Prey Use of Three Wetland Sunfishes:

Effects of Ontogeny, Gape Size and Seasonal Prey Variation

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Introduction

The diets of different sized fishes provide information about variation in potential competitive and predatory interactions in freshwater food webs. Freshwater sunfishes (Centrarchidae) typically undergo ontogenetic niche shifts throughout life affecting their survival and growth[2,3,4,5,6]. The bluespotted sunfish (*Enneacanthus gloriosus*), the dollar sunfish (*Lepomis marginatus*), and the warmouth (*Lepomis gulosus*) (pictured below) are three wetland sunfish species that commonly co-occur in the Florida Everglades. These species vary morphologically (warmouth grow the largest and have the largest gape at a given size), however all three occupy the same habitat (spikerush sloughs) and are primarily benthivorous. Prey use in these species has been poorly studied in wetlands, particularly in relation to intraspecific and interspecific variation.

Objective: Quantify intraspecific and interspecific variation in prey use among bluespotted sunfish, dollar sunfish, and warmouth in Everglades wetlands by comparing individuals within species (i.e. different sizes) and between species (i.e. matched for standard length [SL] or gape).

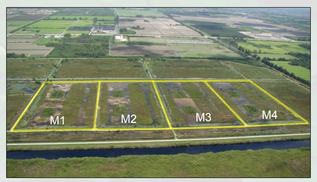
Bluespotted sunfish

Dollar sunfish

Warmouth

Methods

We collected bluespotted sunfish, dollar sunfish, and warmouth from experimental wetland macrocosms at the Loxahatchee Impounded Landscape Assessment (LILA). LILA is a unique Everglades physical model designed for Everglades restoration research. Fish were collected using fyke nets, hoop nets, and minnow traps in March 2011 (dry season) and September 2011 (wet season). Gut contents were acquired via gastric lavage or dissection and were sorted in the lab under microscope. Prey items were dried to determine percent composition. Body part measurements were taken for incomplete prey items and dry weights were back-calculated via regression. Similar prey items were grouped into categories based on size and mobility (Fig 1). We evaluated differences between groupings of fish (i.e., size classes, species, etc.) using percent composition data with an ANOSIM test in PRIMER-E[1].



Aerial photograph of LILA wetlands. Each macrocosm measures ~ 200 m x 400 m.

Fyke net set in LILA slough

Results

General prey use

Warmouth, dollar sunfish, and bluespotted sunfish were strongly invertivorous. We found a diverse array of prey items in fish stomachs (Fig 1), ranging from microarthropods (daphnia, hydracarina, etc.) to decapods (crayfish, shrimp) and vertebrates (fish, tadpoles).

Gut contents of 60 mm SL warmouth

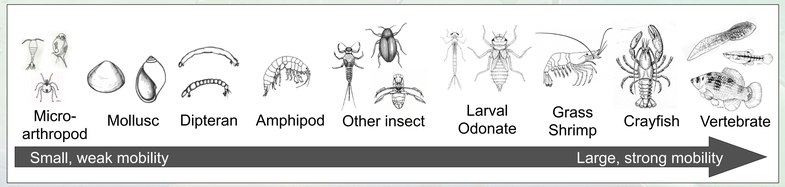


Figure 1. Common prey items consumed by sunfish in Everglades wetlands. Size and mobility increase left to right.

Ontogenetic shifts in prey use

- Bluespotted and dollar sunfish (30- 60 mm SL) did not exhibit ontogenetic shifts in prey use in either season and generally consumed small insects and crustaceans (Table 1, Fig 2).
- Warmouth (30-152 mm SL) displayed ontogenetic shifts in prey use both seasons (Table 1). Dry season warmouth underwent a strong shift from amphipods and odonates to shrimp, crayfish, and vertebrates as size increased (Figs 2,3). Wet season shifts were less pronounced (Figs 2,3) and were possibly influenced by reduced prey densities.

Figure 3. Mean proportion large prey (decapods and fish) consumed by warmouth (primary y-axis, circles) and mean Bray-Curtis similarity to the diet of small-gaped sunfishes (secondary y-axis, triangles) relative to SL.

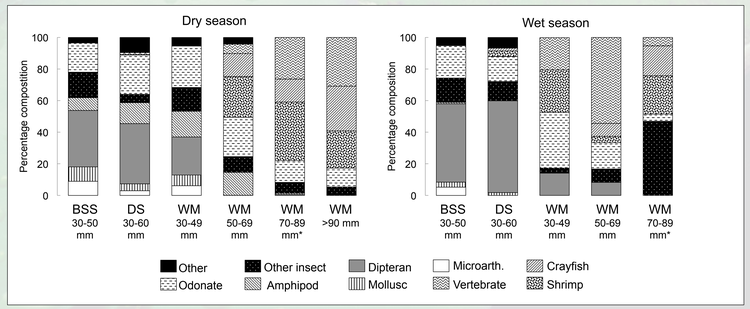


Figure 2. Diet composition (mean percent dry mass) of bluespotted sunfish (BSS), dollar sunfish (DS), and four size classes of warmouth (WM) *All warmouth > 70 mm SL combined in wet season.

Results Continued

Interspecific differences in prey use

- When matched for length, warmouth prey use differed significantly from the two small-gaped species (Tab 1). These warmouth generally consumed larger, more mobile prey items.
- When matched for gape, warmouth prey use differed significantly from the other species in the wet season, but not the dry season (Tab 1). In both seasons, gape-matched warmouth appeared to favor odonate use while the small-gaped species favored dipterans (Fig 4) suggesting a functional difference in feeding strategy.

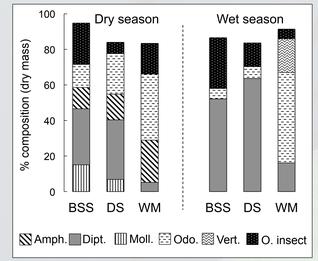


Figure 4. Percent composition of primary prey items found in the guts of gape-matched sunfish Only items that contribute ≥10% of the diet of at least one species are shown.

Table 1. Pairwise *R*-stat values and *P*-values from ANOSIM for contrasts exploring intraspecific and interspecific variation in prey use. For intraspecific contrasts, only adjacent size classes shown. Boldface indicates significantly different contrasts.

	Dry season	Contrast	*R*-stat (*P*)	Wet season	Contrast	*R*-stat (*P*)
Ontogenetic shifts	Warmouth	**30 v 50 mm**	**0.08 (0.05)**	Warmouth	30 v 50 mm	0.07 (0.06)
		50 v 70 mm	**0.09 (0.02)**		**50 v 70 mm***	**0.29 (0.02)**
		70 v 90 mm	0.01 (0.19)			
	Dollar sunfish	30 v 40 mm	0.01 (0.37)	Dollar sunfish	30 v 40 mm	-0.11 (0.84)
		40 v 50 mm	-0.02 (0.67)		40 v 50 mm	-0.01 (0.45)
	Bluespot. sunfish	30 v 40 mm	-0.02 (0.58)	Bluespot. sunfish	30 v 40 mm	-0.06 (0.75)
Interspecific variation	SL matched	**WM v DS**	**0.09 (0.02)**	SL matched	**WM v DS**	**0.23 (0.01)**
		WM v BSS	**0.08 (0.02)**		**WM v BSS**	**0.16 (0.01)**
		DS v BSS	0.02 (0.16)		DS v BSS	0.01 (0.20)
	Gape matched	WM v DS	0.05 (0.15)	Gape matched	**WM v DS**	**0.32 (0.01)**
		WM v BSS	0.05 (0.13)		**WM v BSS**	**0.26 (0.01)**
		DS v BSS	0.04 (0.13)		DS v BSS	0.06 (0.12)

Conclusions

At similar gapes, these sunfish consume similar prey items and the degree of diet overlap suggests strong competition[5]. Seasonal variation in prey availability and differences in hunting strategy/competitive ability may drive differences in prey use. Small warmouth may actively hunt odonates, whereas bluespotted and dollar sunfish may only consume odonates when abundant and frequently encountered during primary foraging (gleaning dipterans form vegetation). As warmouth grow, prey use shifts to larger, more mobile prey items (when available) and they outgrow interspecific competition and become predators of the other sunfish.

Acknowledgments / References

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