Effects of Maternal Growth on Fecundity and Egg Quality of Wild and Captive Atka Mackerel (Pleurogrammus monopterygius):

Big Fat Female Fish are More Fecund

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Objective
Examine how growth and condition affect realized fecundity and egg energy:
1. Estimate total fecundity, batch fecundity, and atresia from three populations with different growth patterns: Amchitka Island, Seguam Pass, and fish held in captivity.
2. Estimate the egg energy content from wild fish and compare to fish held in captivity

Background
Atka mackerel are the most abundant groundfish in the Aleutian Islands (2009 adult biomass 300,000 metric tons). They are distributed in dense aggregations in areas of strong currents from Kamchatka to the Gulf of Alaska along the Aleutian Island chain.

Adult Atka mackerel do not move much. Tagging studies show that 95% of adult Atka mackerel stay within their home range (20-50 nautical miles) (McDermott et al., 2005).

Life history
Atka mackerel are semi-pelagic and mostly occur at a depth of 100-200 m. During the spawning season from July through October, males establish nesting sites where they actively guard the nests. Atka mackerel females are batch spawners and spawn on average four to five batches of eggs in rock crevices or among stones. The eggs are fairly large (2-3 mm diameter) and will be glued together in tight egg-masses that attach to the substrate (McDermott et al., 2007).

Methods
Wild fish collection
Atka mackerel were collected during NMFS research cruises on R/V research vessels. Five females were randomly collected during each travel haul. Females were length, weighed, and the ovaries and ovary were extracted. For each female, one ovary was processed into histological slides with H&E stain for ovary stage determination. The other ovary was sub-sampled for fecundity analysis using the gravimetric method.

Captive fish collection
The 5 captive females were collected from various locations in the Aleutian Islands during a NMFS cruise using bottom trawl gear. The fish were held in seawater tanks until arrival in Dutch Harbor from where they were transported in oxygenated coolers to the Alaska Seafarl Center in Seward. They were transferred into live tanks and fed to satiation three times a week for the remainder of the study.

Conclusions:
Atka mackerel fecundity is best predicted by weight not length. Fecundity differed significantly for areas with different growth patterns. Egg quality was significantly higher for large captive fish than for smaller wild fish. In order to correctly estimate the reproductive output of Atka mackerel populations, it is important to track fish growth and condition on a local scale.

Fat big fish produce more and higher quality eggs.

References
McDermott, S.F., L.W. Fritz, and Y. Hsu 2005. Extracting movement and abundance of Atka mackerel (Pleuragrammus monopterygius) using tag-recapture data. Fish. Oceanogr. 14 (Suppl. 1):113-130.

McDermott, S.F., J.L. Guthridge, and D.B. Schlesinger. 2005. Fecundity, batch fecundity, and respective stages of Atka mackerel (Pleuragrammus monopterygius) in Alaskan waters. Fishery Bulletin 103(4):4-16.

Seguam
Amchitka Island
6 Year old females:
Length: 64 cm
Weight: 2.750 kg
Fecundity: 79,000 eggs
Potential fecundity: NA
Atresia: 9,200 eggs
Batch Fecundity: 6,400 eggs
Real. Fecundity: 46,000 eggs

Potential Fecundity (Thousands)
30 40 50

0 10 20 30 40 50
Age (Years)

Figure 3: Fecundity by length

Fork Length (cm)

Potential Fecundity

300 500 700 900

0 100 200 300

Figure 2: Atka mackerel Length by Age

Amchitka Island
Seguam Pass
10 12 14
Age (Years)

Figure 5: Fecundity by age

Figure 4: Fecundity by weight