

The following supplement accompanies the article

Commercial trawling in seagrass beds: bycatch and long-term trends in effort of a major shrimp fishery

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Supplement. Catch comparison between rollerframe and otter trawls (Table S1), and photographs of potential predators on post-release by-catch from a commercial bait-shrimp trawler (Fig. S1)

Table S1. Catch composition from fishery-independent sampling with paired rollerframe ($n = 52$ tows) and otter trawls ($n = 51$ tows). Taxa are listed from the most to least abundant captured by rollerframe trawls. The mean (\pm SE) densities (number catch per 100 m^2) of captured animals are provided for Size Classes 1 to 6

Species	Common Name	Gear	No. caught	L ₁ (1–25 mm)	L ₂ (26–50 mm)	L ₃ (51–75 mm)	L ₄ (76–100 mm)	L ₅ (101–150 mm)	L ₆ (>150 mm)
Arthropoda									
<i>Tozeuma carolinense</i>	Arrow Shrimp	rollerframe	90,146	327.30 (73.22)	0.03 (0.03)	–	–	–	–
		otter	38,510	137.29 (44.29)	–	–	–	–	–
<i>Farfantepenaeus duorarum</i>	Pink Shrimp	rollerframe	27,124	96.10 (10.71)	2.38 (0.42)	0.02 (0.02)	–	–	–
		otter	3,474	11.76 (2.16)	0.62 (0.11)	–	–	–	–

<i>Periclimenes longicaudatus</i>	Longtail Grass Shrimp	rollerframe	394	1.43 (0.60)	–	–	–	–	–
		otter	768	2.75 (1.27)	–	–	–	–	–
<i>Libinia dubia</i>	Longnose Spider Crab	rollerframe	258	0.04 (0.02)	0.80 (0.21)	0.09 (0.03)	–	–	–
		otter	386	0.04 (0.02)	1.08 (0.24)	0.25 (0.08)	–	–	–
<i>Metoporhaphis calcarata</i>	Arrow Crab	rollerframe	110	0.40 (0.09)	–	–	–	–	–
		otter	27	0.09 (0.03)	–	–	–	–	–
<i>Callinectes sapidus</i>	Blue Crab	rollerframe	76	–	0.06 (0.03)	0.05 (0.03)	0.07 (0.02)	0.07 (0.03)	0.02 (0.01)
		otter	66	0.01 (0.01)	0.11 (0.05)	0.02 (0.01)	0.03 (0.01)	0.06 (0.02)	0.01 (0.01)
<i>Hippolyte zostericola</i>	Zostera Shrimp	rollerframe	4	0.01 (0.01)	–	–	–	–	–
		otter	0	–	–	–	–	–	–
Chordata									
<i>Lagodon rhomboides</i>	Pinfish	rollerframe	36,554	0.20 (0.10)	26.64 (4.39)	82.24 (12.09)	20.52 (3.53)	2.93 (0.36)	0.20 (0.04)
		otter	11,511	0.02 (0.01)	4.20 (0.81)	17.15 (2.17)	14.00 (2.32)	4.98 (0.77)	0.69 (0.09)
<i>Orthopristis chrysoptera</i>	Pigfish	rollerframe	8,868	0.10 (0.05)	7.71 (1.69)	17.15 (2.467)	6.21 (1.03)	0.86 (0.25)	0.17 (0.06)
		otter	2,886	0.06 (0.03)	2.02 (0.48)	3.43 (0.61)	3.39 (0.549)	1.27 (0.40)	0.13 (0.02)
<i>Bairdiella chrysoura</i>	Silver Perch	rollerframe	854	0.76 (0.38)	0.94 (0.27)	0.62 (0.14)	0.57 (0.12)	0.17 (0.05)	0.05 (0.02)
		otter	743	0.36 (0.13)	0.87 (0.21)	0.63 (0.17)	0.46 (0.10)	0.27 (0.06)	0.06 (0.02)
<i>Opsanus beta</i>	Gulf Toadfish	rollerframe	634	0.01 (0.01)	0.12 (0.07)	0.16 (0.06)	0.49 (0.08)	1.17 (0.13)	0.34 (0.04)
		otter	196	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.05 (0.03)	0.37 (0.06)	0.25 (0.04)
<i>Monacanthus hispidus</i>	Planehead Filefish	rollerframe	422	0.17 (0.06)	0.49 (0.09)	0.51 (0.12)	0.28 (0.07)	0.05 (0.02)	0.03 (0.02)
		otter	360	0.19 (0.15)	0.22 (0.06)	0.43 (0.15)	0.32 (0.08)	0.11 (0.03)	0.02 (0.01)

<i>Syngnathus floridae</i>	Florida Pipefish	rollerframe	528	–	–	0.04 (0.04)	0.14 (0.06)	0.53 (0.10)	1.21 (0.24)
		otter	186	–	–	–	0.01 (0.01)	0.19 (0.06)	0.47 (0.14)
<i>Syngnathus scovelli</i>	Gulf Pipefish	rollerframe	346	–	–	0.04 (0.02)	0.33 (0.10)	0.88 (0.19)	0.01 (0.01)
		otter	36	–	–	0.01 (0.01)	0.01 (0.01)	0.11 (0.03)	–
<i>Hyporhamphus unifasciatus</i>	Atlantic Silverstripe Halfbeak	rollerframe	280	–	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.11 (0.04)	0.87 (0.12)
		otter	0	–	–	–	–	–	–
<i>Hippocampus erectus</i>	Lined Seahorse	rollerframe	270	0.36 (0.33)	0.01 (0.01)	0.20 (0.06)	0.34 (0.12)	0.07 (0.03)	0.01 (0.01)
		otter	170	0.01 (0.01)	0.03 (0.02)	0.20 (0.07)	0.29 (0.13)	0.07 (0.05)	0.01 (0.01)
<i>Cynoscion nebulosus</i>	Spotted Seatrout	rollerframe	240	0.01 (0.01)	0.46 (0.12)	0.12 (0.05)	0.18 (0.07)	0.07 (0.02)	0.04 (0.02)
		otter	67	–	0.14 (0.06)	0.02 (0.01)	0.01 (0.01)	0.02 (0.01)	0.05 (0.02)
<i>Chilomycterus schoepfi</i>	Striped Burfish	rollerframe	232	0.04 (0.03)	0.05 (0.02)	0.17 (0.05)	0.15 (0.04)	0.17 (0.04)	0.27 (0.05)
		otter	148	0.04 (0.02)	0.01 (0.01)	0.06 (0.02)	0.05 (0.01)	0.13 (0.03)	0.23 (0.05)
<i>Paralichthys alboguttata</i>	Gulf Flounder	rollerframe	140	–	0.01 (0.01)	0.12 (0.03)	0.12 (0.04)	0.16 (0.04)	0.11 (0.03)
		otter	24	–	–	0.01 (0.01)	–	0.03 (0.02)	0.05 (0.01)
<i>Lactophrys quadricornis</i>	Scrawled Cowfish	rollerframe	92	0.07 (0.03)	0.17 (0.09)	0.01 (0.01)	–	0.04 (0.02)	0.04 (0.02)
		otter	44	0.03 (0.02)	0.10 (0.05)	–	0.01 (0.01)	0.01 (0.01)	0.02 (0.01)
<i>Lutjanus synagris</i>	Lane Snapper	rollerframe	90	0.03 (0.02)	0.12 (0.05)	0.12 (0.05)	0.04 (0.02)	0.02 (0.02)	–
		otter	23	–	0.01 (0.01)	0.04 (0.02)	0.01 (0.01)	0.02 (0.01)	–
<i>Anchoa mitchilli</i>	Bay Anchovy	rollerframe	86	–	0.19 (0.08)	0.09 (0.05)	0.03 (0.03)	–	–
		otter	97	0.01 (0.01)	0.32 (0.10)	0.018 (0.01)	–	–	–

<i>Diplodus holbrookii</i>	Spottail Pinfish	rollerframe	72	–	0.06 (0.03)	0.06 (0.04)	0.03 (0.02)	0.12 (0.04)	–
		otter	39	–	0.02 (0.01)	0.01 (0.01)	0.02 (0.02)	0.08 (0.03)	0.01 (0.01)
<i>Eucinostomus argenteus</i>	Spotfin Mojarra	rollerframe	68	0.06 (0.05)	0.17 (0.10)	0.01 (0.01)	–	–	–
		otter	3	–	–	0.01 (0.01)	–	–	–
<i>Trinectes maculatus</i>	Hogchoker	rollerframe	62	–	0.10 (0.05)	0.12 (0.05)	–	–	–
		otter	0	–	–	–	–	–	–
<i>Eucinostomus gula</i>	Silver Jenny	rollerframe	48	0.04 (0.04)	0.14 (0.08)	–	–	–	–
		otter	2	–	0.01 (0.01)	–	–	–	–
<i>Sphoeroides nephelus</i>	Southern Puffer	rollerframe	44	0.03 (0.03)	–	0.02 (0.02)	0.03 (0.02)	0.05 (0.02)	0.03 (0.02)
		otter	51	–	0.01 (0.01)	0.01 (0.01)	0.04 (0.01)	0.10 (0.03)	0.03 (0.01)
<i>Aluterus scriptus</i>	Scrawed Filefish	rollerframe	42	0.01 (0.01)	0.04 (0.03)	0.09 (0.04)	0.01 (0.01)	–	0.01 (0.01)
		otter	24	–	0.01 (0.01)	0.02 (0.01)	0.05 (0.02)	0.01 (0.01)	0.01 (0.01)
<i>Gobiosoma robustum</i>	Code Goby	rollerframe	24	–	0.06 (0.05)	0.03 (0.03)	–	–	–
		otter	4	0.01 (0.01)	0.01 (0.01)	–	–	–	–
<i>Synodus foetens</i>	Inshore Lizardfish	rollerframe	22	–	–	–	0.04 (0.04)	0.02 (0.01)	0.02 (0.01)
		otter	3	–	–	–	–	–	0.01 (0.01)
<i>Hippocampus reidi</i>	Slender Seahorse	rollerframe	20	–	–	–	0.07 (0.06)	0.01 (0.01)	–
		otter	12	–	–	0.02 (0.02)	0.02 (0.02)	–	–
<i>Sympodus plagiusa</i>	Blackcheek Tonguefish	rollerframe	18	–	–	0.03 (0.02)	0.04 (0.03)	–	–
		otter	1	–	–	–	0.01 (0.01)	–	–
<i>Diplectrum bivittatum</i>	Dwarf Seabass	rollerframe	18	–	–	0.07 (0.05)	–	–	–
		otter	0	–	–	–	–	–	–

<i>Ariopsis felis</i>	Hardhead Catfish	rollerframe otter	14 6	— —	— —	0.02 (0.02) —	— —	— —	0.03 (0.01) 0.02 (0.01)
<i>Mycteroperca microlepis</i>	Gag	rollerframe otter	14 29	— —	— —	— —	0.01 (0.01) —	0.01 (0.01) —	0.04 (0.02) 0.10 (0.03)
<i>Diplectrum formosum</i>	Sand Perch	rollerframe	12	—	—	0.02 (0.02)	0.01 (0.01)	0.01 (0.01)	—
		otter	2	—	—	—	—	0.01 (0.01)	0.01 (0.01)
<i>Strongylura marina</i>	Atlantic Needlefish	rollerframe	12	—	—	—	—	0.02 (0.01)	0.02 (0.019)
		otter	0	—	—	—	—	—	—
<i>Chloroscombrus chrysurus</i>	Atlantic Bumper	rollerframe	8	—	0.03 (0.03)	—	—	—	—
		otter	6	—	0.04 (0.04)	—	—	—	—
<i>Centropristes striata</i>	Black Seabass	rollerframe	6	—	—	—	—	0.01 (0.01)	0.01 (0.01)
		otter	30	—	0.01 (0.01)	—	—	0.02 (0.01)	0.07 (0.02)
<i>Brevoortia patronus</i>	Gulf Menhaden	rollerframe	6	—	—	—	—	0.02 (0.02)	—
		otter	0	—	—	—	—	—	—
<i>Achirus lineatus</i>	Lined Sole	rollerframe otter	4 0	— —	— —	0.01 (0.01) —	— —	— —	— —
<i>Microgobius gulosus</i>	Clown Goby	rollerframe	4	—	—	0.01 (0.01)	—	—	—
		otter	0	—	—	—	—	—	—
<i>Monacanthus ciliatus</i>	Fringed Filefish	rollerframe	4	—	—	0.01 (0.01)	—	—	—
		otter	0	—	—	—	—	—	—

<i>Lactophrys trigonus</i>	Trunkfish	rollerframe	4	0.01 (0.01)	0.01 (0.01)	—	—	—	—
		otter	1	0.01 (0.01)	—	—	—	—	—
<i>Selene vomer</i>	Lookdown	rollerframe	4	—	—	0.01 (0.01)	—	—	—
		otter	5	—	0.02 (0.02)	—	—	—	—
<i>Halichoeres bivittatus</i>	Slippery Dick	rollerframe	2	—	0.01 (0.01)	—	—	—	—
		otter	0	—	—	—	—	—	—
<i>Ophidion holbrookii</i>	Bank Cusk-eel	rollerframe	2	—	—	—	—	—	0.01 (0.01)
		otter	0	—	—	—	—	—	—
<i>Epinephelus morio</i>	Red Grouper	rollerframe	2	—	—	—	—	—	0.01 (0.01)
		otter	2	—	—	—	—	—	0.01 (0.01)
<i>Lophogobius cyprinoides</i>	Crested Goby	rollerframe	0	—	—	—	—	—	—
		otter	1	—	—	0.01 (0.01)	—	—	—
<i>Myrophis punctatus</i>	Speckled Worm Eel	rollerframe	0	—	—	—	—	—	—
		otter	1	—	—	—	—	—	0.01 (0.01)
<i>Scorpaena brasiliensis</i>	Barbfish	rollerframe	0	—	—	—	—	—	—
		otter	1	—	—	—	—	—	0.01 (0.01)
<i>Engraulis eurystole</i>	Silver Anchovy	rollerframe	0	—	—	—	—	—	—
		otter	22	—	0.07 (0.04)	0.01 (0.01)	—	—	—
Mollusca									
<i>Argopecten irradians</i>	Bay Scallop	rollerframe	276	0.11 (0.05)	0.49 (0.11)	0.41 (0.07)	—	—	—
		otter	151	0.01 (0.01)	0.23 (0.06)	0.30 (0.06)	—	—	—

Fig. S1. Post-release mortality of fishes and invertebrates may occur via predation by (A) large flocks of birds (e.g. gulls) and (B) predatory fishes (e.g. Ladyfish and Gafftopsail Catfish—note the reflection of eyes in photo) that follow commercial bait-shrimp trawlers. Photos taken at night aboard a commercial bait-shrimp trawler in the Big Bend, FL, courtesy of C. C. Koenig

(A)



(B)

