Investigating Drivers of Seasonal Change in Fish Abundance in the Homosassa River System

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Background

In the southeastern U.S., some subtropical marine fishes use thermal refugia during winter at the northern limits of their range. In coastal spring-fed rivers like Homosassa, groundwater discharge that serves as the rivers' base flow, has a stable year-round temperature of approximately 23°C. During winter months marine species abundance (dominated by Common Snook and Grey Snapper) increased in the Homosassa river system, consistent with use of the warm springs as thermal refugia.

Historically, small-bodied freshwater fishes in the river's mainstem demonstrate a strong seasonality in abundance, with lowest abundances observed during fall and winter (Frazer et al.2011). However, data suggest there is an additional component driving seasonal change in fish abundance.

Hypotheses

- Marine fish enter the river in fall, when Gulf of Mexico water temperatures fall below 20°C, seeking thermal refuge.
- As marine fish move into the river, interactions (competition for resources, predation) with freshwater fish will occur.
- Cold fronts will concentrate marine fish around springheads; periods between fronts will disperse these fish more broadly along the river.
- To avoid negative interactions, freshwater fish will move from the river's mainstem into backwaters (i.e., tributaries, creeks and canals) during winter.

Main River

Vs.

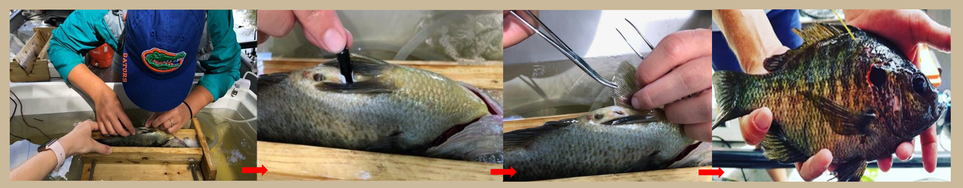
Backwater

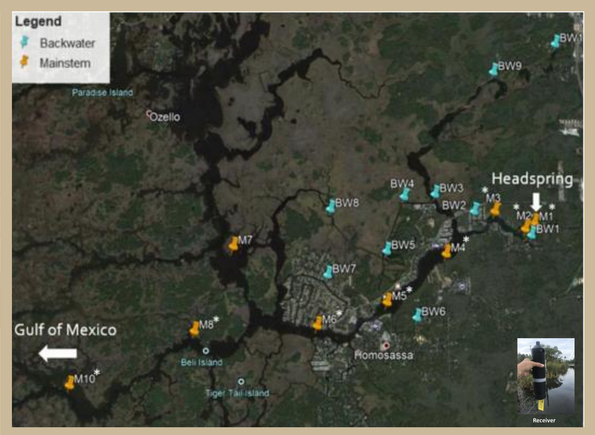
Objectives

- Document the timing of marine species winter influx (Common Snook and Grey Snapper) and their interactions with freshwater fishes.
- Explore habitat use, spatial and temporal movement of marine and freshwater fishes.
- Document temperature and salinity impacts on species distribution and migration.
- Document and characterize mainstem and backwater habitats in the Homosassa River system.

Data Collection

- Acoustic telemetry – 80 tags, four species
  - Largemouth Bass, n=20
  - Redear Sunfish, n=20
  - Common Snook, n=20
  - Grey Snapper, n=20
- Monthly community electrofishing – FWC LTM protocol
- Mark-recapture – freshwater fish only, fin clips
- Habitat evaluation – visual estimates, WDI, HCI
- Water parameters – HOBO temperature and conductivity loggers





Results

Marine fishes were present throughout the study period but were nine times more abundant during cold periods (November–March).

As expected, Common Snook and Grey Snapper aggregated near the springhead during cold fronts. Both marine species expanded their habitat use up to five river kilometers from the springhead during winter and up to eight river kilometers during early spring. The majority of tagged marine fish emigrated from the study area in early spring (February–March). Freshwater fish did not migrate from the mainstem to backwaters as expected; few tagged individuals (6 of 29) moved between mainstem and backwater habitats during winter. Electrofishing data also showed freshwater fish abundance in backwater habitats was two times greater than the mainstem; a seasonal shift in distribution between winter and summer was not apparent.

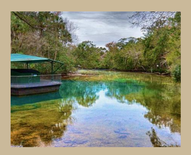


Table 1. Woody Debris Index (WDI) scores and Habitat Complexity Index (HCI) scores for backwater habitat in the Homosassa River system.

Backwater	BW1	BW2	BW3	BW4	BW5	BW6	BW7	BW8	BW9	BW10
WDI Sum	131	9	3	80	213	191	76	176	81	18
WDI Avg	10	1	1	9	10	21	4	26	7	1
HCI	1.8	0.3	0.6	1.2	2.7	2.2	0.8	2.2	0.6	0.8

Table 2. Woody Debris Index (WDI) scores and Habitat Complexity Index (HCI) scores for mainstem habitat in the Homosassa River system.

Mainstem	Zone 1	Zone 2	Zone 3
WDI Sum	376	823	316
WDI Avg	12	17	8
HCI Avg	1.6	1.9	1.5

Results

Marine fishes mostly used mainstem habitats; their abundance in backwaters was half that of the mainstem.

Acoustic telemetry of freshwater species indicated that fish distribution is restricted by high salinities and likely influenced by some degree of habitat complexity.

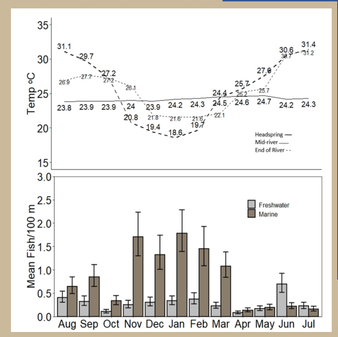


Figure 1. Monthly average water temperatures (top panel) recorded at the headspring receiver (solid line, M1, rkm 12.5), mid-river receiver (dotted line, M5, rkm 9.2), and end of the receiver array closest to GOM (dashed line, M10, rkm 2.5) and monthly electrofishing total average abundance (mean fish/100 m ±SE) of marine and freshwater fish species (bottom panel).

Figure 2. Representative tracking charts describing the movement patterns of acoustically tagged Common Snook. Hourly position estimates are provided along the y-axis with date along the x-axis. River kilometer 12.5 is the springhead and 2.5 is the end of the acoustic array nearest the GOM. Individual fish identification numbers (e.g., 6847) are provided at the top of each panel.

Results

While our hypothesis of seasonal migration by freshwater fishes was rejected, this study clearly demonstrated importance of backwater habitats in supporting freshwater fish communities throughout the Homosassa River system.

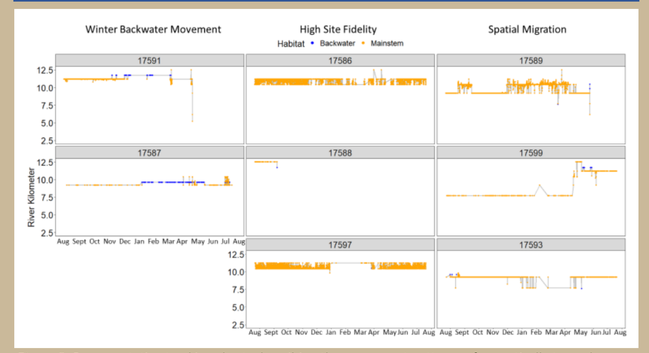


Figure 3. Representative tracking charts describing the movement patterns of acoustically tagged Largemouth Bass. Hourly position estimates are provided along the y-axis with date along the x-axis. River kilometer 12.5 is the springhead and 2.5 is the end of the acoustic array nearest the GOM. Individual fish identification numbers (e.g., 17591) are provided at the top of each panel.

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