Spatial variation in fish sound production in a Mid-Atlantic Bight estuary

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Overview

Soniferous fishes produce species-specific courtship sound that advertises fitness through tone, strength, duration, and repetition rate (Connaughton et al. 2002). Sounds apply in poor visibility and at night. Logging hydrophones allow long period recordings (Locascio and Mann 2008) and recovered data can be algorithmically filtered, reducing analysis time.

The Middle Atlantic Bight (MAB) experiences among the highest annual temperature variation of any oceanographic province worldwide, resulting in seasonal variability of reproduction. Several species of soniferous fish migrate and spawn in this range and can be monitored acoustically to evaluate spawning habitat (Connaughton and Taylor 1995). This may complement active acoustic telemetry. Gathering information about fish behaviors is necessary for the continued management and protection of fisheries.

Materials and Methods

•We recorded fish vocalizations for 10 s intervals every 10 min for a non-continuous period between July 15, 2008 and July 30, 2008) using 3 high frequency Long-Term Acoustic Recording System (LARS) (Loggerhead Instruments).

•Sampling occurred in the Jacques Cousteau National Research Reserve (JCNEER) at Little Sheepshead Creek (LSHC), Grassy Channel, and downstream of the Parkway Bridge over the Mullica River.

•We compared the recorded frequencies with pre-established species vocalizations (D. Mann, pers comm) and analyzed sound production patterns with the qlogger program (Loggerhead Instruments) in MATLAB to identify vocalizations to the species level using spectrograms and frequencies.

•We compared SPL over time and among sites for species-specific sound production.

Results and Discussion

• We identified a dominant calling species at each sampling location based on frequency of species calls in the recordings as well as differences between observed species and dominant species between sampling locations.

• *P. evolans* was recorded only at LSHC Bridge while *B. chrysoura* was not recorded at the Parkway Bridge and *C. regalis* was not recorded at LSHC Bridge.

•Dominant species included *C. regalis* at the Parkway Bridge, *B. chrysoura* and *C. regalis* at Grassy Channel, and *O. tau* and *B. chrysoura* at LSHC Bridge. See inserts for more details.

•Each location was composed of different habitat and water conditions owing to a varied soundscape between recorders.

•While this is only a qualitative study, expansion can include quantifying results and combining with physical water characteristics.

LARS setup with polypropylene rope and 15lb anchor attached at LSHC bridge

LARS setup cable tied to existing hydrophone mooring at Parkway Bridge and Grassy Channel

Bairdiella chrysoura (fam. Sciaenidae) spawn from June through August at a temperature between 19.4 and 28ºC (Johnson, 1978)

Cynoscion regalis (fam. Sciaenidae) spawn from mid-May through early August at a temperature between 15.5 and 23.5ºC (Johnson, 1978).

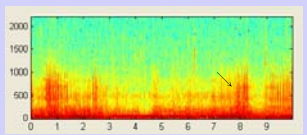
Opsanus tau (fam. Batrachoididae) spawn from April through August at a temperature between 17.5 and 27ºC (Martin and Drewry, 1978)

Prionotus evolans (fam. Triglidae) spawn from May through August at a temperature between 13 and 19ºC (Fritzsche, 1978)

Parkway Bridge

Type of Habitat: Mud bottom, wide river channel bordered by salt marsh
Depth: 5-7 meters

Fish Species Recorded: *C. regalis, O. tau*
Dominant Species: *C. regalis*
Other noise: Boat traffic, chain noise, current noise

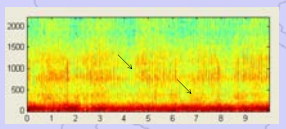


Spectrograph showing *C. regalis* vocalization.

Grassy Channel

Type of Habitat: Sandy bottom, bordered by salt marsh and sand bars
Depth: 5-7 meters in channel, <1 meter on bar

Fish Species Recorded: *B. chrysoura, O. tau, C. regalis*
Dominant Species: *C. regalis* and *B. chrysoura*
Other noise: Boat traffic, chain noise, current noise

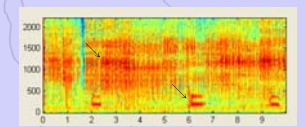


Spectrograph showing *C. regalis* and *B. chrysoura* vocalizations.

Little Sheepshead Creek Bridge

Type of Habitat: Mud bottom, narrow creek channel bordered by salt marsh
Depth: 5-7 meters with some holes as deep as 9 meters

Fish Species Recorded: *B. chrysoura, O. tau, P. evolans, C. Regalis*
Dominant Species: *O. tau* and *B. chrysoura*
Other noise: Boat traffic, car traffic, current noise



Spectrograph showing *O. tau* and *B. chrysoura* vocalizations.

Spectrographs graph and time (x-axis) frequency (y-axis) with SPL (db) displayed using color. Dark red signifies high dB levels, between 80 and 100 dBs, while teal signifies low dB levels, between 50 and 60 dBs.

References are available upon request.

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