Bycatch Abundance, Mortality and Escape Rates in Wire and Wooden Spiny Lobster Traps

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ABSTRACT

We compared the species composition and abundance of bycatch in wire and wooden spiny lobster traps near the Atlantic coast reefs of the Florida Keys. Additional observations of wooden and plastic traps were made in the heterogeneous seagrass-hardbottom community of the Gulf of Mexico. We observed 1,725 individuals representing 77 species in wire traps (n = 1,411 traps) and 758 individuals representing 63 species in wooden traps (n = 1,480 traps). Plastic traps (n = 517 traps) captured 386 individuals representing 25 species, and wooden traps (n = 774 traps) from the same area captured 232 individuals representing 23 species. Tomtates, white grunts, stone crabs, and spider crabs dominated the bycatch from all traps. Wire traps caught significantly more snapper/grouper, grunts, ornamental fish, other fish, and invertebrates than wooden traps did ($\alpha < 0.05$). Snapper and grouper composed 5.5% of the bycatch. Daily bycatch mortality during this experiment was estimated to be between 0.0009 and 0.0027 animals per wooden trap/day and 0.0021 to 0.0064 animals per wire trap/day. Diver observations indicated that immediate escape from both wire and wooden traps was possible for tomtates. Ninety percent of the snapper escaped from both wooden and wire traps within 24 hours. Observed fishing practices in the spiny lobster fishery had a minimal impact on bycatch, particularly snapper and grouper. Current fishing regulations have restricted the number and type of traps available, and little potential exists for the misuse of lobster traps to capture fish.

KEY WORDS: Bycatch, mortality, wire lobster traps, plastic lobster traps, *Panulirus argus*

INTRODUCTION

The Caribbean spiny lobster (*Panulirus argus*) is one of the most intensely exploited and economically valuable shellfish in the Caribbean region. In Florida, the spiny lobster is second only to pink shrimp (*Penaeus duorarum*) in dockside value (Harper, 1995). The number of lobster traps increased from approximately 250,000 in the mid-1970s to approximately 936,000 traps by 1991. However, this increase in effort did not result in a commensurate increase in landings. Concern about overcapitalization of the fishery led to the implementation of management measures that have so far reduced the number of traps to approximately 606,000 (Hunt, 1995; Matthews, in press). Although the number of traps within the fishery has been substantially reduced, concern remains that lobster traps may be used to target commercially valuable fish species and circumvent current restrictions on fish traps.

Considerable variation exists in the design of and materials used in fish and lobster traps. Fish traps in Florida are constructed principally of wire (Harper *et al.*, 1990) and lobster traps are constructed principally of wood. However, current regulations do not limit lobster-trap construction materials, only trap dimensions and entrance position (Florida Marine Fisheries Commission, 1995). Pressure-treated wood is the preferred construction material for 90% of lobster traps, but 9% of traps are constructed at least partially with plastic-coated wire. The remaining 1% of the traps are plastic (Hunt *et al.*, 1994; Matthews *et al.*, in press). These regulations allow lobster traps to be constructed principally of wire, which means that they can be designed to capture more bycatch, specifically snapper and grouper, than wooden traps can. To evaluate whether the concerns regarding use of wire lobster traps are valid, we compared bycatch abundance and bycatch mortality in wooden and wire traps and assessed the fish-catching effectiveness of wooden and wire lobster traps.

METHODS

We examined the contents of approximately 100 wooden and 100 wire traps twice monthly during the first seven months (August 1995 to February 1996) of the eight-month lobster fishing season. These traps were placed in parallel lines in less than 10 m of water near the shallow reefs on the Atlantic coast of the Florida Keys. Also, observations of parallel lines of plastic and wooden traps were made during August, September, and November 1995, in 5 m of water in the heterogeneous seagrass-hardbottom community of the Gulf of Mexico. All traps were approximately 81 x 61 x 46 cm. Wooden and plastic traps have 3-cm or smaller spaces between adjacent laths. Wire traps were constructed with 2.5 x 5.1 cm (1 x 2 inch), plastic-coated, 14-gauge wire, but have wooden tops with variable spacing between each lath. All traps had top entrances with 10 x 13 cm rectangular plastic funnels.

We examined each trap and recorded trap type (wooden, wire or plastic), trap location (to the nearest minute of latitude and longitude), trap status (fishing, broken, robbed, or missing), soak duration (the number of days between successive trap pulls), type of bait, and use of attractants (for attractant def. see Hunt *et al.*, 1986; Heatwole *et al.*, 1988). Each lobster was measured to the nearest 1 mm carapace length (CL). Dead lobsters were measured when sufficient remains were present. Bycatch species were identified and measured to the nearest 1 cm total length (TL). All dead bycatch was identified to the most specific taxon possible. Other invertebrates were identified but not measured, except that stone crab claws were separated into the three common market sizes. Small encrusting and fouling organisms were not recorded.

A Wilcoxon two-sample test was used to test the hypothesis that paired lines of wooden and wire traps and paired lines of wooden and plastic traps contained equal numbers of animals ($\alpha < 0.005$). This conservative significance level was selected to compensate for the multiple comparisons using the Bonferroni correction, and the overall significance of the experiment was held at $\alpha < 0.05$. This test was performed independently on five groups of animals: commercial fish (snapper and grouper), grunts, ornamental fish, invertebrates and other fish (Winer *et al.*, 1991). Broken, robbed, and missing traps were omitted from all analyses. The nonparametric test was chosen because animals in traps were not normally distributed.

The escape/mortality-rate experiment determined the relationship between trap soak period and bycatch mortality. This consisted of placing one small or one medium-sized fish in each of 10 wooden and 10 wire traps and observing how many days were required before the fish died or escaped. The small fish were tomtate grunts (*Haemulon aurolineatum*) averaging 16.6 cm and ranging from 15 to 18 cm total length (TL). Medium-sized fish were gray snapper (*Lutjanus griseus*) averaging 26.9 cm and ranging from 25 to 29 cm TL. All fish were tagged with FLOY® sphyrion-anchor spaghetti tags so that individual fish could be identified. Two lobster were also placed in each trap as attractants.

The decay-rate experiment determined how effectively trap observations depicted bycatch mortality. The experimental design was similar to the escape/mortality experiment's design, except that this experiment consisted of placing one small dead fish or one medium-sized dead fish in each of 10 wooden and 10 wire traps and observing how many days the carcass remained in the trap. The small dead fish were tomtate grunts averaging 16.4 cm and ranging from 14 to 18 cm TL. Medium-sized dead fish were gray snapper averaging 27.2 cm and ranging from 26 to 29 cm TL. Two lobster were also placed in each trap as attractants.

Results from both the trap observations and experimental treatments are included so that the daily bycatch mortality rates (M) for each trap type can be determined. All dead animals, except lobster, observed in the 2891 traps sampled in this study are included. Daily bycatch mortality rates (M) are calculated based on mortality observations (m), trap soak period (s), and the small and medium-sized fish decay period (d). If trap soak period (s) is less than decay period (d), the observed mortality rate is:

$$M = m/s$$

where M = daily mortality rate, m = observed mortality rate, s = trap soak period.

This equation is sufficient for short soak periods because a carcass would not decay and disappear prior to trap retrieval. When the soak period is greater than the decay period (d), the animal carcasses could decay and disappear before the trap is retrieved. An additional term is required to account for the proportion of the time a carcass may have remained in a trap but was not observable because the carcass decayed before the trap was retrieved. In this situation, the following equation is used:

$$M = m/s^{*} (s/d)$$ where d = the time required for a fish carcass to decay.

The assumption inherent with (s/d) is that mortality is independent of soak period. If this assumption is incorrect and the observed mortality rate (m) is dependent on soak period (s), (s/d) can be modified to reflect that dependence:

$$M = m/s^{*} (s/d)^{x}$$

where 'x' represents a nonlinear relationship between confinement-induced mortality (c) and soak period (s). This nonlinear component is included to account for the relationship between bycatch escape period (e) or confinement-induced mortality (c) with trap soak period (s). During our experiment, no confinement-induced mortality was observed, so the term was not included in the daily mortality rate observations.

RESULTS

Many species of fish and invertebrates were routinely observed in lobster traps during onboard monitoring. Ninety-two taxa were observed in wooden and wire lobster traps (Table 1). Of these, we observed 1,725 individuals representing 77 taxa in wire traps (n = 1,411 traps) and 758 individuals representing 63 taxa in wooden traps (n = 1,480 traps). Tomtate (*H. aurolineatum*) and white grunts (*Haemulon plumieri*) dominated the bycatch in wire traps, and stone crabs

Table 1. Number of individuals of each species observed in wood (n=1,480) and wire (n=1,411) lobster traps in the Atlantic Ocean (August, 1995 - February 1996). *Menippe mercenaria* are reported as the number of claws (J=Jumbo, L=Large, and M=Medium).

Species	Wood	Wire	Species	Wood	Wire
Haemulon aurolineatum	102	559	*Pomacanthus arcuatus*	7	9
Haemulon plumieri	127	221	*Scyllarides* sp. and		
Other Crabs	8	136	*Scyllarus* sp.	8	7
Mithrax spp.	78	58	*Epinephelus morio*	10	1
M. mercenaria claws-L	62	44	*Halichoeres radiatus*	2	8
M. mercenaria claws-M	58	26	*Fasciolaria tulipa*	3	7
M. mercenaria claws-J	39	29	*Stenopus hispidus*		9
M. mercenaria	39	19	*Acanthurus chirurgus*	2	9
Hermit Crab	14	42	Other Scaridae	2	8
Lutjanus synagris	24	25	*Calappa flammea*	10	
Stenorhynchus sp.	7	38	*Astrophyton muricatum*	7	2
Calamus spp.	2	41	*Ocyurus chrysurus*		7
Balistes capriscus	21	21	*Diplectrum formosum*	1	6
Lactophrys quadricornis	8	33	*Pomacentrus leucostictus*	2	5
Sparisoma chrysopterum	3	36	*Halichoeres bivittatus*	2	4
Equetus acuminatus	9	24	*Nicholsina usta*	6	
Lachnolaimus maximus	4	28	*Ginglymostoma cirratum*	4	2
Lysmata wurdemanni	14	17	*Octopus* sp.	1	6
Monacanthus hispidus	1	26	*Aulostomus maculatus*	2	3
Lutjanus analis	5	20	*Haemulon album*	1	4
Gymnothorax moringa	17	7	*Abudefduf saxatilis*	1	3
Callinectes sapidus	5	18	*Monacanthus ciliatus*	3	2
Haemulon parrai	2	21	*Apogon* spp.	1	3
Lactophrys bicaudalis	5	14	*Acanthurus coeruleus*	2	2
Haemulon melanurum		18	*Haemulon sciurus*		4
Lytechinus variegatus	17		*Sparisoma aurofrenatum*	4	
Psuedupeneus maculatus	17		*Priacanthus arenatus*		4

Table 1 (continued)

Species	Wood	Wire
Apogon psuedomaculatus	4	
Hepatus epheliticus	2	2
Sparisoma rubripinne		4
Mullus auratus	3	
Thalassoma bifasciatum	3	
Lactophrys triqueter	2	1
Pomacanthus paru	1	2
Lagodon rhomboides		3
Seriola dumerili	3	
Anisotremus virginicus	3	
Canthigaster rostrata	1	1
Aluterus monoceros	1	1
Holacanthus bermudensis		2
Chaetodon sedentarius	1	1
Holothuria sp.	2	
Chaetodipterus faber	2	
Pleuroploca gigantea	2	
Equetus lanceolatus	1	2
Octopus briareus		2
Diodon hystrix	1	
Scorpaena spp.	2	
Acanthurus bahianus		1
Balistes vetula	1	
Urolophus jamaicensis		1
Astrapogon alutus		1
Clypeaster rosaceus	1	
Echinometra viridis	1	
Opsanus beta	1	
Chicoreus pomum	1	
Sphoeroides nephelus		1
Echeneis naucrates	1	
Lutjanus griseus	1	
Rypticus maculatus	1	
Synodus sp.	1	
Lactophrys polygonia		1
Lutjanus apodus	1	
Mycteroperca bonaci		1
Gymnothorax funebris	1	
Decapterus punctatus	1	

(*Menippe mercenaria*) were the most abundant bycatch species in wooden traps. Tomtates, white grunts, stone crabs, and spider crabs (*Mithrax* spp.) accounted for 64% of the bycatch in all traps. Invertebrates were 5 of the 10 most abundant bycatch taxa. Commercial fish (snapper and grouper) composed 5% and 7% of the bycatch in wire and wooden traps, and legal-sized fish (South Atlantic Fishery Council, 1996) occurred in approximately 1 out of 200 (0.5%) wire traps and 1 out of 300 (0.3%) wooden traps. Thirty-four taxa were observed in wooden and plastic lobster traps in the Gulf of Mexico (Table 2). Of these, we observed 386 individuals representing 25 species in wooden traps (n = 774 traps) and 232 individuals representing 23 species in plastic traps (n = 517 traps). Stone crabs dominated the bycatch in both wooden and plastic traps. The only fish to occur commonly in traps in the Gulf were white grunts. Three of the four most abundant bycatch taxa in the Gulf were invertebrates. Commercial fish (snapper and grouper) composed 2.6% and 1.3% of the bycatch in wooden and plastic traps. No legal-sized commercial fish (Florida Marine Fisheries Commission, 1995; South Atlantic Fishery Council, 1996) were observed in the wooden or plastic traps in the Gulf.

Tomtates and white grunts, the most abundant fish in the bycatch, were not evenly distributed among the traps. These taxa aggregated in specific traps, resulting in a strongly skewed distribution of fish with a few traps containing multiple fish and a low average number of grunts/wire trap (mean = 0.55). The overall abundance of grunts varied seasonally. White grunt abundance peaked during October for wooden traps and during November for wire traps; while, tomtate abundance peaked in December regardless of trap type (Figure 1). Size-frequency histograms for the most abundant or commercially important fish were characterized by a broader size range of fish in wire traps. The modal population size for most species was consistent between trap types. Mutton snapper (*Lutjanus analis*) were a notable exception: only a few small individuals occurred in wooden traps, whereas wire traps captured larger fish (between 30 and 40 cm). The size of hogfish (*Lachnolaimus maximus*) also varied between wooden and wire traps. Wooden traps contained fewer fish, but their size varied more than those caught in wire traps (Figure 2).

The comparison of bycatch rates between the 1,480 wooden traps and the 1,411 wire traps indicated that for all five bycatch groups, wire traps caught significantly more animals (Figure 3). Although not statistically tested, the number of taxa observed in wire traps was consistently higher for the four fish groups examined. Only amongst the invertebrates did wooden traps capture more taxa. Wooden traps caught more grunts and invertebrates than plastic traps did (Figure 4). Commercial and ornamental fish rarely occurred in the wooden and plastic traps in the Gulf. Although the catch rates of snapper/grouper and reef

Table 2. Number of individuals of each species observed in wood (n=774)and plastic (n=517) lobster traps in Florida Bay (August, September, and November, 1995). *Menippe mercenaria* are reported as number of claws (J=Jumbo, L=Large, and M=Medium). Trap types are wood (W) and plastic (P).

Species	Wood	Plastic	Species	Wood	Plastic
M. mercenaria claws - J	69	26	*Pleuroploca gigantea*	2	2
M. mercenaria claws - L	141	31	*Lutjanus synagris*	4	
M. mercenaria claws - M	156	37	*Monacanthus ciliatus*	1	2
M. mercenaria	76	81	*Epinephelus morio*	3	
Haemulon aurolineatum	42	19	*Arius felis*		3
Mithrax spp.	10	14	*Urolophus jamaicensis*		2
Lytechinus variegatus	8	15	*Echinaster spinulosus*	2	
Lactophrys quadricornis	9	6	*Calamus* spp.	2	
Ginglymostoma cirratum	8	2	*Diplectrum formosum*	2	
Chaetodipterus faber	1	9	*Nicholsina usta*		2
Haemulon aurolineatum	10		*Bairdiella batabana*	2	
Other Crabs	5	3	*Equetus lanceolatus*	2	
Balistes capriscus		8	*Archosargus probatocephalus*		1
Chilomycterus schoepfi	6		*Chaetodon ocellatus*		1
Opsanus beta	6		*Condylactis gigantea*		1
Fasciolaria tulipa	1	4	*Equetus acuminatus*	1	
Octopus sp.	1	4	*Hypoplectrus unicolor*		1
Lutjanus griseus	2	3	*Monacanthus hispidus*		1
			Mycteroperca microlepis	1	

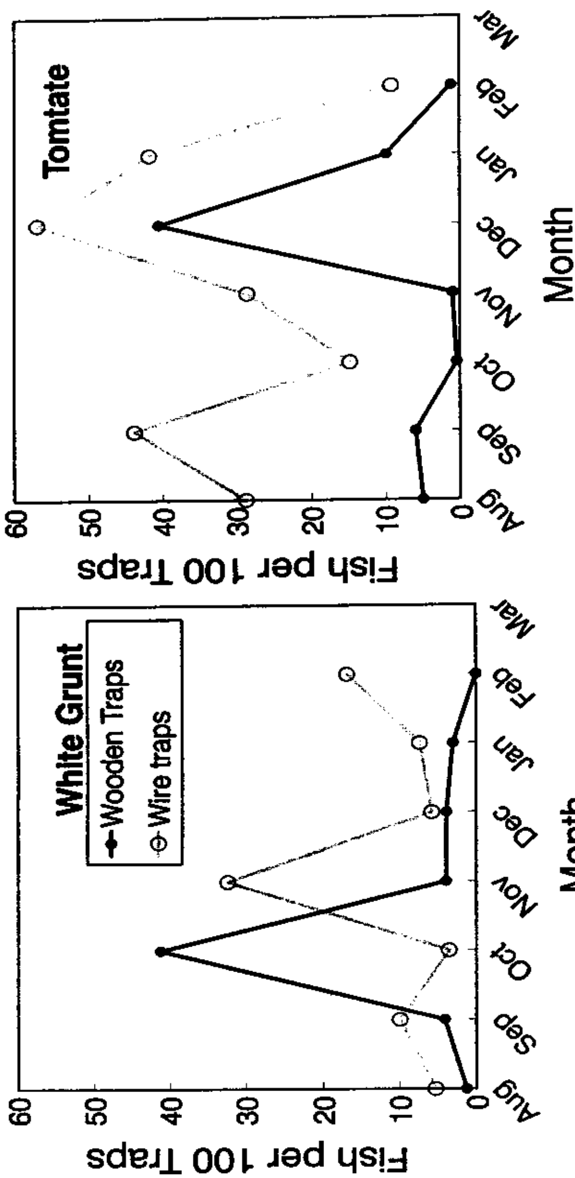

Figure 1. Total number of tomtates and white grunts observed in paired lines of wooden and wire spiny lobster traps. Counts were standardized and reported as total number of fish captured per 100 traps to account for the variable number of traps observed each month.

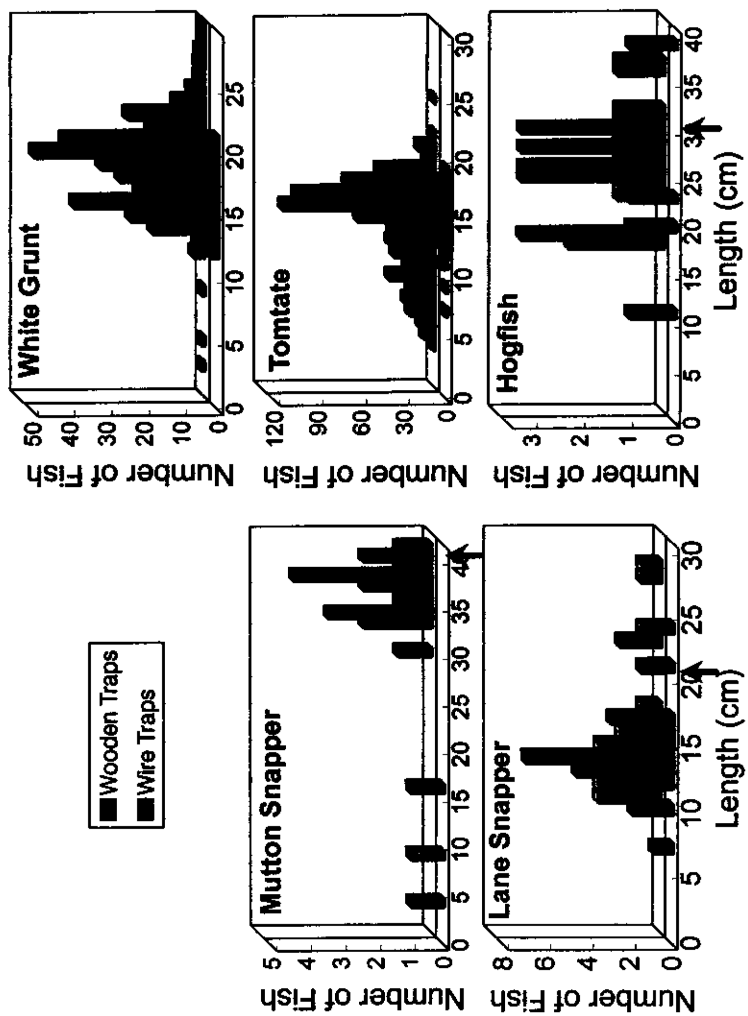

Figure 2. Size frequency histograms of common or commercially important bycatch species observed in wooden and wire spiny lobster traps. All lengths were reported as total length to the nearest cm except for lengths of hogfish, which were reported as fork length to comply with current fishery regulations. Minimum legal size as defined by the South Atlantic Fishery Management Council is indicated by ≠ for species with minimum size limits.

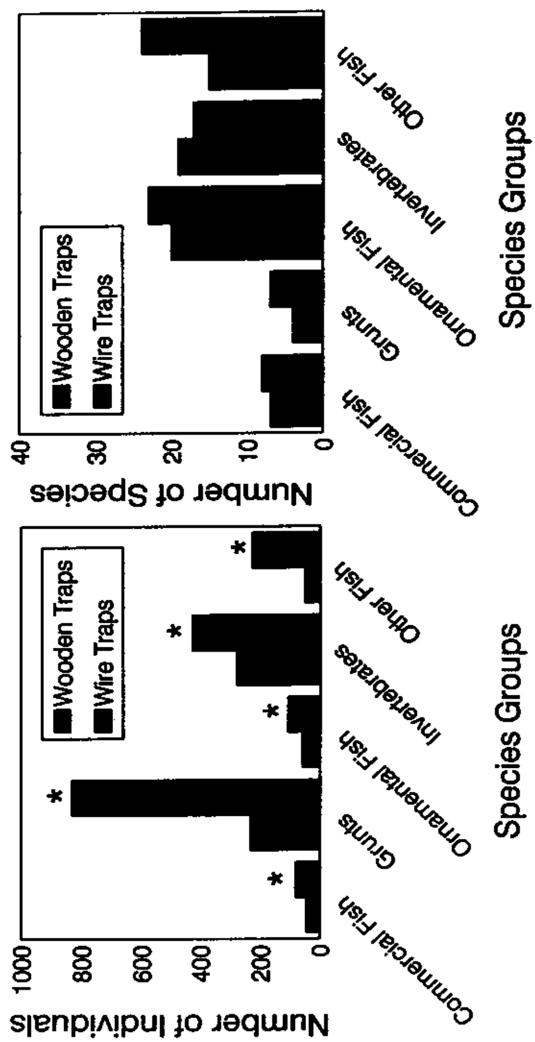

Figure 3. Abundance and species composition of groups of bycatch captured in wooden and wire spiny lobster traps. Significant differences in abundances of bycatch groups caught in wooden and wire traps were determined using a Wilcoxon two-sample test at a<0.05 experiment-wide significance level are identified by *. Significant differences in species diversity of bycatch groups were not examined.

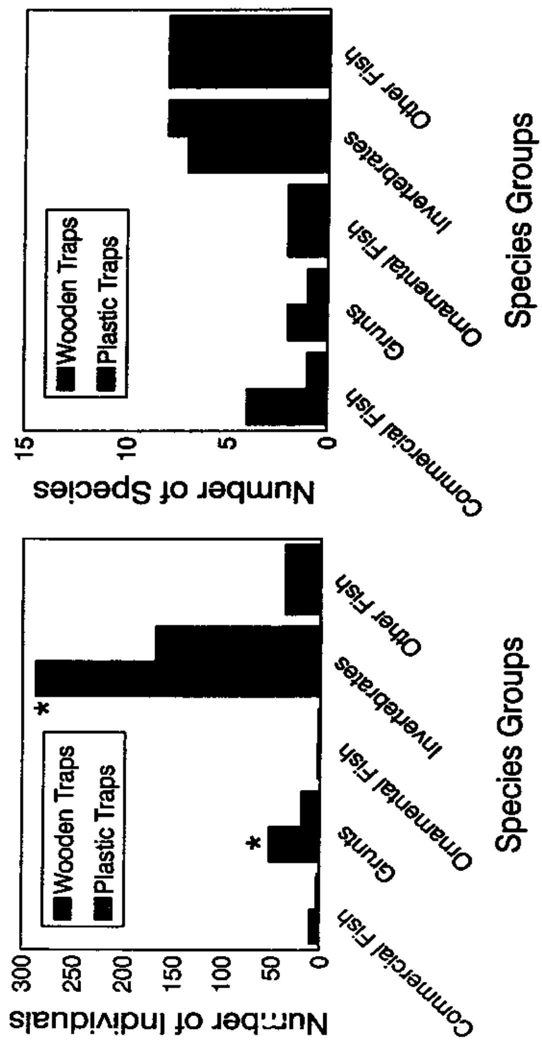

Figure 4. Abundance and species composition of groups of bycatch captured in wooden and plastic spiny lobster traps. Significant differences in abundances of bycatch groups caught in wooden and plastic traps were determined using a Wilcoxon two-sample test at $\alpha < 0.05$ experiment-wide significance level are identified by *. Significant differences in species diversity of bycatch groups were not examined.

fish were significantly different between wooden and wire traps, on average, only 0.031 and 0.056 fish of any size from the snapper/grouper group occurred per trap from either wooden or wire traps respectively.

The escape/mortality experiment indicated that wooden and wire lobster traps do not confine fish for more than a few days. Small tomtates (~16 cm) escaped from wooden and wire traps in less than 24 hours by swimming between the wooden slats or through the wire mesh. Ninety percent of gray snappers (~25 cm) escaped in less than 24 hours and all escaped in less than 48 hours (Figure 5). No confinement-induced mortality was observed among the fish in this experiment.

The decay-rate experiment indicated that the disappearance of fish carcasses was rapid but varied considerably. Small fish carcasses disappeared from traps in less than 24 hours and left no visible remains. Medium-sized fish carcasses disappeared in less than 72 hours and occasionally in less than 24 hours (Figure 6). In most cases, small bone fragments from the medium-sized fish carcass had fallen through the spaces in the trap and were visible on the sea floor.

Observed bycatch mortality (m) during the onboard monitoring was 13 animals from 2,891 traps (Table 3). This excludes animals that may have died and been consumed prior to trap retrieval, decayed prior to trap retrieval, or died after trap retrieval. Even though few dead bycatch animals were observed, there was sufficient information to determine a daily mortality rate (M). Trap soak period (s) was always greater than decay period (d), so in these situations, the following equation was applied:

$$M = m/s^* \ (s/d)$$

Because fish carcasses decayed in 1 to 3 days, applying the daily mortality-rate formula for both decay periods resulted in a maximum and minimum daily mortality rate (M). For wooden traps, the maximum daily mortality rate of bycatch in traps is

$$0.0027 = 0.0027/12.14^*(12.14/1),$$

and the minimum daily mortality rate of bycatch in wooden traps is

$$0.0009 = 0.0027/12.14^*(12.14/3).$$

For wire traps, the maximum daily mortality rate of bycatch in traps is

$$0.0064 = 0.00638/12.40^*(12.40/1),$$

and the minimum daily mortality rate of bycatch in wire traps is

$$0.0021 = 0.00638/12.40*(12.40/3).$$

The maximum daily mortality rate was achieved when fish carcasses decayed in less than one day. The minimum daily mortality rate estimate was achieved when fish carcasses decayed in less than three days. No fish were observed in distress immediately following release, but these daily mortality rates did not include animals that may have died after release.

DISCUSSION

The low number of commercial-quality fish in both wire and wooden lobster traps suggested that current fishing practices in the spiny lobster fishery precluded targeting most fish species. Stone crabs were the only abundant bycatch species that was retained by fishermen. Tomtate, white grunt, and *Mithrax* were relatively abundant in traps but were not retained or routinely injured. If these three species become more valuable for consumption or for the live bait industry the effect of wire traps on the harvest of these species may need to be reevaluated.

The low mortality rate of bycatch in both wire and wooden lobster traps suggested that current fishing practices and trap design resulted in minimal effects on nontarget species. Although statistical differentiation of mortality rates between trap types was possible, mortality occurred rarely, and differentiating mortality rates between trap types would have resulted in erroneous results. Our mortality observations did not include animals that died after release, but this study was conducted in less than 9 m of water and fish were not observed with distended stomachs or other trauma resulting from air-expansion injuries. Wire traps in the fishery were used predominantly deeper than 20 m and postrelease mortality may have been more substantial at those depths. Diver observations suggested that fish escape rates from traps were high. High escape rates provided a mechanism that would preclude most of the long-term detrimental effects of trap confinement. Fish mortality was apparently independent of trap soak period. This eliminated the need for a complex nonlinear or exponential relationship between trap soak period and fish mortality. In estimating mortality rates, we needed to consider only the time required for a carcass to decay and the trap's soak period to accurately reflect trap-induced mortality prior to trap retrieval.

Trap location and habitat type may influence bycatch abundance in different types of lobster traps. In a previous study, lobster traps constructed with wire contained more fish than the more commonly used wooden trap, but different trap styles were generally used in different areas. Wire lobster traps were used in deep water (greater than 20 m) and areas where loggerhead sea turtles (*Caretta caretta*) cause damage to traps. Although that study determined the relative amount of bycatch in the lobster trap fishery, it did not directly compare the amounts and types of bycatch in different trap types fishing in the same habitat and area (Matthews *et al.*, in press). In this study, paired parallel lines of wooden and wire traps near shallow reefs on the Atlantic side of the Florida Keys eliminated the confounding effects of trap location on the abundances and type of animals susceptible to trapping. This study was designed to directly compare bycatch in wooden and wire traps near shallow Atlantic reefs in the Florida Keys; bycatch composition and abundance may differ in other locations.

Examination of paired lines of wire and wooden traps also allowed us to compare bycatch abundance and bycatch mortality. Bycatch mortality was inherently difficult to estimate because bycatch may have died and disappeared prior to trap retrieval. We did not observe that any tagged small and medium-sized fish within our experimental traps died instead of escaping, which confirms the low mortality rate of fish observed in all traps. Decay rates of small and medium-sized dead fish are rapid, which makes it difficult to estimate their mortality rates in traps. But computing the decay rate allows us to calculate an estimate of the total number of animals that died, including those that decomposed, prior to trap retrieval.

The proliferation of lobster traps before 1992 decreased the fishing efficiency of lobster traps and potentially provided motivation alter lobster traps to target fish. The advent of the Lobster Trap Certificate Program and removal of more than 300,000 lobster traps from the water increased the number of lobster each remaining trap captured each fishing season (Hunt, 1995; Matthews, in press), and any incentive to use lobster traps as fish traps may have diminished because the limited numbers of lobster traps allowed in the fishery have made them a valued commodity for catching lobster. Current information suggests that the lobster trap reduction program has proceeded well and that future trap reductions are to be expected. Continued trap reductions should further increase the value of lobster traps and discourage the use of lobster traps as fish traps.

The number of lobster traps allowed in the fishery is expected to decrease, resulting in more efficiency in the fishing industry. As lobster trap efficiency increases, the amount of bycatch should decrease, because bycatch of any species usually occurred in traps with few or no lobster (Matthews *et al.*, in press).

State fishing regulations restrict the dimensions and entrance type of lobster traps and restrict the length of the fishing season. Other regulations restrict the number of snapper and grouper that may be retained on a lobster-fishing boat. Together these regulations appear to effectively limit lobster traps to targeting lobster or other invertebrates. During our observations, no fishing boat ever captured the recreational bag limit for snapper or grouper. On occasion, grunt abundance was high, but these species were routinely discarded.

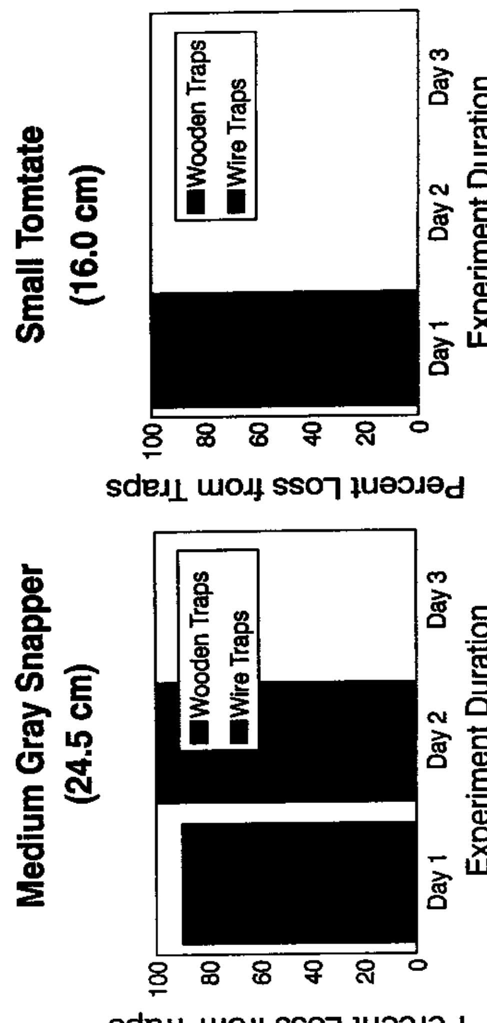

Figure 5. Escape rates observed for small tomtate grunts and medium gray snapper from wooden and wire spiny lobster traps.

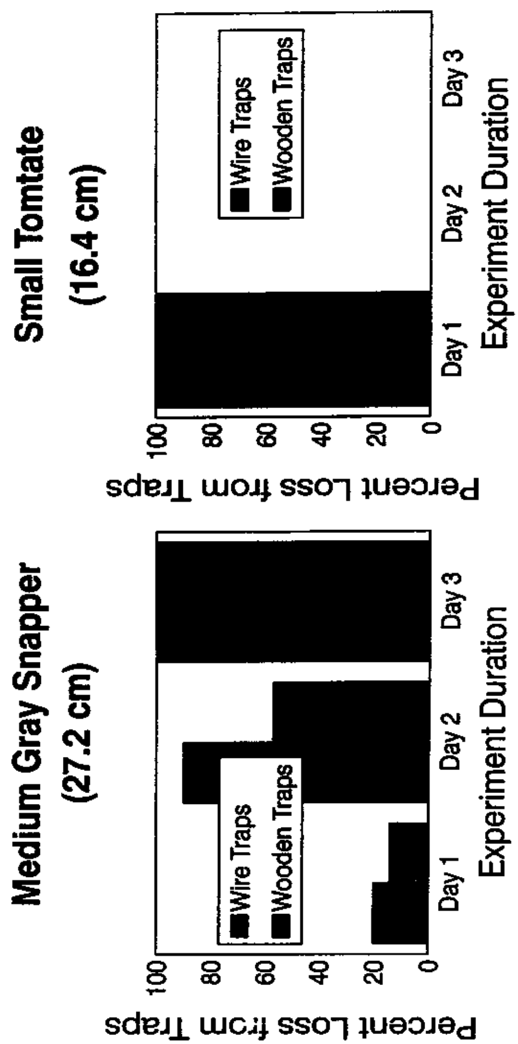

Figure 6. Decay rates observed for small tomtate grunt and medium gray snapper carcasses from wooden and wire spiny lobster traps.

Table 3. Number of dead individuals of each species observed in wooden (n=1,480) and wire (n=1,411) lobster traps in the Atlantic Ocean (August 1995-February 1996).

Species	Wood	Wire
Other Crabs	1	2
Lactophrys quadricorni	1	1
Lytechinus variegatus	2	
Haemulon aurolineatum		1
Sparisoma sp.	1	
Lutjanus synagris		1
Haemulon plumieri		1
Balistes vetula		1
Callinectes sapidus		1

However, the strongly seasonal occurrence of grunts suggests that they could be exploited on a seasonal basis. The exploitation of fish aggregations is a larger fishery management issue and is probably better addressed by closed fishing seasons or closed fishing areas.

Plastic traps and wooden traps captured similar bycatch species and usually captured similar quantities of those species, so plastic traps probably could not be used to circumvent gear restrictions in other fisheries. Also, because fewer than 1% of the traps in the lobster fishery are made of plastic, the potential effects of plastic lobster traps on the fishery are probably small. Fishermen's use of plastic traps was confined to shallow water in the Gulf of Mexico because of practical considerations concerning potential loss of traps and retrieval of lost traps. Concerns, unrelated to bycatch, remain that plastic traps are not biodegradable and if lost will remain indefinitely in the marine environment.

Current fishing practices in the spiny lobster fishery minimally impact bycatch, particularly snapper and grouper. Stone crabs are a common bycatch species, but are occasionally targeted in certain areas; therefore, it is difficult to classify stone crab as bycatch. Current fishing regulations have restricted the number and type of lobster traps available and little potential exists for the misuse of lobster traps as fish traps.

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