

Current Distribution and Status of Blackbanded Sunfish in Florida

Jason O'Connor, Christopher Anderson and Travis Tuten

Florida Fish and Wildlife Conservation Commission

Gainesville Freshwater Fisheries Field Office, 7386 NW 71st St, Gainesville, FL 32653



Introduction

What:

- The Blackbanded Sunfish *Enneacanthus chaetodon* is a smaller member of the centrarchid family that inhabits low pH waterbodies with dense submersed aquatic vegetation
- Ranges from Delaware to Florida
- Has experienced apparent population declines range-wide
- Have long been considered a rare species in Florida, but contributing factors remain unknown

Why:

- Not state listed in Florida
- A species of greatest conservation need in the Florida State Wildlife Action Plan
- Current data on Blackbanded Sunfish are limited to sporadic museum collections, which are insufficient to assess the current distribution and status of Blackbanded sunfish in the state
- A range-wide survey is needed to support an updated Biological Status Review (BSR) for Blackbanded Sunfish

Questions:

- What is the current distribution of Blackbanded Sunfish in Florida?
- Have populations persisted at historical collection locations?
- How does detectability of Blackbanded Sunfish compare to co-occurring species?

Natural History



Spawning/Reproduction:

* March – June (in aquaria)

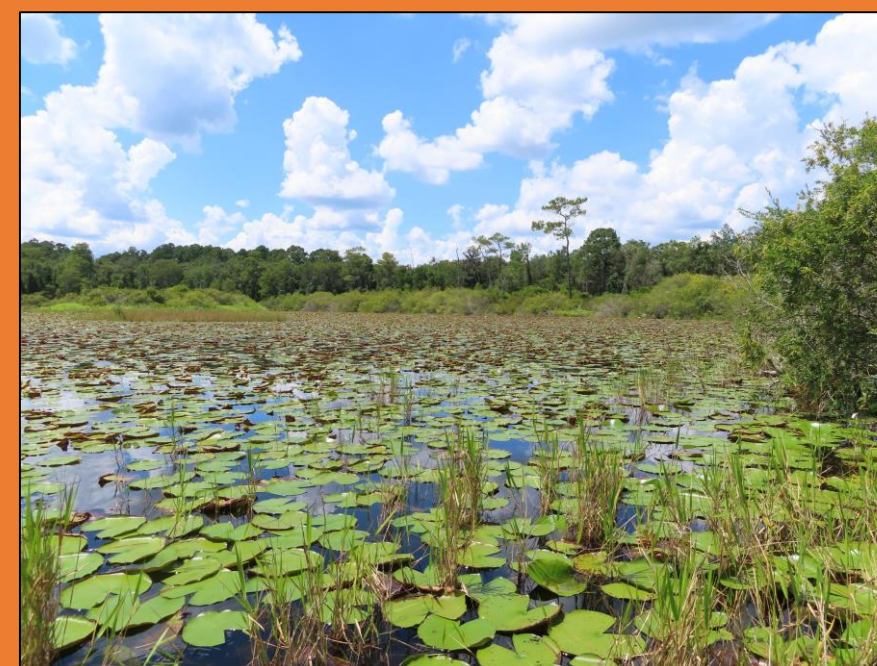
Habitat:

- Low pH
- Heavily vegetated wetlands,
- Typically lentic, though some lotic collections

Lifespan: ~ 4 years

Diet:

- larval invertebrates
 - Chironomid
 - Dragonfly
 - Caddisfly
 - gammarids,
- some filamentous algae/plant material



Methods

Site Selection

Potential habitat identified using Google Earth Satellite imagery.



- Sites considered suitable if
 - Held water through drought
 - High proportion of aquatic vegetation coverage
 - Locations within watersheds with historical collections were prioritized

Sampling Timeframe

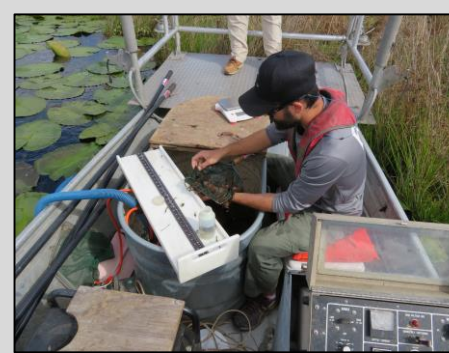
Year	Feb	Mar	Apr	Jun	Jul	Aug
2015	X	X				X
2016					X	
2017	X	X				
2018	X	X		X		X
2019	X	X	X			X

Sampling Protocol

- If possible, a minimum of 3 seine-hauls were pulled across a 10-m distance at each site. Following each haul, all fish were identified to species (in the field if possible, in the lab otherwise), counted or assigned a relative abundance code (1-10, 100-100,100-1000), and released. Additional sampling methods (electrofishing, fyke netting and dipnetting) were employed opportunistically to most effectively sample each waterbody.
- Site covariates recorded:
 - Water temperature
 - Specific conductance
 - pH
 - Dissolved oxygen
 - Plant species observed
 - Substrate type

Analysis

We fit single season, single species occupancy models for species captured at multiple sites to estimate species-specific detection probability using seine hauls and occupancy assuming all sites have an equal probability of being occupied. For Blackbanded Sunfish we also fit additional models including the presence and abundance of other species as covariates of detection and occupancy. Models were ranked using AICc and inferences were based on top ranked model.



Known Distribution

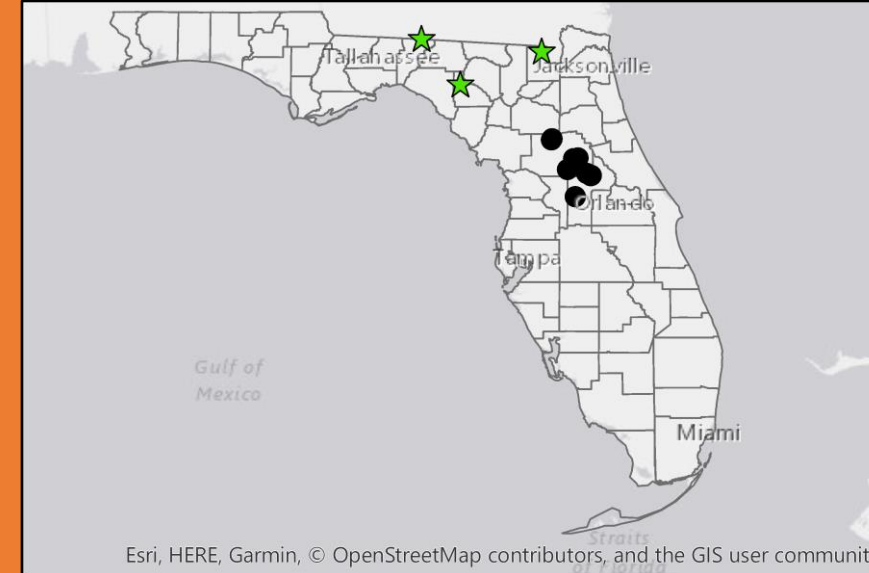
1940s



1950s



1960s



1970s



1980s



2000s

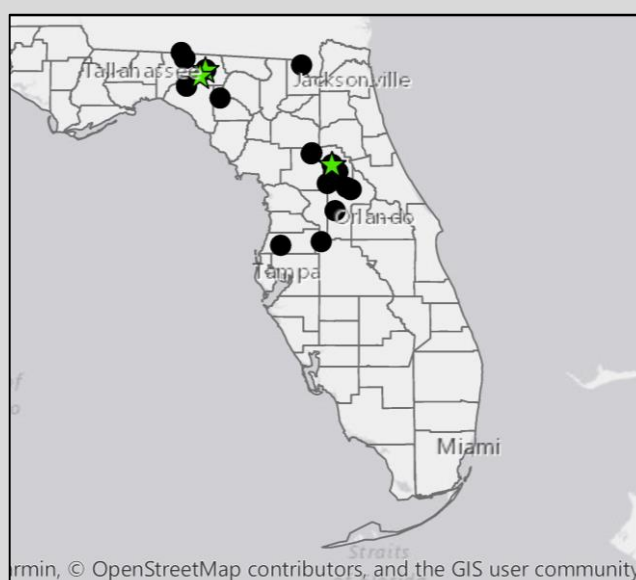


2010s



Results

- 93 surveys conducted across 87 sites
- Blackbanded Sunfish detected at 5 sites
- No Blackbanded Sunfish detected at any of the pre-2009 collection locations.



Detected at 5 locations

- 3 new sites discovered in Ocala National forest (Parramore Praire and 2 adjacent ponds
- 1 new site discovered in Madison County (Sampala Lake)
- Detected at 1 known location (Lake Rachael, Madison Co.)

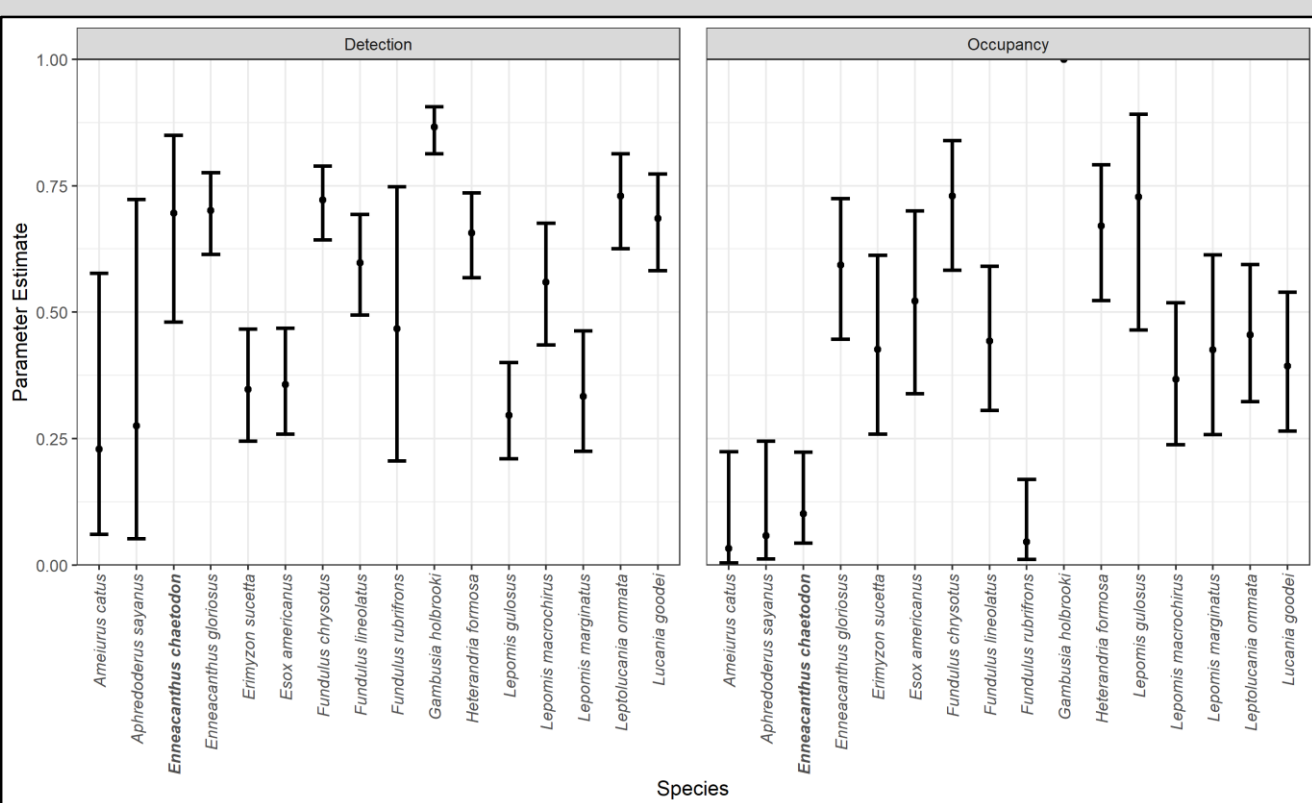


Fig 1. Occupancy and detection estimates for species captured at multiple sites. Estimates are based on single season, single species occupancy models assuming constant detection across surveys and equal probability of occupancy across sites

Table 1. AICc Table comparing single season occupancy models for Blackbanded Sunfish. Each model includes the haul-specific presence of Pygmy Killifish and Bluespotted Sunfish as predictors of detection. PSU = *Elassoma sp.*, BSSU = *Enneacanthus gloriosus*, LITO = *Fundulus lineolatus*, PYKI = *Leptolucania ommata*, LMB = *Micropterus salmoides*, WAR = *Lepomis gulosus*, DOSU = *Lepomis marginatus*, LEKI = *Heterandria formosa*, FLIE = *Centrarchus macropterus*

Occupancy Parameters	K	AICc	Delta_AICc	AICcWt	LL	Cum.Wt
PSU + BSSU + LITO + PYKI + LMB (presence)	9	50.87998	0	0.735837	-14.2971	0.735837
PYKI abundance	5	54.22325	3.34327138	0.138293	-21.4595	0.87413
LITO presence	5	56.43366	5.553673105	0.045795	-22.5647	0.19924
PYKI presence	5	56.82572	5.945740205	0.037643	-22.7607	0.957567
PSU presence	5	58.00957	7.129585734	0.020826	-23.3526	0.978393
WAR presence	5	59.58721	8.707228217	0.009463	-24.1414	0.987856
BSSUpresence	5	60.68727	9.80729046	0.00546	-24.6915	0.993316
LMB presence	5	63.43802	12.55803652	0.00138	-26.0668	0.994696
DOSU presence	5	64.83263	13.95264599	0.000687	-26.7641	0.995383
null	2	65.59368	14.71369622	0.00047	-30.6744	0.995852
LEKI presence	5	66.07301	15.19303049	0.00037	-27.3843	0.996222
LITO abundance	5	66.09452	15.2145358	0.000366	-27.3951	0.996588
LEKI abundance	5	66.44601	15.5660266	0.000307	-27.5708	0.996894
BLUE abundance	5	66.48423	15.60424425	0.000301	-27.5899	0.997195
FLIE abundance	5	66.51697	15.63698907	0.000296	-27.6063	0.997491
FLIE presence	5	66.54407	15.66408481	0.000292	-27.6199	0.997783
LMB abundance	5	66.57207	15.69209169	0.000288	-27.6339	0.998071
BLUE presence	5	66.60976	15.72977475	0.000283	-27.6527	0.998354
WAR abundance	5	66.62645	15.74646928	0.00028	-27.6611	0.998634
DOSU abundance	5	66.66258	15.78259648	0.000275	-27.6791	0.999189
PSU abundance	5	66.6845	15.80451781	0.000272	-27.6901	0.999461
BSSU abundance	5	66.68723	15.8072501	0.000272	-27.6914	0.999733
All species (abundance)	14	72.98871	22.10873046	1.16E-05	-16.8187	1

Discussion

- Similar to previous surveys, Blackbanded Sunfish were rarely encountered (5 of 93 sites) even during targeted surveys in suitable habitat. However, at occupied sites, Blackbanded Sunfish were easily detected using seine-hauls ($p = 0.71$) and detectability was did not differ appreciably from other small bodied species that occupy similar habitat (E. gloriosus, L. ommata, L. goodiei, F. lineolatus). Detectability can be heavily influenced by abundance. That Blackbanded Sunfish and Bluespotted Sunfish, a common, more widespread congener, had similar detectability suggests that at occupied sites the two species occurred at similar relative abundances (both co-occurred at all 5 locations).
- The best Blackbanded Sunfish occupancy model from our candidate set predicts that the presences of Pygmy Killifish and Bluespotted Sunfish in a seine-haul is a positive predictor of detection. Including the presence of species that require similar habitat as Blackbanded Sunfish allows us to adjust detection estimates to account for hauls that may have been less effective due to depth, or vegetation density. The model also predicts that the likelihood of a site being occupied by Blackbanded Sunfish is higher at sites where *Elassoma sp.*, Bluespotted Sunfish, Lined Topminnow, Pygmy Killifish, and Largemouth Bass have been collected.
- Lack of detection at any surveyed historical (pre-2009) location suggests that Blackbanded Sunfish populations have declined in Florida. Wetlands typically occupied by Blackbanded Sunfish are often hydrologically dynamic and endure periods of drought, during which, the wetland may completely disappear. As a result, Blackbanded Sunfish populations may be susceptible to local extirpation.

Future Directions:

- Our results are heavily influenced by a small number of positive detections. Additional surveying may reveal new populations which would improve our model predictions.
- Our detection results are heavily dependent on the assumption that detectability among seine hauls conducted on a single day are independent and that seine hauls are equally effective across sites and time. It is possible that our 5 detections were at locations that support unusually dense populations of Blackbanded Sunfish, or were seining was more effective than at other sites. In order to better assess these assumptions repeated surveys at known sites are needed at multiple points in time and additional measures of seine-haul efficacy should be included in future models.