DIET OF JUVENILE BONEFISH OFF ELEUTHERA ISLAND, THE BAHAMAS

Lucas Griffin, Chris Haak, Andy Danylchuk, and Curt Griffin

Department of Environmental Conservation, University of Massachusetts Amherst, Amherst, MA 01003

Photo credit Aaron Adams

Introduction

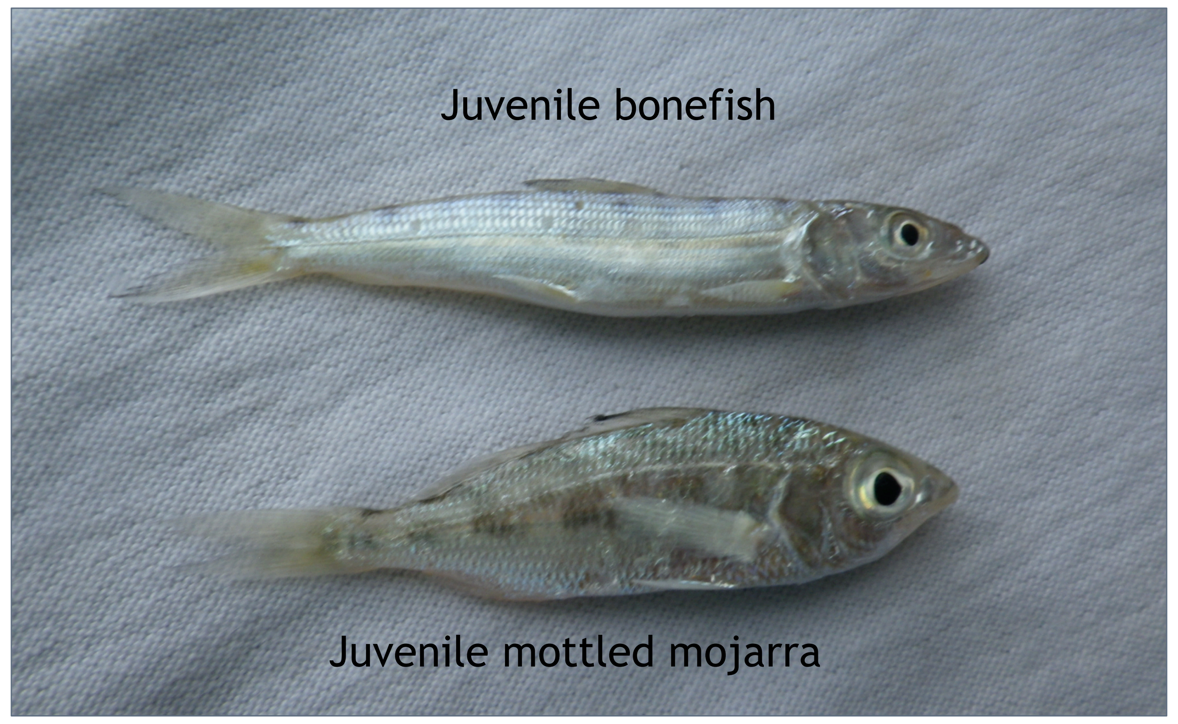
Despite their importance as a sport fish, there is limited information on the life history and diet of juvenile bonefish (*Albula* spp.), especially for *Albula vulpes* – the species that appears to support the largest segment of the recreational fishery (Adams et al. 2007). Although Snodgrass et al. (2008) reported on the diet of juvenile bonefish in Florida, *Albula* species B predominated (86%) in their samples. However, there is no information on the diet of juvenile bonefish in The Bahamas where *A. vulpes* represents the majority of bonefish species in the islands. Information on juvenile bonefish, a critical stage before recruitment to the fishery, is essential for developing effective bonefish conservation programs.

Objectives

1. Describe the diets of juvenile bonefish captured in coastal embayments of Eleuthera Island.
2. Compare the size and diets of juvenile bonefish and mottled mojarra (*Eucinostomus lefroyi*) captured in mixed species groups.
3. Compare the diets of juvenile bonefish captured off Eleuthera Island and Florida.

Methods

Fish Collection. –We sampled for juvenile fish at 36 sampling sites within 18 sample locations (Fig. 1) in coastal embayments of Eleuthera Island, The Bahamas from 26 May to 3 August 2011 (Fig. 1). There were 1-5 sampling sites within each sample location, and each sampling site was sampled 1 – 52 times during the study. All captured fishes were identified and counted or estimated when hundreds were caught within a haul. Tidal stage was recorded for each haul using two-hour periods corresponding with the two daily high, mid, and low tides. All captured juvenile bonefish and a subsample of juvenile mottled mojarra from the same haul were collected to examine the potential of diet overlap in the two species.



Fish Measures & Gut Content Analyses. – We measured standard, fork and total lengths of all collected bonefish, and fork and total lengths for mojarra. The digestive tracts of all bonefish and a minimum of four mojarra per haul were removed and either frozen or preserved for subsequent gut content analyses. When shell fragments from bivalves were encountered, we could not determine the number of individual bivalves represented; thus, we recorded these fragments as a single bivalve. We recorded percent frequency of occurrence (*O*) and percentage by number (*N*) of each taxon following Cortes (1997), but prey weights were not measured. Thus, we were not able to calculate the index of relative importance (*IRI*) used by Snodgrass et al. (2008). Alternatively, we calculated an arbitrary importance index $I = O \times N$ for use in ranking prey taxa consumed.

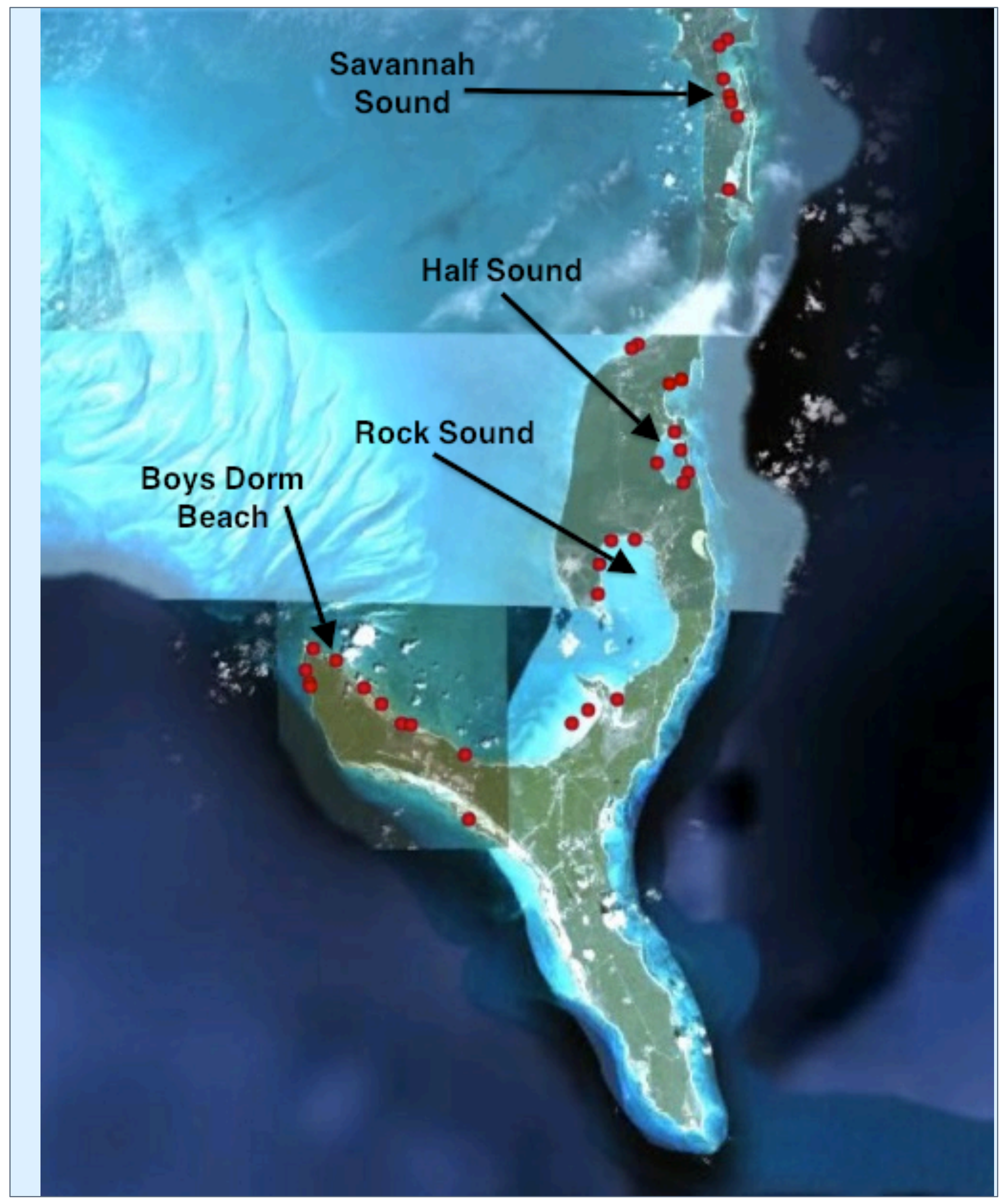


Fig. 1. Eleuthera Island showing 18 sample locations and the four locations (named) where juvenile bonefish were captured.

Statistical Analyses. – We used the student t-test to compare the mean fork and total lengths of bonefish and mojarra, and the Kruskal-Wallis test to evaluate if mean number of bonefish captured varied by tidal stage. We used the importance index (I) to rank the order of prey taxa found in bonefish and mojarra digestive tracks, and the Mann-Whitney U test to determine if the distributions of the top five prey taxa differed between bonefish and mojarra, and the diet of juvenile bonefish in Florida reported by Snodgrass et al. (2008).

Results

We pulled a total of 296 seine hauls at 36 sampling sites within 18 sample locations (Fig. 1). A total of 139 juvenile bonefish were captured in 36 hauls (12% of seine hauls) at four sample locations, including: Boys Dorm Beach, Half Sound, Rock Sound, and Savannah Sound (Fig. 1).

Bonefish were always captured with mojarra (100% of hauls), and barracuda (*Sphyraena barracuda*) (29%) and hardhead silverside (*Atherinomorus stipes*) (17%) were the next two fish species most frequently caught with bonefish. The mean number of bonefish captured in hauls containing bonefish was 3.8 (n=35, SD=6.2, range 1-35). In contrast, much higher numbers of mojarra (X=179, SD=234.7, n=30) were captured in hauls containing bonefish, and mojarra numbers ranged greatly from 2 to nearly 1,000 fishes in a haul. Mean total and fork lengths of bonefish were 25% and 21% longer than those of mojarra lengths within hauls (t=8.69, df=175, P<0.001 and t=7.57, df=167, P<0.001, respectively)(Table 1).

	Mean total length (SD)	Mean fork length (SD)	Mean standard length (SD)
Bonefish (n=133)	82.5 (20.6)	70.7 (17.7)	66.5 (16.6)
Mojarra (n=720)	65.9 (18.8)	58.4 (14.7)	NA

Table 1.Differences in mean total and fork lengths (mm) of bonefish and mojarra captured in mixed species groups in seine hauls.

Juvenile bonefish were captured during all tidal stages with the highest mean numbers of bonefish per haul captured during outgoing tides (Table 2). Although the greatest number of bonefish was captured during the two hours prior to low tide, there were no differences in bonefish captured between tidal stages (H=4.105, df=5, P=0.534).

	Tidal Stage					
	Early incoming	Mid incoming	Late incoming	Early outgoing	Mid outgoing	Late outgoing
Total no. of hauls	43	63	46	34	53	55
No. of hauls with bonefish	4	5	6	5	9	6
Mean no. of bonefish per haul	2.0	1.2	2.7	5.0	3.7	7.5

Table 2. Mean numbers of bonefish caught per haul by tidal stage.

Of 85 bonefish digestive tracts, 62 (73%) contained prey items. The five most important prey items were amphipods A, an unidentified species A, bivalves, carideans, and brachyurans (Fig. 2). Of 120 mojarra digestive tracts, 93 (78%) contained prey items. The five most important prey items were bivalves, amphipods B, mollusks, nematodes, and amphipods C. Although amphipods were dominate in the diets of both bonefish (rank #1) and mojarra (ranks #2 and #5), they consumed different amphipod species with very little overlap. Despite these differences, the Mann-Whitney U test yielded a nearly significant test for the five most important taxa eaten by bonefish and mojarra (U=3(5), Z= 1.88, P=0.06). In contrast, the five most important prey taxa for bonefish reported by Snodgrass et al. (2008) were polychaetes, amphipods, copepods, carideans, and malacostracans. The five most important prey taxa in the diet of Eleuthera Island bonefish differed from that of Florida bonefish based on the rank order of prey taxa importance indices (U=24(5), Z= 2.3, P=0.02).

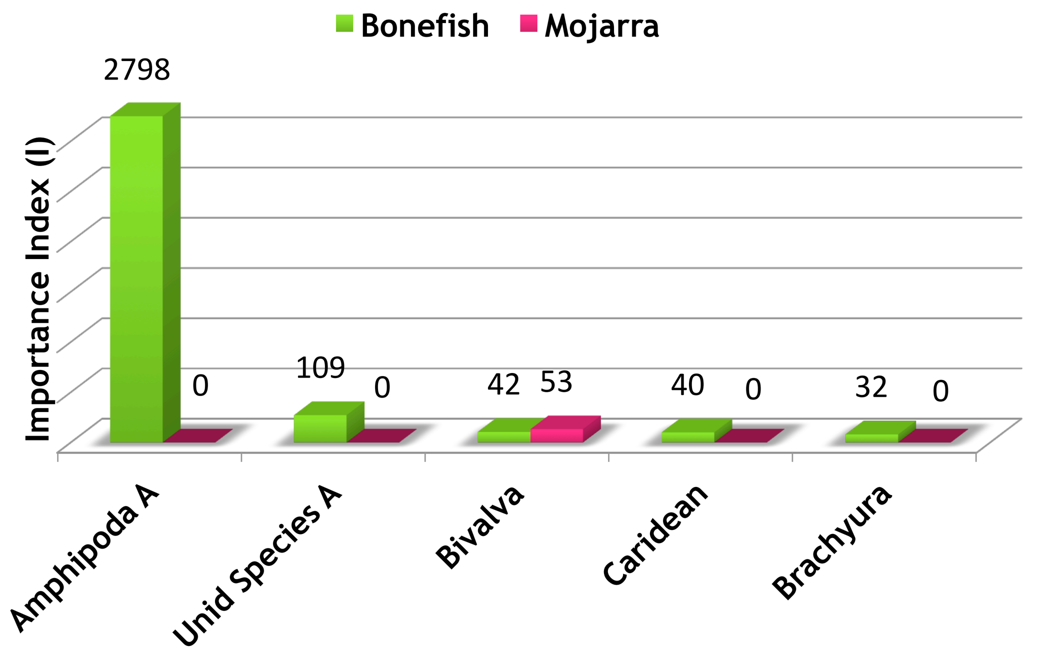


Fig. 2. Importance indices values for five most important prey for bonefish and corresponding values for mojarra.

References

Adams, A.J., R.K. Wolfe, M.D. Tringali, E. Wallace, G.T. Kellison. 2007. Rethinking the status of *Albula* spp. biology in the Caribbean and western Atlantic. Pages 203-214 *in* J. S. Ault, editor. Biology and management of the world tarpon and bonefish fisheries. CRC Press, Boca Raton, Florida, USA.

Cortes, E. 2007. A critical review of methods of studying fish feeding based on analysis of stomach contents: application to elasmobranch fishes. Can. J. Fish. Aquat. Sci. 54: 726-738.

Snodgrass, D. 2008. Abundance, growth, and diet of young-of-the-year bonefish (*Albula* spp.) off the Florida Keys, U.S.A. Bull. Mar. Sci. 82(2):185-193.

Acknowledgements

The authors wish to thank the Bonefish and Tarpon Trust for funding this project, and Justin Lewis and Liane Nowell for their assistance with collection and processing fish specimens. Andrew Clark at the College of Charleston provided access to dissecting scopes. Many thanks to Aaron Shultz and the staff at the Cape Eleuthera Institute for making this study possible.