Movement and Habitat Use of Subadult Red Drum (*Sciaenops Ocellatus*) and Spotted Seatrout (*Cynoscion Nebulosus*) in the Mission-Aransas National Estuarine Research Reserve

Movimiento y Uso del Habitat de los Subadultos de Tambor Rojo (*Sciaenops Ocellatus*) y Corvina Pinta (*Cynoscion Nebulosus*) en la Reserve Nacional de Investigación Estuario de Mission-Aransas

Mouvement et Utilisation de L`Habitat par les Sub-Adultes de Ombrine Ocellée (*Sciaenops Ocellatus*) et de Acoupa Pintade (*Cynoscion Nebulosus*) dans la Réserve Nationale de Recherche Estuarienne de Mission-Aransas

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EXTENDED ABSTRACT

Red drum (*Sciaenops ocellatus*) and spotted seatrout (*Cynoscion nebulosus*) are highly sought-after game fish providing economic and recreational value to the Gulf of Mexico. Information regarding movements, essential habitat, and habitat connectivity is needed for effective management and conservation of both species, as well as the habitat they utilize. The objectives of this study were to characterize and compare fine-scale habitat use for both species, and examine the influences of habitat type and depth on habitat use. A VEMCO VR2W Positioning System (VPS) array consisting of 20 VR2W passive acoustic receivers was deployed in June and July 2013 to encompass approximately 350m^2 of the Mission-Aransas National Estuarine Research Reserve (TX) and a variety of habitat types including shoal grass (*Halodule wrightii*), turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), oyster reef, and unvegetated substrate. Subadult red drum (n = 14) and spotted seatrout (n = 15) were implanted with VEMCO V9 acoustic transmitters and tracked within the array for a maximum of 28 days. VPS triangulates fish positions using time-difference-of-arrival analysis, requiring detection of the same transmission by at least three receivers. A total of 48,292 detections were recorded: 13,433 for red drum and 34,859 for spotted seatrout. From these, 1,477 positions with a horizontal positioning error (HPE) < 2 m were generated.

Orthorectified satellite imagery verified by ground observation in the field was used to categorize area encompassed by the array into three categories for analysis: seagrass (undifferentiated), oyster reef, and bare (unvegetated) substrate. Three categories were also created for depth: shallow (< 0.3 m), mid (0.3 - 1.0 m), and deep (> 1.0 m). Euclidean distance-based analyses were conducted to examine preferential habitat or depth usage by either species. One thousand random points were generated within an area that encompassed all of the receivers in the array as well as all of the estimated fish positions. Distance from each of the random points to each habitat and depth zone was measured. Distance to each of the habitat and depth zones were also measured for each of the fish positions, and means were taken for each fish. The EDA ratio for each habitat/depth type was calculated as the mean observed distance (from fish positions) divided by the mean expected distance (from random points). If habitat use is random the EDA ratio value is expected to be equal to one. A value greater than one indicates that the habitat type or depth zone was "avoided", and a value less than one indicates that it was "preferred". MANOVA was used to compare overall ratios between and within species. ANOVA and univariate t-tests were used to determine which habitat types were used disproportionately for between and within species comparisons, respectively.

Habitat mean EDA ratios showed that overall distance to habitat type differed between species ($p < 0.05$), and specifically that distance to oyster reef differed between species ($p < 0.01$) (Figure 1). Red drum exhibited nonrandom distance to habitat overall ($p < 0.05$), and preferred oyster reef ($p < 0.01$) and seagrass ($p < 0.05$). Spotted seatrout exhibited nonrandom distance to habitat overall ($p < 0.01$), and avoided oyster reef ($p < 0.01$).

Depth mean EDA ratios showed that overall distance to depth zone differed between species ($p < 0.01$) (Figure 2). Distances to shallow ($p < 0.01$), mid ($p < 0.01$), and deep ($p < 0.01$) zones all differed between the species. Red drum exhibited nonrandom distance to depth zone ($p < 0.01$). Red drum preferred the shallow ($p < 0.05$) and mid ($p < 0.05$) zones and avoided the deep ($p < 0.05$) zone. Spotted seatrout exhibited nonrandom distance to depth zone ($p < 0.05$), and preferred the deep zone ($p < 0.01$).

Results showed that sub-adult red drum and spotted seatrout movement patterns and habitat use are influenced by habitat type and depth. Red drum preferred seagrass and oyster, and a depth of less than a meter. Spotted seatrout avoided oyster and preferred depth greater than a meter. This implies that the value of habitat types within and between species varies based on depth. In addition, depth likely impacts spatial habitat connectivity, by influencing the ability of individuals to move between and within habitat types. Results described the use of multiple habitat types by each species, and indicated possible preferences for certain habitat and depth combinations. This information is important for the management of the habitat types used by the species, by indicating which habitat characteristics should be prioritized for conservation or restoration.

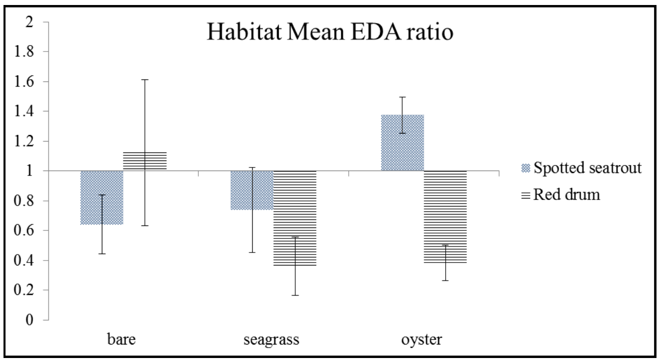

Figure 1. Mean EDA ratios examining habitat use for spotted seatrout and red drum. Spotted seatrout avoided oyster ($p < 0.05$), and red drum preferred seagrass ($p < 0.05$) and oyster ($p < 0.01$). Between species comparison showed that distance to habitat type differed between ($p < 0.05$), and specifically that the distance to oyster differed between species ($p < 0.01$).

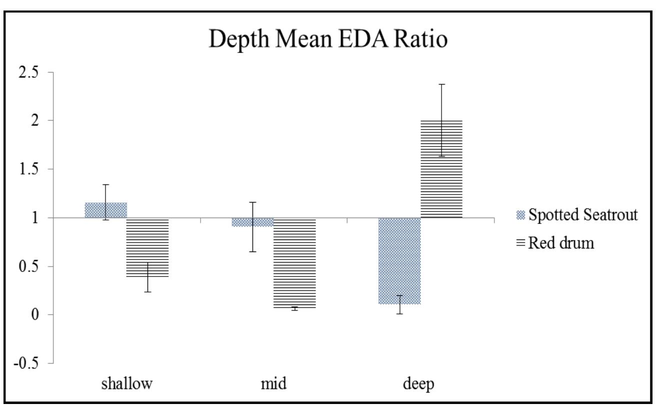

Figure 2. Mean EDA ratios examining depth use for spotted seatrout and red drum. Spotted seatrout preferred the deep zone ($p < 0.01$), and red drum preferred the shallow ($p < 0.05$) and mid ($p < 0.01$) zones while avoiding the deep zone ($p < 0.05$). Between species comparison showed that distance to depth zone differed ($p < 0.01$) for each depth zone: shallow ($p < 0.01$), mid ($p < 0.01$), and deep ($p < 0.01$).