents, dietary habits varied among the species: starry flounder fed heavily on bivalves, while yellowfin sole preferred polychaete worms. Whitespotted greenling fed primarily on amphipods and mysids.

Juvenile Pacific herring were also abundant in trawl catches, but only during the fall months and March, providing evidence for an offshore movement during the winter. The diet of Pacific herring was composed of mainly pelagic prey species dominated by mysids and copepods. Many herring had significant parasite loads in their stomachs, reducing useable stomach volumes.

The highest catch rates for fish in the Iliamna/Iniskin Estuary were in inner portions of Iliamna Bay. The dominant fish species included juvenile herring, Pacific staghorn sculpin, longfin smelt, and starry flounder. Abundances were sufficiently high to indicate that this area provides a distinct and valuable habitat for herring and other fish species in the Iliamna/Iniskin Estuary, although comparable sheltered, inner-bay habitats in Iniskin Bay were not sampled.

Three intertidal lagoons were commonly used by juvenile chum, pink, and sockeye salmon early in the outmigration season. Catches in these lagoons were substantial enough to support the conclusion that these lagoons provide important local rearing habitat for juvenile salmonids that differs from many of the other habitats characterized in the Iliamna/Iniskin Estuary. These lagoons provide the three main estuarine habitat functions ecologically important to juvenile salmon—foraging habitat, areas of transition to marine salinities, and areas where predators can be avoided.

Analysis of sampling data also suggests that the portion of outer Iniskin Bay area between North Head and Knoll Head provides valuable nearshore and stream habitats for pink salmon and Dolly Varden. The catch rates for both species were substantially higher in this area than in other portions of the study area. Large pink salmon runs are known to occur in Y Valley Creek, which discharges to this area. The highest catch rates for adult Dolly Varden also were observed near the mouth of Y Valley Creek, suggesting that this may be a natal or overwintering stream for the species as well as a foraging area during summer months.

Macroinvertebrates were abundant in bottom-trawl catches during the entire March through November period that has been sampled over the study years; catches were dominated by a few species of pandalid and crangonid shrimp. Macroinvertebrate densities did not decrease during the fall and winter periods, as demersal fish abundances did, suggesting year-round use of the Iliamna/Iniskin Estuary by macroinvertebrates. Increased sexual maturity of some

macroinvertebrates, including shrimp, was observed during the fall and winter months. Juvenile Dungeness and tanner crab were at times moderately abundant in trawl catches in the Iliamna/Iniskin Estuary, especially tanner crab in the fall.

Substantially fewer invertebrate species were observed in the catch from beach seine sets than in deeper demersal samples, with the notable exception of high densities of mysids in the beach seine catch in inner Iliamna Bay. Mysids are an important prey species for juvenile salmonids and several other fish species in the Iliamna/Iniskin Estuary.

The epibenthic macroinvertebrates sampled are important prey for several fish species (as confirmed in the diet analysis) in the Iliamna/Iniskin Estuary, including whitespotted greenling, Dolly Varden, and Pacific staghorn sculpin. Several families of invertebrates (amphipods, pandalid shrimp, and crangonid shrimp), common in samples, comprise a substantial portion of the diet of these fish.

43.3 References

Otis, E.O., W.R. Bechtol, and W.A. Bucher. 1998. Coping with a Challenging Stock Assessment Situation: the Kamishak Bay Sac-Roe Herring Fishery. F. Funk, T.J. Quinn II, J. Heifetz, J.N. Ianelli, J.E. Powers, J.F. Schweigert, P.J. Sullivan, and C.I. Zhang (eds.), Fishery Stock Assessment Models. Alaska Sea Grant College Program Report No. AK-SG-98-01. University of Alaska Fairbanks. Pp. 557–573.

Nearshore Fish and Invertebrates—Cook Inlet



Threaded sculpin caught in a trawl sample, March 2, 2010.



Herring spawn on *Fucus* spp., May 27, 2010.



Beach seining in Cottonwood Bay, May 27, 2010.



Pulling in a 120-foot beach seine, November 12, 2008.