

Summary of Target Species and Protected Resource Catch Rates by Hook and Bait Type in the Pelagic Longline Fishery in the Gulf of Mexico 1992-2002.

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Background

Results from the NED pelagic longline experiments conducted during 2001 and 2002 demonstrate that catch rates of marine turtles (leatherback and loggerhead turtles) were significantly reduced when pelagic longline sets were fished using large circle hooks (18/0 size) and/or fish (primarily mackerel) bait compared to smaller “J” hooks and squid baits. The controlled experimental conditions of the study allowed direct inference regarding the independent effects of changes in gear configuration without subsequent confounding by additional factors associated with target fishery sets such as time of day, the use of light sticks, fishing location, and other factors.

However, due to differences in environmental conditions, fishing practices, and target species it is unclear if it is appropriate to extrapolate results from the NED experiment to the entire fishery. In addition, there has been a recent increase in estimated bycatch of leatherback turtles in the Gulf of Mexico, which may be associated with changes in fishery practices (Figure 1). Thus, a preliminary analysis was undertaken to examine both protected species and target species catch rates by hook and bait type in observed pelagic longline fishery effort in other regions. The data for this analysis was taken from the POP observer database maintained at SEFSC. In a total of 4209 pelagic longline sets between 1992-2002, hook brand and model was recorded, and it was possible to identify these as either circle or “J” hooks based on company catalogues. Because the observer program is designed to randomly sample the fishery, it is assumed that the observed fishing effort is reflective of the actual fishing activity.

Summary of Results

In general, the pelagic longline fishery along the U.S. east coast and in distant waters of the tropical north Atlantic were observed to use almost exclusively “J” hooks (Table 1). Only in the Gulf of Mexico (GOM) were both hook types observed in appreciable numbers. Additionally, there were a small number of sets using both hook types simultaneously (Table 1). Circle hooks were predominantly 16/0 size and “J” hooks were 7/0 or 8/0 in the Gulf of Mexico (Table 2). By comparison, larger hooks of both types were used during the NED experiment (Table 2). The proportion of observed sets in GOM using circle hooks varied across time but declined dramatically in the last 2 years (Figure 2). In 2002, only “J” hooks or sets using both hook types were observed in this fishery. There is a strong association between hook type and bait type. Sets using

“J” hooks primarily used squid baits, though often in combination with various fish types. Circle hook sets employed predominantly fish baits, primarily dead sardine (Figure 3).

Catch rates also varied strongly with gear configuration. Those sets using “J” hooks had higher average catch rates of marine turtles, swordfish, bigeye tuna, and bluefin tuna. Those using circle hooks had higher average catch rates of yellowfin and other tuna species (Figure 4).

However, hook type is strongly correlated with bait type. To evaluate the potential effects of bait type, I show average catch rates by fish vs. squid baits for sets employing “J” hooks alone (Figure 5). Sets employing “J” hooks and squid bait had higher catch rates of leatherback turtles and swordfish while those using fish had higher catch rates, on average, of yellowfin tunas (Figure 5). Similar patterns were observed on circle hooks (Figure 6). Squid bait had higher catch rates of swordfish and turtles, and fish bait had higher catch rates of yellowfin tuna. However, there are a very low number of circle hook sets using squid baits, so any inferences are inherently uncertain.

Hook size also strongly influenced bycatch rates during the NED experiment. In the Gulf of Mexico fishery, the highest catch rates for leatherback turtles occurred on smaller (size 7/0) “J” hooks employing squid baits or both squid and fish (Figure 7a). Loggerhead turtles were caught exclusively on “J” hooks employing squid bait. Observed catch rates actually increased with increasing hook size (Figure 7b), however the large uncertainty makes it unlikely that this is a significant pattern. Catch rates of target finfish species are also potentially influenced by hook size. Swordfish catch rates were highest on large “J” hooks regardless of bait type (Figure 8a). For yellowfin tuna, catch rates were highest in sets employing fish baits, and rates were comparable across large circle hooks and relatively smaller “J” hooks (Figure 8b). Bigeye tuna catch rates were comparable between circle hooks employing fish bait and “J” hooks employing squid baits (Figure 8c).

In general, the observed patterns in the Gulf of Mexico are consistent with those in the NED experiment. It is important to recognize that in the regular fishery effort, hook and bait type are also confounded with other characteristics of the set. Primarily, sets targeting swordfish (“J” hook and squid bait) are soaked at night while those targeting tunas (typically circle hooks and/or fish baits) are soaked during the day. The confounding with time of day prevents any direct inference regarding the independent effects of bait or hook type in the GOM pelagic longline fishery. It is also possible that the fishery behavior during the observed trips analyzed here is different from that occurring in the fishery, therefore any broad inferences should be treated with caution.

The generally high catch rates of marine turtles in recent years has been associated with an increase in the proportion of the observed fishery in the Gulf of Mexico using “J” hooks and squid baits. The results from the NED experiment and the current analysis supports the argument that the increased catch rate of turtles is related to this observed change in fishery behavior.

Table 1. Numbers of observed sets by fishing area using “J” hooks (J), Circle hooks (C), or both hook types (JC). Only in the Gulf of Mexico were there a significant number of sets using circle hooks.

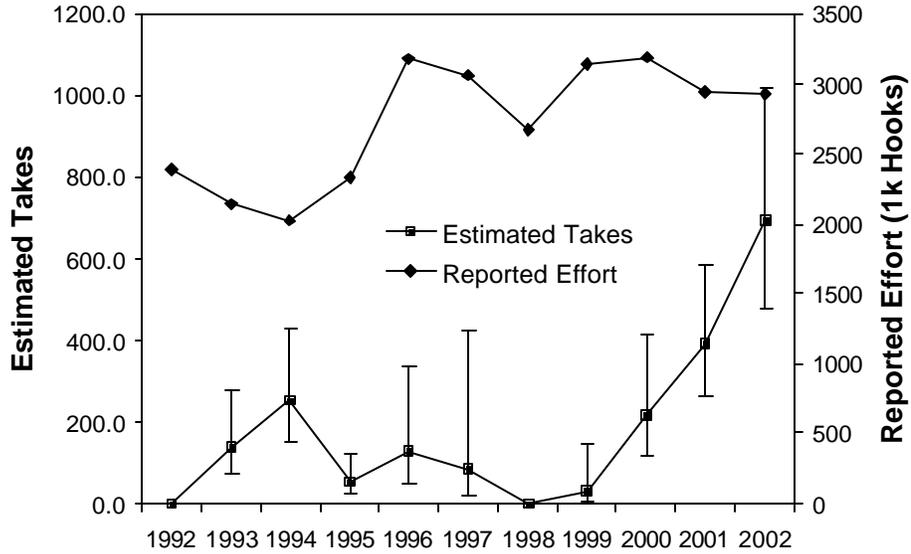
Fishing Area	Hook Type	# Sets
CAR	J	206
FEC	J	583
FEC	JC	2
GOM	C	333
GOM	J	1311
GOM	JC	85
MAB	C	11
MAB	J	361
NCA	J	266
NEC	C	5
NEC	J	220
NED	J	201
SAB	J	535
SAB	JC	8
SAR	J	14
TUN	J	33
TUS	J	31

Table 2. Hook sizes observed in pelagic longline fishery hauls in the Gulf of Mexico (1992-2002) and NED experiment (2001-2002).

Area	Hook Size	Number of Hauls
<i>Circle Hooks</i>		
GOM	13/0	11
GOM	14/0	3
GOM	15/0	132
GOM	16/0	270
NED-E	18/0	506
<i>"J" Hooks</i>		
GOM	7/0	757
GOM	8/0	433
GOM	9/0	183
GOM	10/0	13
NED-E	8/0	38
NED-E	9/0	632
NED-E	10/0	23

Figure 1. Total estimated bycatch (alive and dead turtles) of (A) leatherback turtles and (B) loggerhead turtles in the pelagic longline fishery in the Gulf of Mexico. Means (delta lognormal method) and 95% confidence intervals are depicted along with total reported effort (numbers of hooks) to the pelagic longline fishery logbook program.

A. Leatherback Turtles



B. Loggerhead Turtles

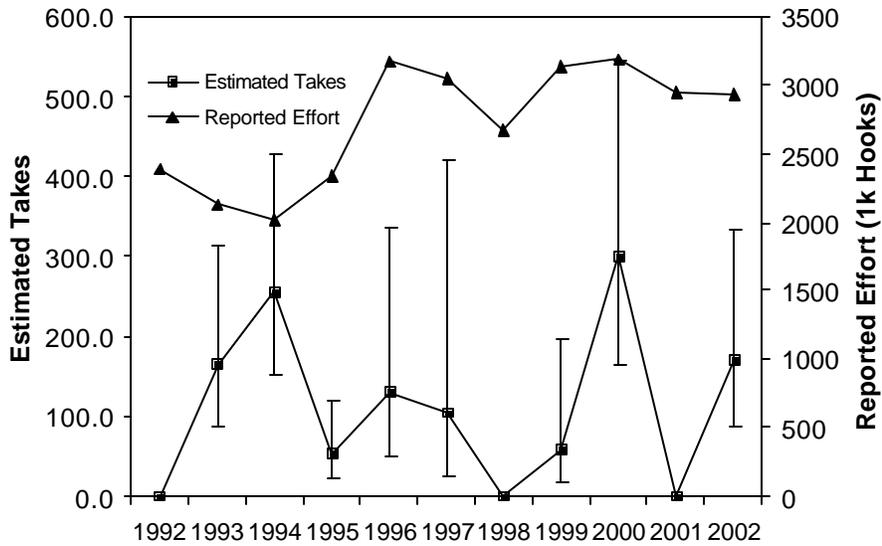


Figure 2. Proportion of observed sets using each hook type in observed pelagic longline hauls in the Gulf of Mexico between 1992-2002.

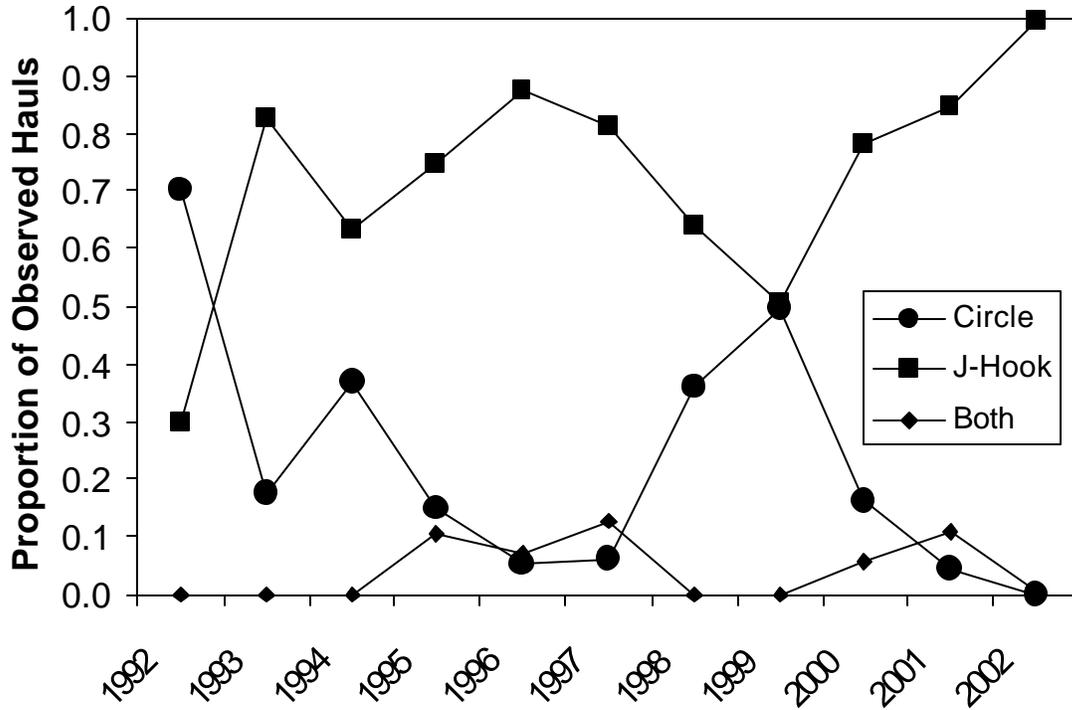


Figure 3. Major bait types by hook type (J = “J” hook, C = Circle Hook, JC = both types on set) in observed pelagic longline hauls in the Gulf of Mexico between 1992-2002. Bait type abbreviations: Mack_Deal – Dead Mackerel; Herr_Deal – Dead Herring; Squid – Squid; Sard_Deal – Dead Sardine; Scad_Alive – Alive bigeye scad.

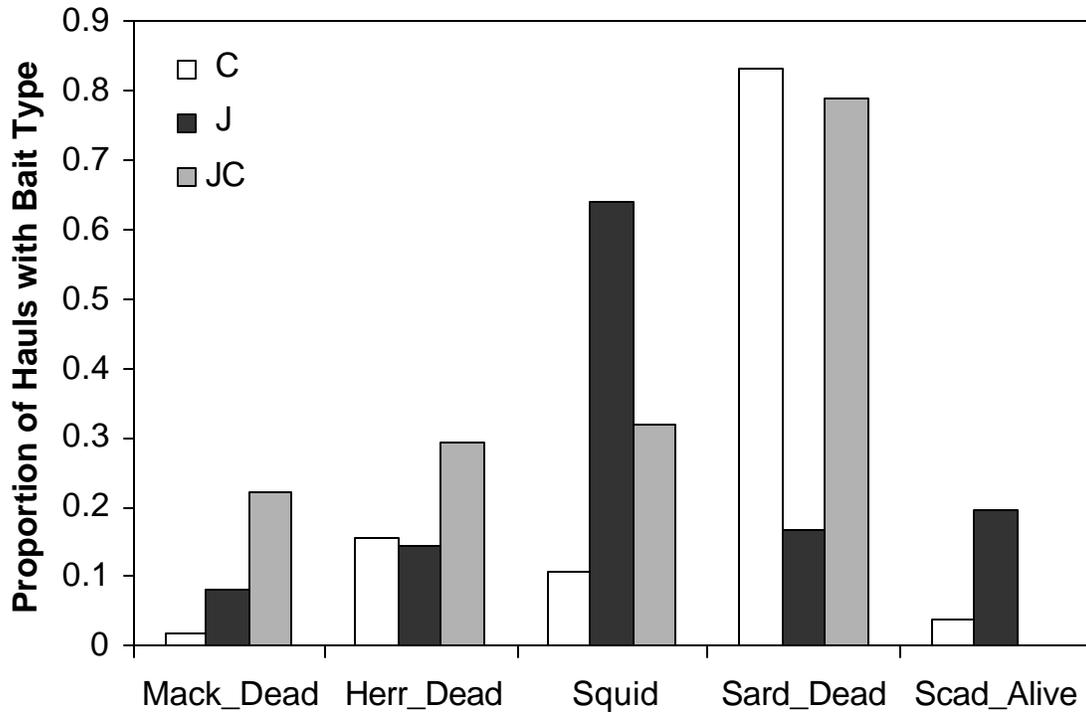


Figure 4. Catch rates (N/1000 hooks) by hook type (J = “J” hook, C = Circle Hook, JC = both types on set) in observed pelagic longline hauls in the Gulf of Mexico between 1992-2002. Means and 95% confidence intervals are shown. Species abbreviations: MAM = marine mammals, TLB = leatherback turtles, TTL = loggerhead turtles, BET = bigeye tuna, BFT = bluefin tuna, SHX = sharks, BLF = billfish, SWO = swordfish, TUN = other tunas, YFT = yellow fin tuna.

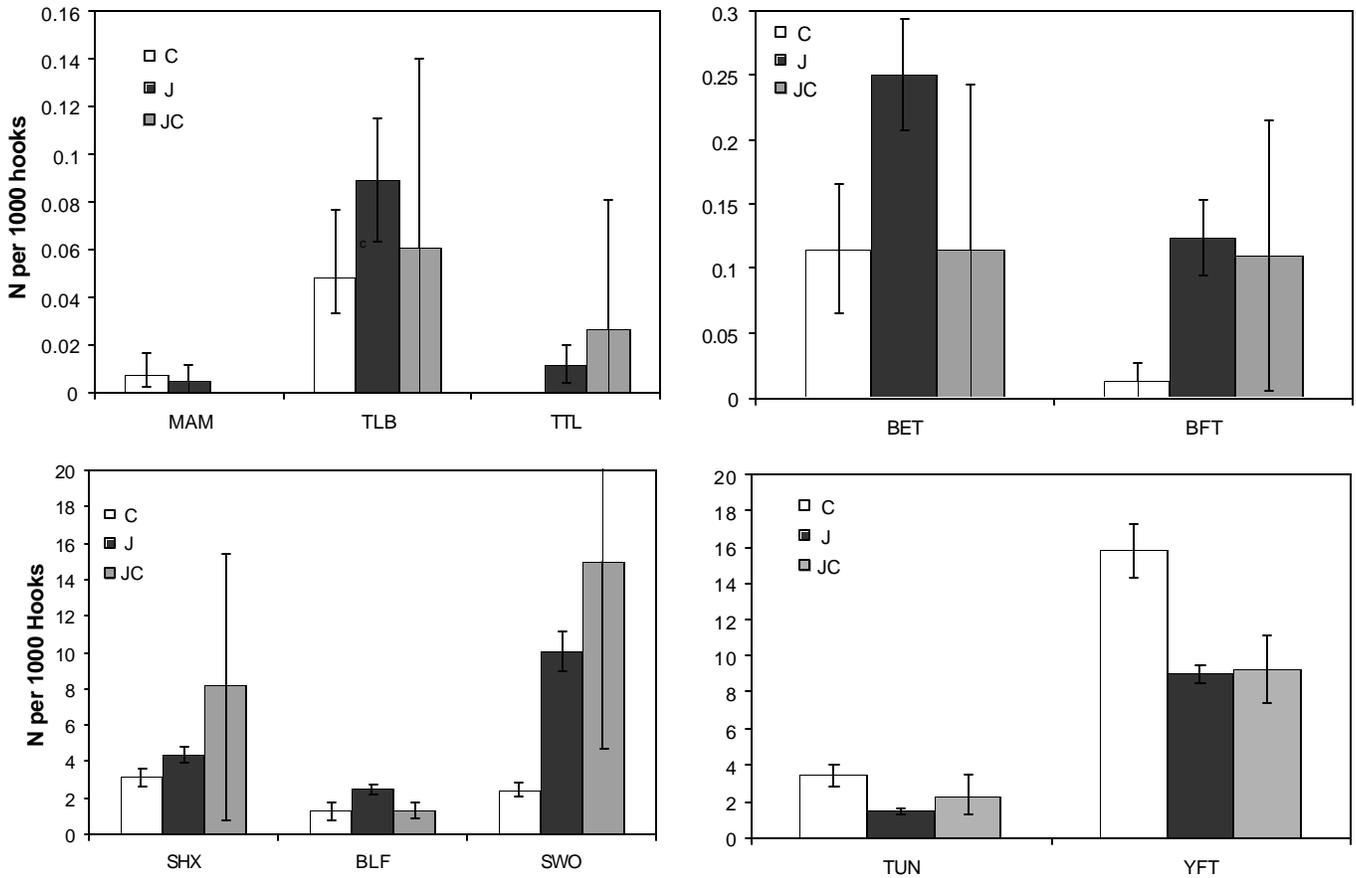


Figure 5. Catch rates (N/1000 hooks) by bait type in observed pelagic longline hauls using “J” hooks only in the Gulf of Mexico between 1992-2002. Means and 95% confidence intervals are shown. Species abbreviations: MAM = marine mammals, TLB = leatherback turtles, TTL = loggerhead turtles, BET = bigeye tuna, BFT = bluefin tuna, SHX = sharks, BLF = billfish, SWO = swordfish, TUN = other tunas, YFT = yellow fin tuna.

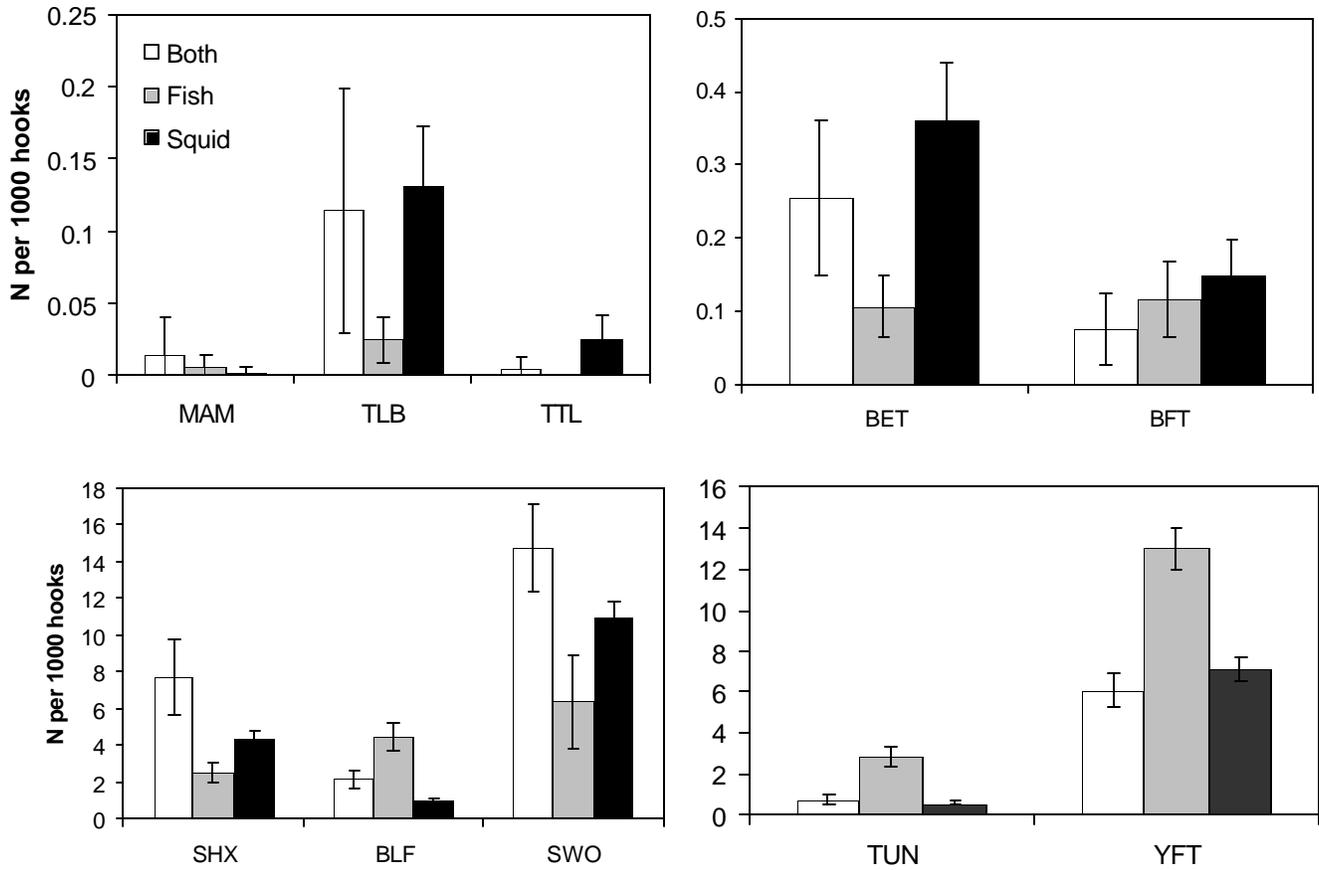


Figure 6. Catch rates (N/1000 hooks) by bait type in observed pelagic longline hauls using Circle hooks only in the Gulf of Mexico between 1992-2002. Means and 95% confidence intervals are shown. Species abbreviations: MAM = marine mammals, TLB = leatherback turtles, TTL = loggerhead turtles, BET = bigeye tuna, BFT = bluefin tuna, SHX = sharks, BLF = billfish, SWO = swordfish, TUN = other tunas, YFT = yellow fin tuna.

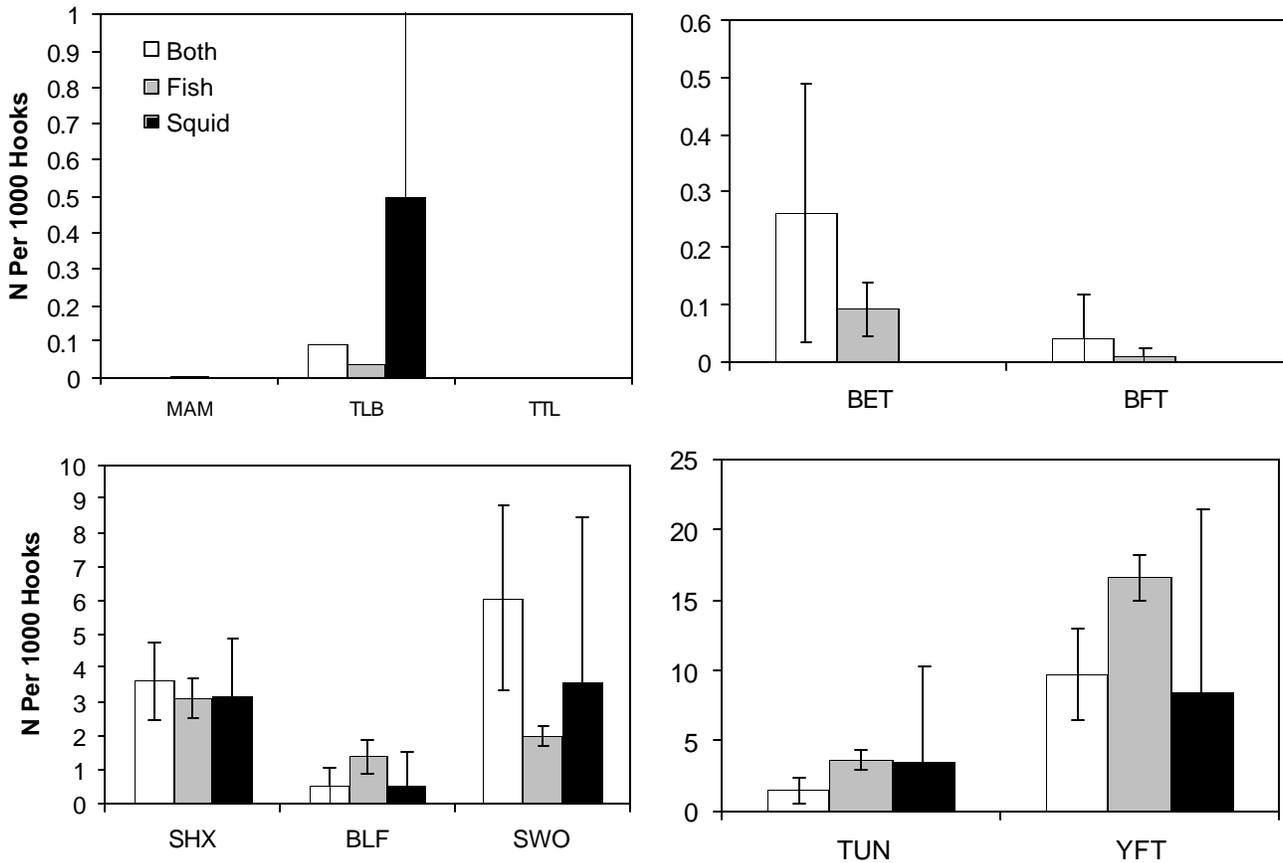
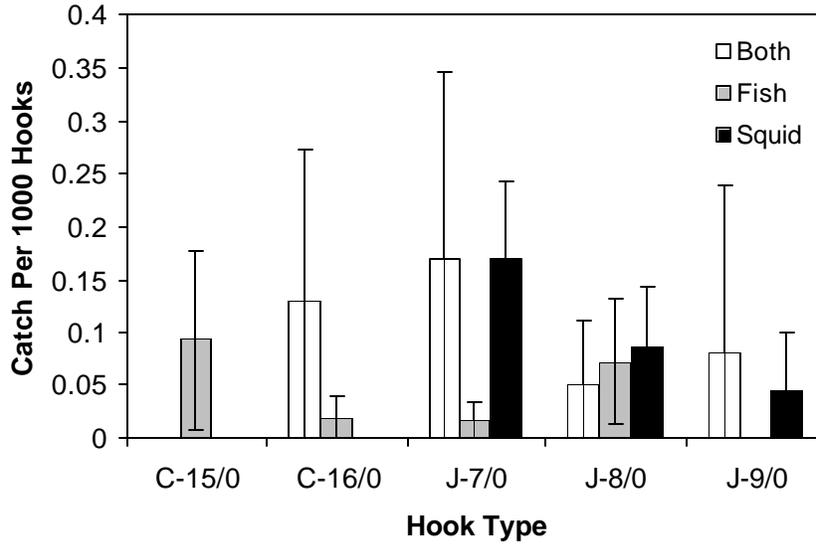


Figure 7. Catch rates (N/1000 hooks) of (A) Leatherback turtles and (B) Loggerhead turtles by bait type and hook size in observed pelagic longline hauls using only one hook type in the Gulf of Mexico between 1992-2002. Means and 95% confidence intervals are shown.

A. Leatherback Turtles



B. Loggerhead Turtles

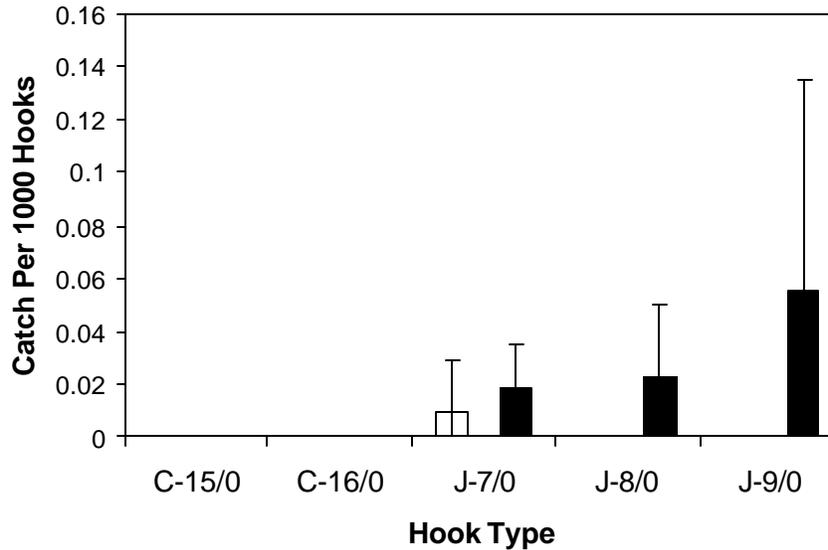
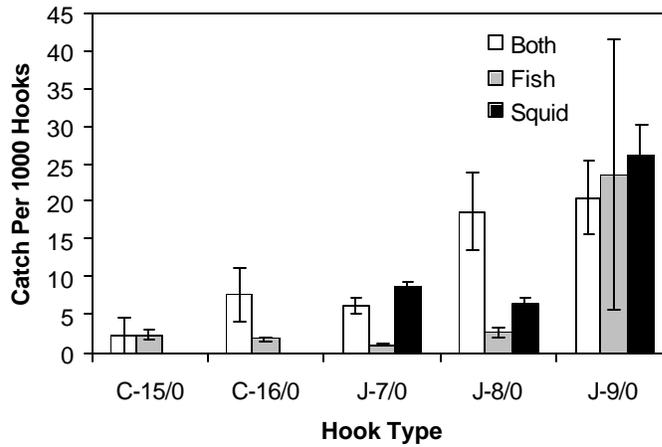
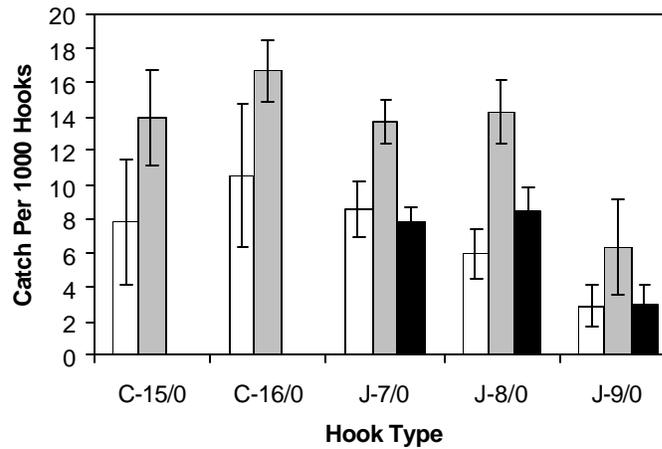


Figure 8. Catch rates (N/1000 hooks) of (A) swordfish and (B) yellowfin tuna and (C) bigeye tuna by bait type and hook size in observed pelagic longline hauls using only one hook type in the Gulf of Mexico between 1992-2002. Means and 95% confidence intervals are shown.

A. Swordfish



B. Yellowfin Tuna



C. Bigeye Tuna

