Habitat use and migrations of Atlantic tarpon in the northern Gulf of Mexico

Uso de hábitat y migraciones del sábalo Atlántico en el norte del Golfo de México

Utilisation de l'habitat et migrations du tarpon Atlantique dans le nord du Golfe du Mexique

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EXTENDED ABSTRACT

Atlantic tarpon (*Megalops atlanticus*) are popular gamefish targeted in coastal waters of the Atlantic Ocean (Luo et al., 2019). Tarpon are capable of long-distance migrations (hundreds of kilometers) but have also been observed exhibiting resident behaviors in estuarine and coastal habitats (Luo et al., 2020). Well documented seasonal patterns have been reported with northern movements to higher latitudes in the late spring and early summer and southern movements in the late summer and early fall (Spotte, 2016). Recent studies have indicated the potential of migratory contingents or stocks within Gulf of Mexico (Luo et al., 2020). The aim of this study was to identify essential habitats of juvenile tarpon along the Texas coast and quantify environmental drivers of tarpon occurrence in this region. In addition, acoustic telemetry was used to assess movements of adult tarpon tagged in Texas and Louisiana for characterizing population connectivity and migration patterns.

Five major bay systems along the Texas coast (Galveston Bay, Matagorda Bay, San Antonio Bay, Corpus Christi Bay, and Laguna Madre) were investigated over the past four decades (1980-2018) to assess trends in presence and relative abundance of juvenile tarpon in. Catch per unit effort (CPUE) data from Texas Parks and Wildlife Department (TPWD) gillnet surveys were analyzed to identify seasonal variation as well as bay specific inter-decadal differences. Generalized additive models (GAMs) were used to identify environmental and temporal variables that influenced tarpon presence. Innovasea V16-4H (69kHz) acoustic transmitters were deployed on adult tarpon (>120 cm FL) east and west of the Mississippi River Delta, off Texas and Louisiana. Transmitters were placed internally by making a small incision located posterior and slightly dorsal of the pelvic fin into the peritoneal cavity of tarpon. An array of acoustic receivers deployed off Texas and Louisiana, comprised of 36 Innovasea (VR2Tx and VR2W) acoustic receivers, was used to track movement patterns of tarpon in the western Gulf of Mexico, and movements outside this region were identified using cooperative acoustic networks including the Integrated Tracking of Aquatic Animals in the Gulf of Mexico (iTAG) orphan tag database.

Overall, 23,849 TPWD gillnet sets were conducted over a 38-year period resulting in a total of 407 tarpon collected across five major bay systems along the Texas coast (Galveston Bay, Matagorda Bay, San Antonio Bay, Corpus Christi Bay, and Laguna Madre). CPUE (per 1000 hours soak time) was found to be markedly higher in gillnet sampling conducted in the fall compared to spring. Both CPUE and frequency of occurrence was noticeably higher in southern bay systems compared to northern systems. Mean decadal CPUE showed increasing trends between the last two decades (2000-2009 and 2010-2018) for each of the five bay systems. Matagorda Bay, Corpus Christi Bay, and Laguna Madre saw the clearest increases between the last two decades with total mean abundance for the three bays having CPUE values of 1.59 from 2000-2009 and 2.00 from 2010-2018 (Figure 1). This may be attributed to warming trends which have accelerated in recent years (Fujiwara et al., 2019). Increased northern ranges for species that are common prey items for tarpon such as Gulf menhaden (*Brevoortia patronus*), Atlantic croaker (*Micropogonias undulatus*), white mullet (*Mugil curema),* and blue crab (*Callinectes sapidus*) have experienced higher occupancy probabilities in northern Texas bays associated with warming trends which may also account for increasing tarpon abundance due to foraging behaviors (Ault, 2010; Fujiwara et al., 2019).

GAMs indicated that salinity (PSU) and water temperature (°C) were significant environmental factors affecting tarpon presence in a majority of the Texas bay systems, with tarpon presence being highest in fresh and brackish regions and water temperatures between ~20-26°C. Relative abundance of tarpon was noticeably higher in bay systems located further south on the Texas coast, and these bays typically experience warmer water temperature year-round and rarely have fish kills associated with cold weather events (Fujiwara et al., 2019). Relative abundance of tarpon for all five bay systems has increased since 1990, with notable rises within the last decade of sampling. Luo & Ault (2012) found 99% of water temperature data recorded through satellite tags deployed on tarpon were above 20°C.

Preliminary acoustic tagging observed in both northern and southern movements for tarpon tagged east and west of the Mississippi River Delta. To date, migration patterns for individuals tagged on each side of the delta were distinct and support the premise of two distinct stocks or migratory contingents inhabiting the northern Gulf of Mexico.

KEYWORDS: Atlantic tarpon, Gulf of Mexico, tagging, environmental drivers

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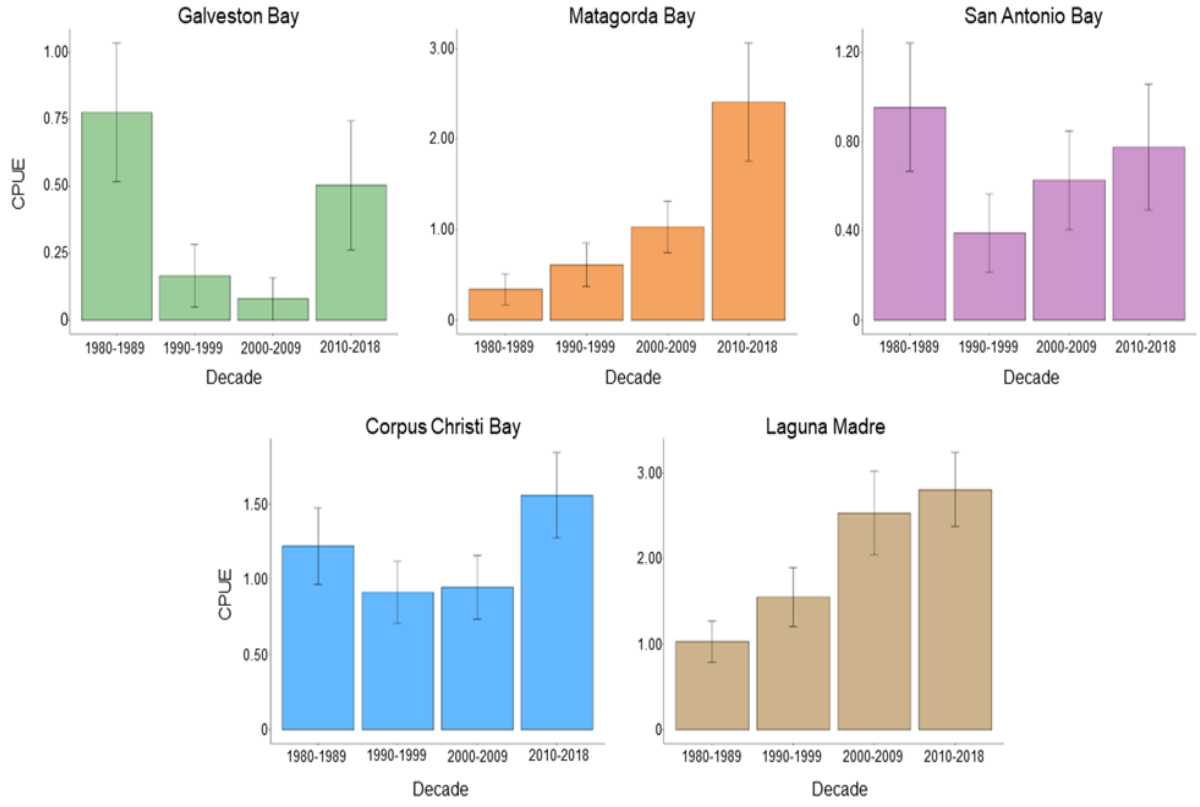

Figure 1. Histograms depicting mean decadal CPUE (catch per 1,000 hrs. soak time) of tarpon collected in Texas Parks and Wildlife (TPWD) gillnet surveys for each of the five bay systems (Galveston Bay, Matagorda Bay, San Antonio Bay, Corpus Christi Bay, and Laguna Madre) from 1980 to 2018.