Nearshore Fish Atlas of Alaska

INTRODUCTION

The Magnuson-Stevens Fishery Conservation and Management Act of 1996 requires the identification of essential fish habitat (EFH) for species included in federal fishery management plans (FMPs) (Minello 1999). Identifying EFH requires basic information on fish distribution and habitat use. For many FMP species in Alaska, however, such information is limited, especially for early life stages. In particular, resource managers need information on fish use of shallow, nearshore (<20 m offshore and <5 m deep) habitats to protect areas critical to fisheries.

Alaska has about 55,000 km of tidal shoreline (Heard and Andersen 1999) and a wide diversity of estuarine and marine habitats including fiords, bays, channels, and straits. Nearshore areas of intertidal and subtidal vegetation are extremely important because of their high value as fish habitat and vulnerability to human disturbance (North Pacific Fishery Management Council 2002). Two types of submerged vegetation, eelgrass (*Zostera marina*) and kelps (e.g., Laminariales) are widely distributed in lower intertidal and shallow subtidal areas along the coast of Alaska (McRoy 1968; Phillips and Watson 1984; O'Clair and Lindstrom 2000; Wyllie-Echeverria and Ackerman 2003). Other common habitat types in Alaska include steep bedrock outcrops and non-vegetated substrates of sand or gravel. Little information is available on fish use of the shallow, nearshore environment.

Nearshore habitats with and without submerged vegetation provide food resources, cover, and nursery habitat for many marine species important in sport and commercial fisheries (Gotceitas et al. 1997; Norcross et al. 1999; Dean et al. 2000; Spalding et al. 2003). Of the few studies done in Alaska, important commercial and forage fish species found in eelgrass or kelp have included Pacific herring (*Clupea pallasii*), juvenile Pacific cod (*Gadus macrocephalus*), juvenile rockfish (Sebastes spp.), and juvenile salmon (Oncorhynchus spp.) (Laur and Haldorson 1996; Dean et al. 2000; Murphy et al. 2000; Byerly 2001; Johnson et al. 2003, 2005).

This interactive, online atlas provides access to data on the distribution, relative abundance, and habitat use of fishes captured in shallow, nearshore waters of Alaska from 1998 to present. Most of our sampling has been in southeastern Alaska, but we continue to expand our efforts throughout Alaska including Prince William Sound, the Aleutian Islands, and the Arctic.

MATERIALS AND METHODS

Catch data in this atlas were compiled from a suite of studies with different objectives (Murphy et al. 2000; Johnson et al. 2003; Harris et al. 2005; Harris and Neff in prep.; Johnson and Thedinga 2005; Thedinga et al. 2006), but methods of fish capture were similar. Fish are sampled with a beach seine within 2 hours of low tide (range +1.0 to −1.5 m below mean lower low water MLLW). A complete description of the beach seine and its deployment are provided in Johnson et al. (2003). Sample sites are selected based on habitat type as determined by visual observation of the dominant substrate present and the presence or absence of rooted vegetation. Sites also have to be approachable by skiff and free of obstructions (e.g., large boulders). Some sites are sampled more than once in the same year or in different years. A geographic position is obtained in the middle of each seine site with a hand-held global positioning system (GPS). Most sampling, to date, has been in summer.

Habitats sampled include soft bottoms with eelgrass, cobble beaches with understory kelps, steep bedrock outcrops, and sand or gravel beaches with no rooted vegetation. Most eelgrass sites are located inside protected bays and inlets with freshwater influence. Relative to MLLW, eelgrass occupies areas of the lower intertidal and subtidal zones from +1 m to −6 m. Eelgrass usually grows in soft substrates of sand, silt, or mud. Most kelp sites are more oceanic and located in exposed locations at the entrance of bays. Understory kelp occupies subtidal areas to depths of about −30 m. Understory kelps often grow as dense, low-lying mats on rocky substrates. Kelp habitats sampled are usually dominated by *Laminaria saccharina*, a brown kelp that has a smooth blade up to 3.5 m long and 18 cm wide (O'Clair and Lindstrom 2000). Other kelps commonly found with *L. saccharina* are *Cymathere triplicata* and two or more Alaria spp. Bedrock outcrops are usually steep and located in exposed locations at the entrance of bays; kelps (Laminaria and Alaria spp.) are usually attached to bedrock faces. Sand or gravel beaches with no rooted vegetation are generally "pocket beaches" found inside protected bays.

Captured fish are identified to species and enumerated. Fork length or total length (depending on species) is measured to the nearest mm for up to 50 individuals of most species. In large catches (thousands of fish), the number of fish is estimated gravimetrically. To achieve this, a random subsample of approximately 500 fish is removed from the total catch and the remainder of fish are collectively weighed to the nearest 0.1 kg. Fish in the subsample are weighed to the nearest gram and counted by species. A mean weight of fish determined from the subsample is used to estimate the number of fish in the total catch. The proportion of each species in the subsample is also used to determine the species composition of the total catch.

SUMMARY

At least 98 fish species, many of commercial importance, use shallow, nearshore habitats in Alaska. Commercially important and forage fish species that we capture include walleye pollock (*Theragra chalcogramma*), Pacific herring, chum salmon (*O. keta*), and pink salmon (*O. gorbuscha*). Most of these are target species in either a groundfish or salmon FMP in Alaska (North Pacific Fishery Management Council 1998, 2002). Because we capture mostly juveniles, it appears that nearshore habitats may be particularly important nursery and rearing areas for many species. Abundant non-commercial species in nearshore habitats include Pacific sand lance (*Ammodytes hexapterus*) and Pacific sandfish (*Trichodon trichodon*); these species are important prey for sea birds, marine mammals, and other fishes (Paul et al. 1997; Robards et al. 1999).

Most of the habitat types that we examine are common and distributed throughout the rugged and complex coast of Alaska. For most species, eelgrass was utilized more than any other habitat type. Eelgrass offers a complex three-dimensional environment that provides food and shelter for fish that is otherwise lacking on bare or sparsely covered bottoms (Heck and Orth 1980; Spalding et al. 2003). Some species, however, exhibited a preference for habitats other than eelgrass. For example, most flatfish were captured on sand-gravel substrates, walleye pollock in rocky areas with kelp, and Pacific sandfish near bedrock outcrops.

Our sampling represents only a "snapshot", temporally and spatially, on fish and habitat distribution. The patchy distribution of some fish species and differences in water temperature,

salinity, proximity to spawning areas, life stage, sampling effort, and time of sampling can determine the presence or absence of any given species at any given time. For example, the fact that we did not capture chum salmon fry in late fall or winter at a given site does not mean that they would not have been present in the spring. In addition, the absence of a particular habitat type (e.g., eelgrass) from any given locale represents a lack of sampling of that habitat type and not necessarily the absence of that habitat type.

This atlas provides access to data on nearshore fish assemblages and essential fish habitat in Alaska. Information on distribution and habitat of fishes will help resource managers identify important fisheries habitat. The geographic coordinates of all sampling sites identifies locations of sensitive habitat types (e.g., eelgrass) that may need protection as EFH. Further studies are needed to identify the spatial coverage of eelgrass and other important habitat types in Alaska and the function of these habitats as EFH. Shallow, nearshore waters support a diverse and abundant community of fishes, many of commercial importance, and should be protected from human disturbance.

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