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## Researcher Focuses on Atka Mackerel

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A NOAA Fisheries researcher has turned his attention to one of the more interesting and perhaps important fish species in the North Pacific-Atka mackerel. The brightly colored mackerel is caught in trawl fisheries along the Aleutian Islands and by sport fishers around Homer, Seward, and in Prince William Sound. Not only do some humans enjoy the taste of Atka mackerel, Steller sea lions favor them as a primary food source.

jpg Atka Mackerel

"Understanding the complex reproductive behavior of Atka mackerel is essential for conserving and managing the species," said Robert Lauth, Alaska Fisheries Science Center biologist who has been studying the species for seven years. Atka mackerel stocks are doing well. "It's an opportunity to study an important fish species that has not declined," he said.

"Atka mackerel is the only fish species in Alaska that is targeted by a major commercial trawl fishery and also exhibits a peculiar life history trait where males take care of the developing young for extended periods," Lauth explained.

In late spring, large groups of males aggregate in rocky and high current areas to establish nesting territories in depths ranging from 15 meters to 140 meters. They appear to spawn and nest in a variety of rocky habitats but seem to prefer those close to island passes or headlands and those near the continental shelf drop-off. Individual males defend their nesting territory and remove marine life and debris in preparation for a female to lay a clutch of eggs. To find deep-water nurseries, Lauth developed a portable winch and camera system for making direct visual observations of nesting male Atka mackerel in deep waters. In shallower waters, scuba divers place underwater cameras for the same sort of observations.

Atka mackerel females form large schools and usually remain separated from nesting males. They visit nesting sites several times during the summer and fall, choose a mate, and spawn a batch of eggs. Both males and females can spawn with more than one mate during the spawning season. Egg clutches are adhesive and are securely wedged into depressions or crevices in boulders, cobble, and rocky reefs. Individual clutches of eggs need to be tightly clumped, otherwise the strong ocean currents and surge, essential for providing more oxygen to promote healthy egg development, would dislodge and sweep them away.

"The relation of spawning and nesting sites to ocean currents may be very important to the survival of the hatched larvae and to the population structure of Atka mackerel." Lauth said.

Lauth thinks that light may be one of several factors limiting the depth of Atka mackerel spawning and nesting sites. During his most recent study, he noticed a sudden drop-off of nesting males at 140

meters even though neither the temperature nor bottom habitat changed. Lauth states that, "Atka mackerels are obviously visual animals," evidenced by their reliance on color in a ritualistic mating display, and on daily vertical migrations in response to light and darkness.

Lauth is working with Jared Guthridge from the Alaska SeaLife Center and Nicola Hillgruber from the University of Alaska Fairbanks to see how water temperature influences egg development. Having this information will enable him to figure out exactly when females are spawning and how long males stay to guard nests.

Males must vigilantly guard developing egg clutches until they hatch to protect them from being eaten by fish and invertebrates or from being smothered by kelp and other debris. If Atka mackerel are spawning as late as October, and if the ocean's temperature at a nesting site was around 4°, Lauth believes it is possible that males could be confined to their nesting territory for up to 7 months, from June to January. It is still unknown how spawning and nesting periods vary from site to site or from one end of Alaska to the other.

Lauth would also like to conduct more studies of Atka mackerel spawning and nesting behavior. When gravid females swim overtop a male's nesting territory, the male will swim up to meet her, turns into a nose dive, wags his tail up and down like a handshake, and points toward the spot where he wants the female to lay her eggs.

"I would like to use sonic tags to see if males return to the same nesting spot year after year," Lauth said. He would also like to place underwater cameras on a nesting site and record behavior around the clock for a couple weeks during the peak spawning season. With the high density of males at nesting sites, Lauth also wonders if males from adjacent nests try to sneak in and fertilize the eggs of their neighbor while the female is laying the eggs.

One of the more curious aspects of the Atka mackerel's reproductive behavior is egg cannibalism. Larger Atka mackerel (>35 cm) of both genders eat eggs from nests. "Guarding males probably have limited opportunity to feed during the extended nesting season so it is understandable that they might eat from the cookie jar every now and then". Lauth has also observed 20-30 females ganging up to eat eggs from a nest while the guardian male hovered helplessly nearby. There are several theories on egg cannibalism in fishes, including reproductive competition, low food availability, or opportunistic feeding.