Preliminary Study of Blue Crab Catch in Traps Fitted With and Without a Diamondback Terrapin Excluder Device

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Abstract: Comparisons were made on the catch rate, sizes of blue crabs *(Callinectes sapidus),* and bycatch taken in Mississippi Sound waters with crab traps equipped with and without a diamondback terrapin *(Malaclemys terrapin)* excluder device from April through August 1997. The excluder device consisted of welding rods shaped into a 5 $\times$10 cm rectangle and fitted into the funnel entrances of a common Gulf Coast crab trap. All blue crabs taken were counted, carapace width measured (mm), and sexed. Bycatch was recorded for each sample. A total of 740 blue crabs were captured, 370 in control traps and 370 in excluder traps. No significant difference in mean size (2-tailed *t*-test) and catch rate (paired *t*-test) by trap type was observed. The Kolmogorov-Smirnov 2-sample test indicated a significant difference in the size distribution of blue crabs between the 2 trap types. This statistical difference is attributed to the small sample size of blue crabs collected. No diamondback terrapins were captured in this study. Little difference in the bycatch catch rate was observed between the 2 trap types.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 54:221–226

The issue of bycatch in marine fisheries and the search for feasible techniques to reduce bycatch has heightened in recent years. The Magnuson-Stevens Fishery Conservation and Management Act as amended includes 10 national standards, which are applied to federal fisheries management in the United States. In the 1996 Mississippi legislative session, a modified version of these standards was adopted into law. One of these standards provides that, "Conservation and management measures

shall, to the extent practicable (i) minimize bycatch, and (ii) to the extent bycatch cannot be avoided, minimize the mortality of that bycatch" (§ 49-15-2(g)).

The diamondback terrapin *(Malaclemys terrapin)* is restricted to a narrow band of coastal estuarine waters from Corpus Christi, Texas, to Cape Cod, Massachusetts (Palmer and Cordes 1988). Seven subspecies of the diamondback terrapin are recognized (Ernst and Barbour 1972, Conant 1975, Behler and King 1979, Smith and Brodie 1982). The Biloxi terrapin was in high demand for food consumption in the past and was heavily harvested in the late 1800s and early 1900s along the Atlantic seaboard and the northern Gulf of Mexico (Carr 1952).

The habitat of the diamondback terrapin directly coincides with the habitat of the blue crab in Mississippi. Blue crabs are caught commercially and recreationally throughout the estuarine near shore waters of Mississippi. Commercial crabbing is currently restricted from the estuarine waters north of the CSX railroad bridge in the 3 coastal counties of Mississippi (Sect. 1 Ord. No. 4.005, An ordinance to establish regulations for the taking of crabs). (Fig. 1). Recreational crabbing is allowed in these areas but is restricted to 6 crab traps per household (§ 49-15-84 (2)).

Several studies from the Atlantic coast (Bishop 1983, Rosenburg 1992, and Wood 1992) suggest that crab traps being actively fished and abandoned traps, which may "ghost fish" (continue to catch after being lost), could be responsible for a substantial portion of diamondback terrapin mortality. In a study of terrapin populations,

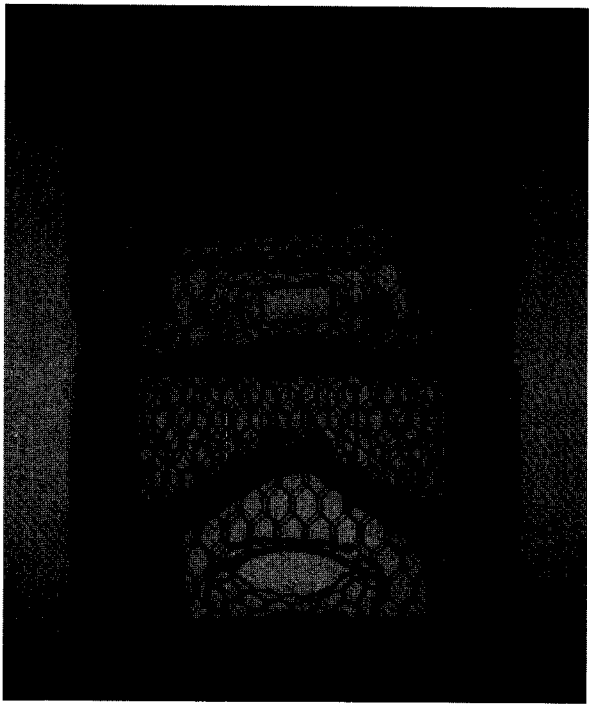

Figure 1. Crab trap with (top) and without (bottom) terrapin excluder.

within Mississippi coastal waters, similar conclusions were reached about crab trap mortality on diamondback terrapin populations (Mann 1995).

Rosenburg (1992) tested modified traps, which were 2 m high and deployed in shallow water (water depth <2 m). These traps allowed terrapins entering the trap to come to the surface for air. No difference was found in the catch rates of blue crabs from the modified traps when compared to the control. The large size of this trap would incur higher construction costs and further limit the number of traps fishermen could deploy from their vessel. Also, many areas fished in Mississippi have water depths >2 m which makes these traps useless in reducing terrapin mortality. Wood (1992) investigated a method of modifying crab traps by attaching a rectangular piece of wire to the entrance of the funnels. The wire would exclude terrapins above a certain size. This type of excluder device would require little modification to existing crab traps and may be more acceptable to the crabbing industry. They are also not restricted by water depth relative to their ability to reduce terrapin mortality.

The primary purpose of this study was to compare sizes and catch rates of blue crabs captured in traps fitted with terrapin excluder devices similar to the one developed be Wood (1992) to unmodified traps typically used in the blue crab fishery in Mississippi. The secondary purpose of this study was to compare bycatch captured by the 2 trap types.

Methods

The crab traps used in this study measured 0.6 × 0.6 × 0.4 m and were constructed of vinyl coated hexagonal mesh. Each trap was fitted with 4 funnels for crab entry. This type of crab trap is typical of traps used by recreational and commercial fisherman in Mississippi. The terrapin excluders were made of welding rods shaped into a 5 × 10 centimeter rectangle and were attached to the funnel entrances with aluminum hog rings (Fig. 1).

Six traps were fished between 1 April and 31 August 1997 in an area just east of the Long Beach small craft harbor and in the Bay of St,. Louis at the mouth of the Jourdan River (Fig. 1). For each area 3 traps were fitted with terrapin exclude devices. The 6 crab traps (3 with the excluder device and 3 without the excluder device) were fished concurrently and deployed in an alternate fashion. The traps were baited with striped mullet *(Mugil cephalus)* or Atlantic croaker *(Micropogonias undulatus).*

The traps were generally checked and fresh bait added every 2 or 3 days depending on weather conditions. All crabs in each trap were enumerated, the size of each crab was recorded (to the nearest mm) as the distance across the carapace between the tips of the lateral spine, crabs were sexed and bycatch in each trap was noted.

The mean size and catch rate of blue crabs between control and experimental traps were analyzed with Statgraphics Plus 3.0. Mean size differences were tested with a 2-tailed *t*-test ($\alpha<0.05$). Size differences were also examined with a Kolmogorov-Smirnov 2 sample test ($\alpha<0.05$). (The Kolmogorov-Smirnov test examines if 2 samples can be reasonably expected to come from the same distribution. Catch rate was examined with a paired *t*-test ($\alpha<0.05$).

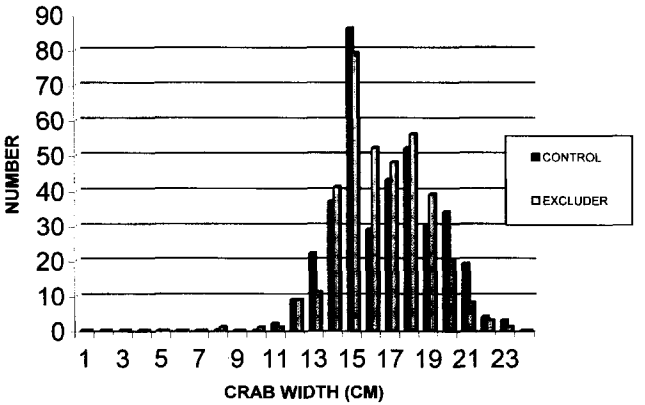

Figure 2. Size distribution of blue crabs by trap type.

Results

A total of 740 blue crabs were captured, 370 in the control traps and 370 in the excluder traps. Excluder traps caught 160 females and 210 males. Control traps caught 125 females and 245 males.

Crab size frequency data for control vs. excluder traps was similar (Fig. 2). No significant difference was seen in the mean size of blue crabs caught between control traps (15.18 cm (SD = 2.47)) and excluder traps (14.97 cm (SD = 2.20)). A significant difference was found between the length frequency distributions from the 2 trap types. Control traps caught more smaller blue crabs in the range of 9 to 12 cm and larger blue crabs in the range of 20 to 23 cm (Fig. 3).

Daily catch rates between trap types were similar (Fig. 3). No significant difference was seen between the mean number of crabs caught in the control traps (mean = 19.50, SD = 6.50) and the excluder traps (Mean = 19.50, SD + 12.20).

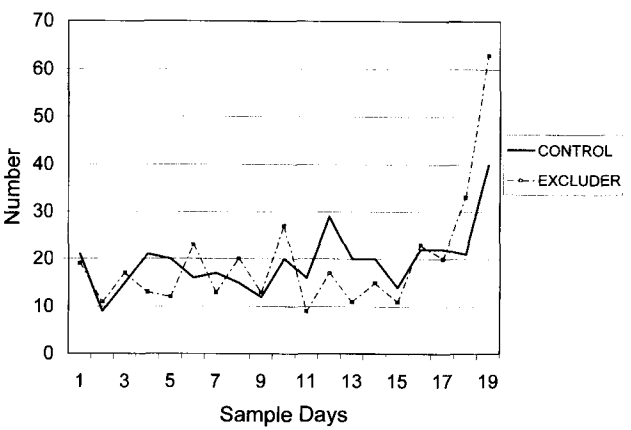

Figure 3. Number of blue crabs by trap type.

Table 1. By catch for control and excluder traps.

Species	Control	Excluder
Southern flounder *(Paralichthys lethostigma)*	2	1
Gulf toadfish *(Opsanus beta)*	4	7
Polka-dot batfish *(Ogcocephalus radiatus)*	1	0
Pinfish *(Lagodon rhomboids)*	4	4
Sand seatrout *(Cynoscion arenarius)*	0	2
Southern kingfish *(Menticirrhus americanus)*	2	1
Croaker *(Micropogonias undulatus)*	3	0
Atlantic spadefish *(Chaetodipterus faber)*	3	5
Spot *(Leiostomus xanthurus)*	2	0
Hardhead catfish *(Arius felis)*	6	4
Stone crabs *(Menippe adina)*	12	9
Spider crab *(Libinia emarginato)*	2	5
Total	42	38

The bycatch did not include any diamondback terrapins. Bycatch for both trap types included 11 species of finfish and 2 species of crabs. Forty-two individuals were caught in the control traps and 38 individuals were taken in traps fitted with the excluders (Table 1). Little difference in bycatch catch rate was seen between the 2 trap types.

Discussion

Little difference was observed in the mean size and daily catch rate of blue crabs between modified and unmodified crab traps. Even though mean size and catch rate was not significantly different, the distribution of the sizes of crabs was significantly different. This difference may be attributed to more blue crabs being caught in the upper and lower size range in the control traps.

Data from a similar study (Mazzarella 1994) using the same 5 x 10 cm terrapin excluder device in crab traps on the east coast, showed no significant difference in the size distribution between the 2 trap types. The detectable difference in size distribution in this study may be due to the small sample size (740 blue crabs) when compared to Mazzarella's data (22,981 blue crabs).

Any management measures implemented should take into account the future viability of diamondback terrapin populations tempered with the cost and feasibility of blue crab trap modification. The slight decrease in numbers of larger crabs observed in excluder traps could have an overall economic impact to the fishermen. Future studies should include an expansion of this project to increase sample size, use of different size excluders to test effects on blue crab catch and turtle excluding effectiveness, economic effects on blue crab fishermen, and mapping of areas where excluder traps would be most effective.

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