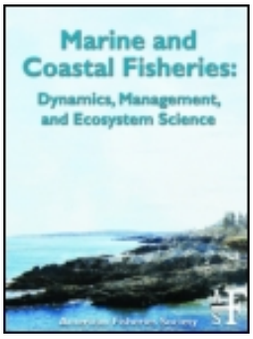

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Introduction to a Special Section: Atka Mackerel Distribution, Life History, Ecology, and Management

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This suite of papers on the life history, ecology, and management of Atka mackerel was originally presented at a research symposium (29–30 April 2008) in Seattle, Washington. The studies were done as a collaborative effort between the Alaska Fisheries Science Center, the University of Alaska–Fairbanks, the Alaska Sea Life Center, and the North Pacific Fisheries Foundation. This research was funded by the National Marine Fisheries Service, the North Pacific Research Board (project 522), and the North Pacific Fisheries Foundation.

Atka mackerel *Pleurogrammus monopterygius* are widely distributed along the continental shelf extending from the Kuril Islands in Asia through the Gulf of Alaska. They are the most abundant groundfish in the Aleutian Islands region, with an estimated exploitable biomass of 388,500 metric tons in 2010 (Lowe et al. 2009), and are a key component of the Aleutian Islands ecosystem. Within Alaska waters they are concentrated in the Aleutian Islands chain, where they form dense aggregations in island passes.

Atka mackerel are obligate spawners on hard rocky bottoms and exhibit a polygamous mating system, elaborate sexual dichromatism, and social behaviors that have been documented in other hexagrammids. Nesting colonies are widespread across the continental shelf and are associated with areas of strong currents and hard substrate as deep as 144 m (Lauth et al. 2007). In June, the reproductive phase begins with adult males establishing individual territories within nesting colonies. Adult females aggregate in dense patches close to the nesting colonies during the spawning season, presumably to feed (Cooper and McDermott, unpublished).

In July spawning starts, and during a 12-week period ending in mid-October females spawn four to five batches of adhesive eggs in the territories of different males (McDermott et al. 2007). After spawning, females disperse and males guard the nests until the eggs hatch following an incubation period of 39–75 d in the eastern and central Aleutian Islands, with maximum hatching occurring in late November (Lauth et al. 2007).

Atka mackerel exhibit a size cline across their range, with individuals having smaller sizes at age in the western Aleutian Islands area and larger sizes at age in the eastern areas. Historical morphological and meristic studies provide some indications of separate populations within Alaska. However, a genetic study of allozyme variation showed no evidence of discrete stocks (Lowe et al. 1998), a result that is reexamined in this special section using another class of nuclear markers.

Atka mackerel's highly localized aggregations and their overall large biomass make them an important prey species in the Aleutian Islands ecosystem. Atka mackerel have been identified as the main prey item for the endangered Steller sea lion *Eumetopias jubatus* and fish species such as Pacific cod *Gadus macrocephalus* and arrowtooth flounder *Atheresthes stomias* (I. Ortiz and E. Logerwell, National Marine Fisheries Service, unpublished). Adult Atka mackerel consume a variety of prey but principally feed on calanoid copepods, euphausiids, and myctophid fishes (Rand 2007). Egg cannibalism during the spawning period has been observed for both sexes. Heterocannibalism by both sexes and male filial cannibalism are common phenomena in species that have evolved to provide exclusive paternal care.

Atka mackerel are the target of a large offshore commercial fishery in the Aleutian Islands. The spatial patterns of the fishery generally reflect the distribution and behavior of the species; the fishery is highly localized and focuses on the same locations each year, almost exclusively at depths shallower than 200 m. The fishery is currently managed by the North Pacific Fishery Management Council under a quota system whereby the overall total allowable catch (TAC) is divided into two equal seasonal allowances: an A-

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season allowance from January 1 to April 15 and a B-season allowance from September 1 to November 1. In addition, the Atka mackerel TAC is allocated to three subregions within the Aleutian Islands. The spatial dispersion of the TAC was initially implemented as a proactive measure to prevent localized depletion of Atka mackerel. The seasonal apportionments were implemented in response to concerns about Steller sea lions. Both actions serve to temporally and spatially disperse catch as a precautionary measure. Furthermore, the Atka mackerel fishery is rationalized through the formation of cooperatives that self-manage allocations of the quota among the participants. The TAC for 2009 was set at 76,400 metric tons; the total Atka mackerel catch was about 75,000 metric tons, with an estimated first wholesale value of US$67.6 million.

Historically, the Atka mackerel fishery has operated close to sea lion rookeries in the Aleutian Islands and largely within areas now designated as critical habitat for Steller sea lions. Concerns that commercial fishing might cause localized depletion (Lowe and Fritz 1997) resulted in a suite of protective measures in 1992, including 10–20 nautical mile trawl exclusion zones (TEZs) in critical habitat around sea lion rookeries and haulouts (Fritz et al. 1995). The designation of TEZs was largely intended to preserve prey abundance for Steller sea lions at local scales. Due to the ecological importance of Atka mackerel as a forage item for sea lions and its value as a commercially exploited species, a broad-scale tagging effort has been undertaken to estimate local abundance in and around these TEZs. The tagging research cruises have also been used as platforms to conduct basic research on the life history, ecology, and population dynamics of Atka mackerel. Many of the results of these research cruises are reported in this special section.

This collection of studies provides a broad foundation for examining an exploited fish species from an ecosystem perspective. Even though the studies presented here focus on a single species, such in-depth analysis of the life history and distribution of this key species in the Aleutian Island ecosystem can provide us with insights on the ecology and management of other species in this system. For instance, the small-scale distribution and spawning behavior of Atka mackerel will affect their availability to predators and impact their own prey field as well as influencing fishing locations and local exploitation rates. Therefore, the knowledge gained from these studies provides the framework needed to incorporate future research efforts toward integrating ecosystem-based perspectives with present fisheries management and conservation practices.

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