Genetic population structure of black drum, *Pogonias cromis*, in US waters and life history in South Carolina

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**Abstract**

Black drum is an estuarine-dependent saltwater fish that supports recreational and commercial fisheries throughout the US-Atlantic coast and the Gulf of Mexico. Life history traits have been described throughout its geographical range, but differences exist for some characteristics between regions, which leads to the question of whether there are regional populations of black drum. The data on black drum in South Carolina have primarily been collected as supplemental data from South Carolina Department of Natural Resources (SCDNR) fishery-independent and fishery-dependent surveys. However, these data are limited, especially for adult black drum. Only one previous study has examined genetic population structure of black drum using mitochondrial DNA and limited samples from the Atlantic. The current study will use nuclear microsatellite markers to examine genetic variation of black drum along the Gulf of Mexico and US east coast to determine if different populations and subpopulations exist. Life history data will also be collected, including size and age at maturity, reproductive biology, growth, and population age structure. These additional data would be necessary to perform an adequate age-based stock assessment. Data from this study will prove useful for management and conservation of this species. Knowledge of genetic population structure will allow for accurate definition of geographic boundaries to determine useful management units. Life history information from South Carolina can be used to better manage the population’s resilience to current fishing pressure.

**Genetic Population Structure**

- Genetic population structure examined in one previous study using mitochondrial DNA.
- Evidence for genetic divergence between the Gulf of Mexico and the Atlantic (one sample location in the Atlantic).
- Isolation-by-distance observed in Gulf.
- Important to define geographic boundaries for proper management.

**Questions**

1. Do distinct populations of black drum exist in the Atlantic and Gulf of Mexico?
2. Is there any genetic population structure along the US east coast?
3. What are the population characteristics of black drum in South Carolina based on life history traits?
4. How do life history traits of SC black drum compare with other states?

**Methods**

- **DNA Sampling**
  - Fin clips are being collected and stored in 2.0 ml tubes with sarsosyl-urea, a tissue preservative (tissue volume <25% of preservative volume).
  - Targeting samples from sites in the Gulf of Mexico from TX to FL and in the Atlantic from FL to NJ.
  - Confirmed sampling locations: MS in the Gulf of Mexico, all states from FL to NJ in the Atlantic (Figure 1).

- **Genetic Analysis**
  - No microsatellite primers for black drum currently available, but primers can amplify across species in the same family.
  - Screening of spotted seatrout (*Cynoscion nebulosus*) and red drum (*Sciaenops ocellatus*) microsatellite primers to be used in study.
  - Determine which primers provide reliable amplification of black drum DNA.
  - Establish optimal annealing and extension temperatures for PCR (Figure 2).

- **PCR & Isolate DNA**
  - Screen primers for polymorphism (Figure 3).
  - Current polymorphic loci:
    - Spotted seatrout: Cneb23, Cneb25, Cneb31, Cneb41, Cne08A
    - Red drum: Soc017, Soc083, Cne612
  - Test genetic heterogeneity across sample sites using pairwise comparisons of FST and AMOVA.

**Life History Sampling and Trait Characterization**

- Black drum will be sampled in South Carolina through SCDNR surveys and recreational anglers.
- Measure length, sample gonads and otoliths.
- Gonads: sex and maturity.
- Otoliths: age.
- Characterize growth, size and age at maturity, reproductive biology (e.g., fecundity, spawning season), and population age structure.

**Introduction**

- Important recreational and commercial fish species.
- Found along US east coast and Gulf of Mexico.
- Offshore movement in the fall with potential for long-range migration, as evidenced by some studies.

**Life History**

- Life history studies reveal differences between the Atlantic and Gulf, possible populations (Table 1).
- South Carolina life history data is limited, especially for adults (>3 years).
- Additional data is needed for adequate age-based stock assessment.

**DNA Sampling**

<table>
<thead>
<tr>
<th>Traits</th>
<th>Atlantic</th>
<th>Gulf of Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Age (years)</td>
<td>59</td>
<td>43</td>
</tr>
<tr>
<td>K (growth coefficient)</td>
<td>0.105</td>
<td>0.038</td>
</tr>
<tr>
<td>L∞ (asymptotic length in cm)</td>
<td>117.3</td>
<td>110</td>
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</tbody>
</table>

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**Genotype**

![Image](image_url)

Figure 1. Confirmed fin clip sampling locations indicated by labeled states.

Figure 2. Visualization of PCR products from annealing temperature gradient protocol. Circled bands from same sample with decreasing temperature left to right.

Figure 3. Visualization of PCR products with polymorphic microsatellite primers, Cneb31.

**References**