

# Non-Invasive Sex Determination of Summer Flounder, *Paralichthys dentatus*

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## INTRODUCTION:

- Sex bias in a commercially harvested fish species can limit reproduction potential in stock
- Regulatory catch size limits and specific trawling gear can produce these sex biases
- The ability to sex this species non-invasively would be useful in fishery surveys and aquaculture
- Three methods are presented: ultrasound, candling, and examination of possible sexual dimorphisms

## METHODS:

**Ultrasound:** Using an Aloka SSD-210 DXII ultrasound equipped with a 7.5 megahertz probe, fish were scanned beginning at the body cavity and moving posterior (Figure 1). Fish were submerged in water while being scanned thus coupling gel was not needed. Female ovaries were identified by the presence of oval contours (Figure 2) whereas males were identified by their absence.



Figure 1

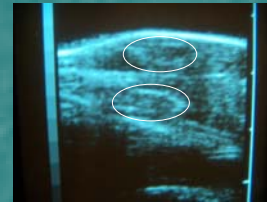


Figure 2: female ovaries

**Sexual Dimorphisms:** Pectoral and pelvic fins were measured and standardized to total length of specimen. Genital and anal pore coloration were also noted. These results proved to be inconclusive.



Figure 3

**Dissection:** After all three methods were performed, fish were dissected to confirm or disprove the non-invasive evaluation. Differences between sexes were easily distinguished by the females extension into the body cavity (Figure 4). Ovaries were measured on each side beginning at the genital pore on the pigmented side and the anal opening on the unpigmented.



Figure 4: female ovary



Figure 5: male testes

**Candling:** Using a lightbox with a 500 W halogen light, fish were candled in a dark room while on their unpigmented side. Female ovaries were identified by a pink triangular extension posterior to the body cavity (Figure 6).

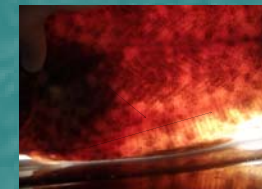


Figure 6: female ovary

## CONCLUSIONS:

### Ultrasound Examination

In flounder over the recreational size catch of 45.7 cm (18 inches), ovary contours were distinct in virtually all scans (94.6% accuracy) (Figure 8). Females smaller in size, probably pre-spawners, had very low clarity in ultrasound scans. Scans showed much static due to shallower penetration. When trying to identify ovaries, markings such as opercular movements, and the end of the body cavity served as markers for locating the gonads. Fish that consumed food just prior to examination had gorged stomachs which in turn caused distorted images in the gonad portion of the fish due to the acoustic waves echoing off of the large organ.

### Candling

Effectiveness of this technique relied on the sexual maturity of the specimens. Pre-spawning females were very difficult to distinguish from males due to the lack of a distinct ovary extension and a transparent ovary coloration. Females with ovaries greater than 90 mm were correctly identified with a 93.3% accuracy using this technique (Figure 9). This technique proved to be the best method for determining sex over commercial and recreational size catch limits (83.4% and 93.1% respectively) (Figure 8).

### Morphological Examination

Based on results, no sexual dimorphisms were found to be conclusive in this species.

## RESULTS:

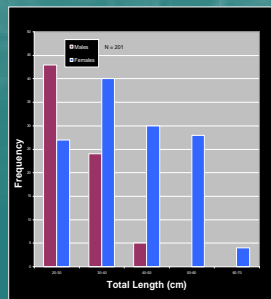


Figure 7 shows a comparison of males to females at different specimen sizes.



Figure 8 shows the accuracy relative to the total length of the specimen. Two dashed lines are shown marking the commercial catch limit size of 35.6 cm (14 inches) and the recreational size of 45.7 cm (18 inches). Overall averages for candling and ultrasound were 81.8% and 77% respectively

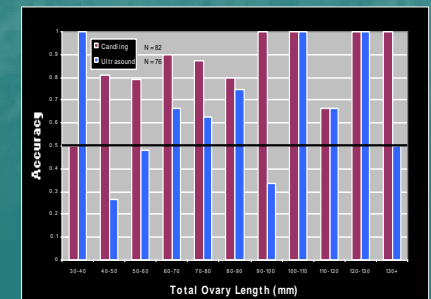


Figure 9 shows the accuracy relative to ovary length. Lengths were measured from the genital pore to the end of the ovary extension.