Summary Report on the Catch-and-Release Mortality Study on Tarpon in Boca Grande Pass, 2002–2004 (REVISED AND UPDATED September 11, 2013)

Background

Tarpon (*Megalops atlanticus*) are among the most highly sought inshore sport fish in Florida waters. State regulations require anglers to purchase a $50.00 tag (i.e., a permit) to harvest or possess a tarpon. The number of tarpon tags sold and used each year is used to estimate annual fishing mortality due to harvest. However, fishing mortality due to harvest is of limited use in estimating total fishing mortality for a predominantly catch-and-release fishery. In addition, the state's angler intercept program does not currently target tarpon anglers; therefore, the program does not provide enough tarpon intercepts for a reliable estimate of recreational effort or success rates. In recent years, local guides have claimed that there has been a decrease in survival and a decrease in numbers of fish in Boca Grande Pass, site of one of the state's premier tarpon fisheries. If true, it could indicate tarpon stocks in Florida are in trouble. Researchers used ultrasonic telemetry to accomplish the study objective of obtaining current catch-and-release mortality-rate estimates for tarpon that anglers caught via live bait and breakaway jig techniques, the two predominant methods of tarpon fishing employed in Boca Grande Pass.

Additional Issue

Late in 2003 and the winter of 2004, the Florida Fish and Wildlife Conservation Commission (FWC) and local guides expressed interest in the rates of foul-hooked tarpon and possible "snagging" of fish. At the time, the sample size of hook placement observations was inadequate to make a statistically valid statement on the percentages of tarpon that were foul hooked using each fishing method. In 2004, researchers made supplemental trips solely to increase the numbers of observations on hook placements in tarpon landed in Boca Grande Pass and adjacent waters.

Research Results

During the 2002–2004 tarpon fishing seasons (April–July), FWC staff members working on the Catch-and-Release Mortality Study accompanied guides on 83 trips. Forty-two of the trips involved anglers using the breakaway jig method of fishing, and 41 trips involved anglers using the live bait method of fishing. Of the 138 tarpon hooked on jig trips, 41 (30%) were landed, and 22 were tagged with acoustic transmitters and then released. On the live bait charters, 92 tarpon were hooked; 44 (48%) were landed, and 19 were tagged. Scientists using a research vessel fitted with a directional hydrophone tracked the tagged fish for up to six hours to evaluate post-release survival.

Catch-per-unit-effort (number of tarpon landed per hour fished) was higher on live bait trips (0.19) than jig trips (0.06). Researchers used the IGFA rule that defines a landed fish as one where the leader has been touched. The average size of a landed tarpon caught using jigs (171cm TL) was significantly larger than tarpon caught using live bait (142cm TL) methods (t-test, $p<0.0001$)). The average fight time of tagged tarpon was 26 minutes on jig trips (range 5 to 98 minutes) and 11 minutes on live bait trips (range 4 to 55 minutes). Despite the significant difference between fight times (t-test, $p<0.005$), these average times are normal to low relative to tarpon fishing in other parts of the state.

Mortality Rates Summary

Researchers, using estimates based on cessation of tag movement from tags placed on tarpon, determined that the catch-and-release mortality rate of Boca Grand Pass tarpon evaluated for this study is 19.5% (8 of 41 fish died). The catch-and-release mortality rate is 9.8% when calculated using only the number of fish for which there was visual confirmation of mortality (4 of 41 fish died; Table 1). Four tarpon caught and released in 2002 were labeled as unconfirmed mortalities because researchers were unable to visually confirm that stopped acoustic signals were the result of the actual death of the fish.

Table 1. Numbers of tagged tarpon in 2002–2004 that suffered mortality and associated mortality rates for jig and live bait caught tarpon.

	N Tagged	Mortality unconfirmed	Mortality confirmed	Mortality Rate (%) incl. unconfirmed	Mortality Rate (%) confirmed
Jig	22	2	3	22.7	13.6
Live Bait	19	2	1	15.8	5.3

Based on the difference in the number of observed mortalities and the number of expected mortalities between fishing methods (jig and live bait), statistical comparison (Yates Chi-square test) showed no significant difference between jig- and live-bait fishing on tarpon catch-and-release mortality rates in Boca Grande Pass.

Scenarios evaluated included where the four unconfirmed fish were presumed dead (X^2 = 0.027; p = 0.870), were presumed to survive (X^2 = 0.139; p = 0.709), or were removed from the analysis completely based on the uncertainty (X^2 = 0.129; p = 0.720); all evaluated scenarios yielded insignificant differences in mortality rates.

Table 2 provides more detailed information based on direct observations of the eight tarpon that died (confirmed or unconfirmed).

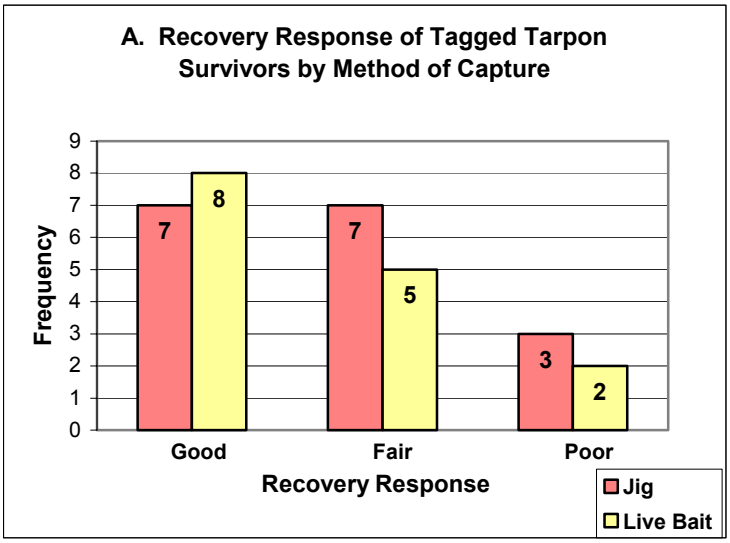
Table 2. Condition at release and observations on the eight tagged tarpon recorded as mortalities (unconfirmed or confirmed) in the Boca Grande Pass Catch-and-Release Mortality study, 2002–2004.

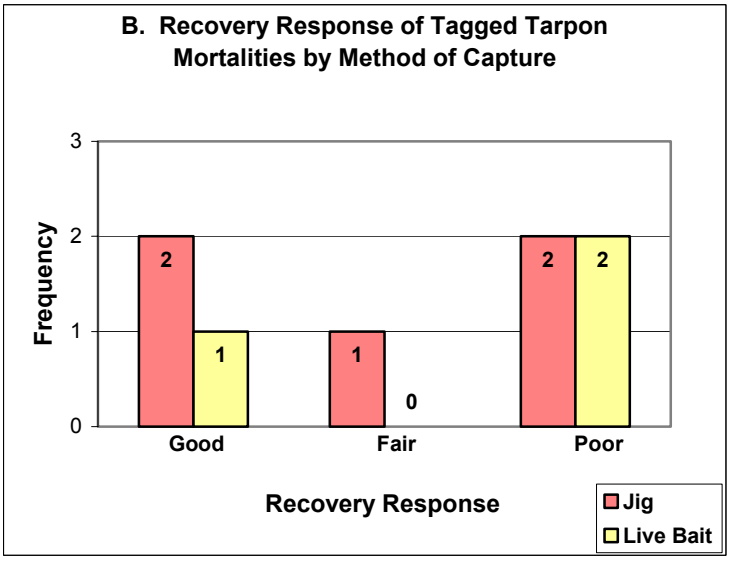
Date	Hook Position	Fight (min)	Condition at Release	TL (cm)	Hook Type	Observations
JIG						
5/7/2002	jaw	10	Fair	152	Circle	At time of release, captain said the fish didn't look good. The fish swam slowly against the current for some time—therefore alive. Then it slowly drifted with the current. Eventually the signal stopped moving and stayed in the same general area for about three hours. Fish was presumed dead. Since the mortality was unconfirmed, it is possible that the tag could have fallen out of the fish.
6/24/2002	cheek	19	Poor	160	J	Fish handled and held for tagging between gill arches. At time of tagging, the fish did not flinch. Fish was then resuscitated over ~ 50yds. Eventually, fish responded but was not doing well. It came back up to surface twice but didn't move much. Tag signal essentially stayed in the same area in which the tracking boat's receiver last detected the fish. Believe fish to be dead.
6/4/2003	maxillary	14	Poor	120	J	Shark Attack—Later the tag was returned; it had teeth marks in the float.
6/1/2004	isthmus*	5	Good	130	Circle	Shark Attack—witnessed
6/4/2004	maxillary	40	Good	180	Circle	Shark Attack—witnessed
Live Bait						
5/29/2002	jaw	14	Poor	182	J	At time of release, the tarpon was floating sideways. After release, it seemed to swim a little, but then the signal stayed in the same general area. The following day this signal was detected in the same spot. Either the fish died, or the tag fell out of the tarpon.
7/9/2002	jaw	5	Good	109	J	Suspected shark attack. First tarpon of trip was attacked on the line during the fight. At time of release of this tarpon, captain was worried about sharks. Ran boat in fast circles to scare away sharks at release. After release, fish was moving very slowly; tracking boat followed the "very strong" signal, which just suddenly disappeared. Tracking boat searched two more hours and found no signal. It vanished.
5/8/2003	jaw	9	Poor	150	J	Shark Attack—on video. Camera deployed once signal stopped moving.

* (behind lower jaw) This was a secondary hook placement. Fish was originally hooked on the upper jaw.

Most of the 41 tarpon released with tags (78%) were classified as being in good (active) or fair (moderately active) condition at the time of release (Figure 1). Nine fish were classified as being in poor condition (not active) at the time of release. One live-bait-caught fish was not observed at the time of release. We did find that some tarpon released without resuscitation and some of those that were fought for long periods of time recovered and survived.

Figure 1. The frequency of good, fair, or poor recovery responses for jig- and live-bait-caught tarpon that were tagged and released and (A) survived or (B) died in 2002—2004.





Shark attacks were the cause of all the observed and confirmed tarpon mortalities (both methods) and occurred within the boundaries of the pass during the first 20 minutes following the catch-and-release event. In a recent study in the Bahamas (Cooke and

Philip, 2004, in press), bonefish that were tagged and released in shark infested waters suffered 39% mortality. In Boca Grande Pass, tagged tarpon suffered 9.8% mortality based on confirmed shark attacks.

Based on researchers' observations, sharks attacked and fed on hooked tarpon regardless of fishing method used. In 2004, eight shark attacks occurred while tarpon were being fought on the line. Of those eight, four of the tarpon were attacked during live-bait trips, and four were attacked during jig trips. It may appear that shark attack incidence is higher with one fishing method over another, but this may be a factor of light limitations and diel fishing practices. Several factors may influence the perceived difference in the number of shark attacks:

- Jig fishing takes place during daylight hours, when it is easier to observe and photograph a shark attack as it takes place.
- Live-bait fishing takes place predominately at night, when it is more difficult to observe and photograph a shark attack as it takes place.

Sharks were also observed preying on free-swimming tarpon that were not associated with a hook-and-line event. Shark predation on tarpon is not a new issue. From the nineteenth century to the present, many articles in the popular literature, such as O. A. Mygatt's "Good Day's Tarpon Fishing," published in *Outing Magazine* in 1890, have documented stories about sharks and tarpon. Dimock (1911) wrote about the sharks in Boca Grande Pass and about the number of boats in the pass. The FWC has video footage from the 1950s that shows captains in Florida using tarpon as bait for shark fishing, and in 2004, FWC staff members witnessed two captains using tarpon as shark bait. Boca Grande Pass is not the only site of shark predation on tarpon. In 2004, there were reports of large sharks attacking tarpon in Egmont Channel at the mouth of Tampa Bay. One popular long-time guide wrote of never before seeing the numbers of sharks pursuing tarpon off Venice, Florida, like he did in the 2004 season.

Other research in Boca Grande Pass (Breder 1944) noted the presence of sharks during spring and summer, "In the late winter and early spring, sharks are not numerous in Boca Grande and Captiva Passes [*sic*] and probably cut no figure in the matter of any consequence. In the late spring and summer they become exceedingly numerous and voracious. In fact, in the summer it may become almost impossible to land a tarpon, once hooked, because as soon as one gives evidence of being in difficulty, shown by its peculiar swimming movements, the sharks close in, leaving the angler half a fish or only the head." This situation actually caused Breder's colleague, Bishop, to suspend his tarpon tagging work in 1938 and 1939.

No definitive conclusions related to fishing method can be made regarding tarpon mortality rates caused by sharks because natural predation rates by sharks are unknown, and anglers were not fishing with both methods at the same time that sharks were feeding.

Observer Program Results

In 2004, FWC staff members were charged with making extra observations on hook placements in the tarpon fishery of the Boca Grande area. Staff members accompanied guides and clients on 24 jig trips, 19 live bait trips, and 3 other trips (flats and beach). Four trips resulted in no catch. While waiting for a tarpon to be tagged, tracking-boat personnel made 28 additional hook-placement observations, and eight ancillary observations were made when any captain called FWC staff members to come see where their clients' fish were hooked.

During the 2004 season, FWC staff members observed 211 hookups, from which 104 tarpon were landed, and hook placement was observed for 97 of the landed tarpon. Hook placement for 2004 is summarized in Table 3. The "Other" category records observations made on 10 tarpon that were hooked using dead bait fished on the bottom, MirrOlures®, or free-lined crabs with no weight and spinning gear. Eighty-nine observations are recorded in the table because researchers included only observations made when an FWC staff member was aboard a charter. The table does not include ancillary observations by staff members called over to view a fish already landed on another charter.

Table 3. Hook placements for landed fish in the 2004 Catch and Release Mortality Study and Observer Program (excludes ancillary and any "no observation" data). A hook placement classified as mouth includes all jaw locations (maxillae, supramaxillae, premaxillae, and lower jaw) and those inside the buccal cavity (roof of mouth, tongue, etc.). Hook placements classified as head were hooked in either the cheek or the isthmus (posterior to lower jaw).

Hook Placement	Jig	Live Bait	Other*	Totals
Mouth	42	32	10	84
Head	4	0	0	4
Tail	1	0	0	1
Total	47	32	10	89

A foul hooked tarpon was defined as one hooked in any part of the body other than the mouth (tail, head, eye, fins, etc.). The maxillae, supramaxillae, and premaxillae (8 bones) constitute a tarpon's upper jaw.[1] According to the definition, tarpon hooked in these areas are not considered foul hooked. These areas are part of the mouth or

[1] "Clipper" and "button" are vernacular terms used by local fishing guides and are not scientific terms used to describe the morphology of a fish. "Clipper" refers to the very large and pronounced maxillae or supramaxillae bones, which constitute part of the upper jaw of a tarpon. The word "button" refers to the premaxillary bones that are also part of the upper jaw. Both the clipper and the button have been points of contention in this study. Since both terms refer to the jaw of the tarpon, these fish were all included under the category "Mouth" in Table 3 and are not considered foul hooked, regardless of hook orientation. In the database, fish that were hooked in the soft tissue of the corner of the mouth and fish that were hooked behind the clipper were also categorized under the variable code for clipper.

mouthparts; it is probable that a fish hooked there was hooked as a result of striking the bait or active feeding behavior.

The table below shows the percentages of foul hooked tarpon for 2004 as well as for the period 2002–2004 (pooled estimate for all three years):

	Jig	**LB**
2004:	5/47 = 10.6%	0/32=0%
2002–2004:	8/73 = 11%	0/64=0%

The total percent of foul-hooked tarpon for the fishery of Boca Grande Pass, regardless of fishing method used, was 5.4% (8 out of 147; does include 10 "other" observations). Although foul hooking was significantly different between fishing methods (Chi-sq 5.589, p = 0.018, significant at alpha 0.05), these percentages are not unusually high. The 5.4% from this tarpon study is in accord with foul-hooking percentages recorded in other recent fishery literature (Table 4). Some foul hooking is normal with all hook-and-line fisheries, especially with artificial bait due to the nature of trying to "trick" the fish into striking a non-natural prey item as an act of feeding or aggression. Taylor et al. (2001) reported a 4% foul-hooked rate of snook caught on live bait and a 12% foul-hooked rate of snook caught using artificials in a catch-and-release mortality study. The 0% foul-hooking rate reported here for live-bait fishing is extremely low and does not represent foul hooking rates reported for most recreational hook-and-line fisheries. The 10.6% foul hooking rate estimated for the jig fishery in 2004 and the 11% rate calculated with data pooled over the 3-year study is similar to the previously reported 11.5% (2003 summary). In either case, foul hooking did not contribute significantly to the mortality of tarpon in this study.

Table 4. Summary of recently published studies and their calculated percentages of foul-hooking- and release-mortality rates.

		Total	Percent	Percent
Study	**Species**	**Caught**	**Foul Hooked**	**Mortality**
Caruso, 2003	Striped Bass	118	9%	9%
Lukacovic, 2001	Striped Bass	433	13%	5%
Prince et al., 2002	Sailfish	360	3%	
Falterman, et al., 2002	Pelagics	163	7%	
Skomal, et al., 2002	Bluefin Tuna	101	3%	16%
Zimmerman and Bochenek, 2002	Summer flounder	160	2%	
Aguilar et al., 2002	Red drum	112		7%
Grover et al., 2002	Chinook salmon	276	17%	
Cooke and Philip, 2004 (in press)	Bonefish	35	0%	20%

The Tarpon Population

Only qualitative observations on the local stocks can be reported from this study. Claims were made of declining numbers of tarpon in Boca Grande Pass. Guides agreed the numbers of tarpon during the 2002 and 2003 seasons were lower than "normal." In 2003, Charlotte Harbor also experienced extreme red tide events and flooding which may have affected the numbers of tarpon. In 2004, however, countless tarpon were observed in the pass and adjacent waters of the harbor, flats, beaches, and offshore areas. FWC staff members observed extreme "hill" tide events in the pass that lasted for days. Large schools of tarpon of varied sizes extended through the pass. Smaller (2.5 ft to 3 ft) tarpon were observed near the surface and larger (up to 8 ft) fish could be seen at the bottom of the schools. These schools were over 30 ft thick in places, as estimated from the marks on depth sounders. Such size variation within large aggregations of fish is indicative of a healthy stock. It is also important to note that natural variability in fish populations is common for all species. Furthermore, 2004 was an exceptional year for tarpon fishing all along the gulf coast. An article in the Houston Chronicle said it was the best run of tarpon off Texas since 1997. As recently as August 24, 2004, a 208-pound tarpon was landed in Lake Pontchartrain, Louisiana, where locals say they have been seeing 20–30 fish a day. News articles reported the best late season tarpon fishing ever in Boca Grande just prior to Hurricane Frances (9/9/2004). Based on these observations and the results from this study done on a predominantly catch-and-release fishery, it appears that the tarpon population is healthy and resilient.

Conclusions

- Fundamental differences in the two fishing methods make it difficult to compare them, and results must be interpreted in that light.

- No significant differences were observed in catch-and-release mortality rates of tarpon caught by anglers using artificial jigs and live bait in Boca Grande Pass.

- Sharks were responsible for all of the confirmed mortalities, and shark attacks occurred on the line while using both methods of fishing.

- While more tarpon were foul-hooked using artificial bait than live bait, percentages were not unusually high and did not contribute negatively to the survival of tarpon.