

Identifying potential spawners: a maturity validation study of sablefish in Southeast Alaska

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Abstract

Sablefish, *Anoplopoma fimbria*, is one of the most commercially important species in Southeast Alaska. The Chatham Strait longline fishery was estimated at an ex-vessel value of \$4 million with an average price per pound of \$2.67 in 2007. Estimation of maturity is essential for determining an appropriate harvest rate, and in order to accurately estimate maturity ovaries must be classified correctly. In 2007, 215 sablefish ovary samples were collected during a longline survey performed by the Alaska Department of Fish & Game in Chatham Strait. Ovary samples were collected from all developmental stages in order to assess the validity of the current maturity classifications, as well as the timing of the maturity staging with respect to the spawning season. Particular emphasis was placed on resolving uncertainty of staging at early developmental stages: separating spawners of the approaching season from spawners of the following season. Maturity state was determined by macroscopic inspection, based on ovary size and appearance, and histological examination, based on the most advanced oocyte stage present. Histological analysis confirmed the overall appropriateness of most macroscopic stages. However, a high degree of misclassification of ovaries staged macroscopically as "maturing juvenile" occurred. Histological examination revealed that 51% of these ovaries had oocytes that contained yolk and 49% possessed only immature oocytes. This indicates that at least half of sablefish staged macroscopically as maturing juvenile will spawn in the approaching season. If a stock assessment model is used that requires the identification of potential spawners, then the outcome is likely an increase in spawning stock biomass when histological results are considered in addition to macroscopic maturity classification.

Methods

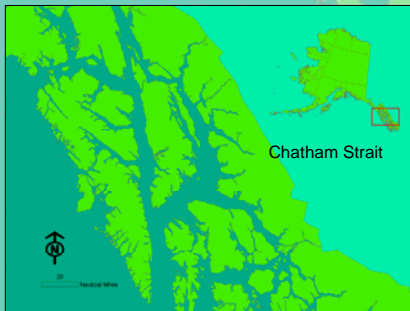
- In Aug. 2007 ovary samples and maturity data, fork length, weight, and a maturity stage based on a 6-point macroscopic scale (Tab. 1) were collected from 215 sablefish during an ADF&G longline survey in Chatham Strait.
- Histological analysis was used to validate the appropriateness of macroscopic maturity staging.
- Ovaries were classified by histology into a maturity state based on the most advanced oocyte stage present.
- To obtain a general idea of the spawning schedule of sablefish in Chatham Strait, the proportion of ripe and spawning/spent fish was plotted by month for fish sampled from 2002–2007.

Results

- Maturity data were sampled from a total of 215 ovaries in 2007.
- No yolk was observed in sablefish ovary samples macroscopically classified as "immature".
- Yolked oocytes were found in 51% of ovaries staged macroscopically as "maturing juvenile" (Fig. 1).
- All fish macroscopically classified as "mature/developing" contained yolked oocytes and "spawning" fish contained yolked and/or hydrated oocytes as the most advanced oocyte stage present.
- 96% of fish classified as "spent/post-spawning" and 88% staged as "resting" had yolk in their oocytes.
- 50% of females examined from Chatham Strait (2002–2007) spawned by the end of February; from January through April a decline occurred in the proportion of fish with ripe ovaries (Fig. 2).

Table 1. Macroscopic maturity stages

1-Immature	Ovaries appear as two narrow ovoids. May be veined.
2-Maturing juvenile	Ovaries enlarging, translucent and pinkish to clear; eggs not yet discernable. Has not spawned before. Will spawn coming year.
3-Mature/developing	Ovaries large and becoming white to yellowish white with developing eggs discernable and firmly attached.
4-Spawning	Ovaries very large with translucent eggs loose within ovary or extruding from the oviduct.
5-Spent/post spawning	Ovaries shriveled and opaque, soft and flaccid, often reddish in color.
6-Resting	Ovaries large, firm and opaque, not shriveled. No eggs discernable. Has spawned previously. Noticeable follicle structure.



Introduction

- Sablefish are a commercially valuable deep water species that occur in the Bering Sea, south to Japan in the western Pacific and to Baja California in the eastern Pacific (Mecklenburg et al. 2002).
- Sablefish are long-lived. Forty-year old fish commonly occur in commercial samples, and in Southeast Alaska, the maximum reported age is 79 years. Length at 50% maturity was estimated at 58.3 cm for females and 52.4 cm for males off the west coast of Canada (Mason et al. 1983) and 63.2 cm for females and 58.8 cm for males in Southeast Alaska.
- Spawning occurs from January–March with peak spawning in mid-February off the west coast of Canada from Vancouver Island to the Queen Charlotte Islands (Mason et al. 1983).
- Size-at-maturity is a critical parameter for the estimation of spawning stock biomass which is used to determine the total allowable catch of sablefish in Chatham Strait.
- Maturity classification based on macroscopic examination has not been previously validated using more accurate histological techniques.



Misclassification of "maturing juvenile" ovaries

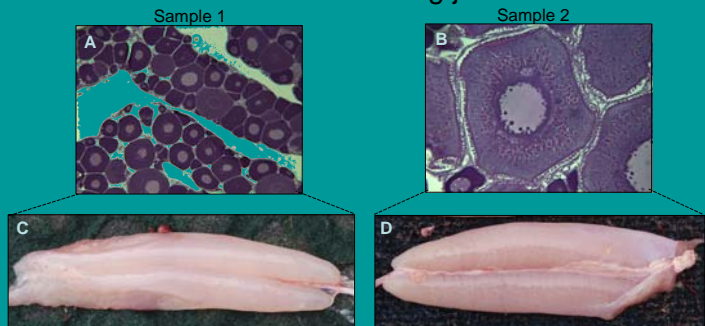


Figure 1. (A) Immature and (B) yolked oocytes from (C and D) ovaries macroscopically classified as maturing juvenile.

Discussion

The maturity data suggests that the spawning period in Southeast Alaska is similar to that observed in British Columbia, occurring from January through April with peak spawning in February (Fig. 2). Histological analysis confirmed the overall appropriateness of most macroscopic stages for identifying spawners of the approaching season. However, a high degree of misclassification occurred of ovaries staged macroscopically as "maturing juvenile"; histology revealed that 51% of these fish had oocytes that contained yolk and 49% possessed only immature oocytes (Fig. 1). This indicates that at least half of the "maturing juvenile" sablefish will spawn in the approaching spawning season. However, there is a possibility that a larger proportion of the "maturing juvenile" fish will mature and spawn in the approaching season. There is at least 4 months from the time of staging (Aug.) to spawning during which oocyte development could occur. In addition, histology indicated that the 6-point scale may need some refining. The presence of yolked oocytes in the majority of "spent/post-spawning" and "resting" ovaries indicates that these fish are preparing for the approaching spawning season and may have been more appropriately classified as "mature/developing".

References

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- Mecklenburg, C.W., T.A. Mecklenburg, and L.K. Thorsteinson. 2002. *Fishes of Alaska*. American Fisheries Society. Bethesda, Maryland.

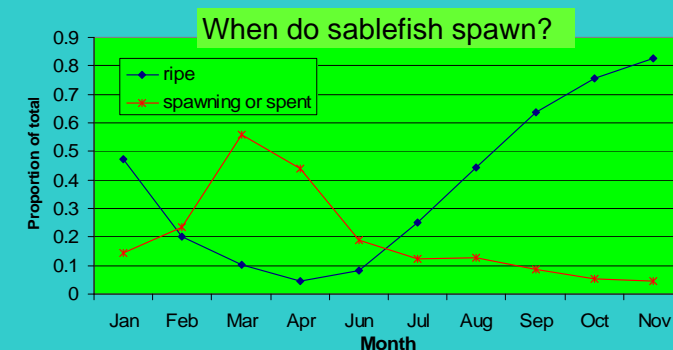


Figure 2. Maturity state for Chatham Strait sablefish sampled from 2002–2007. No sampling occurred in May or December.