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of the*

Atlantic States Marine Fisheries Commission



Circle Hook Definition and Research Issues

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*Working towards healthy, self-sustaining populations for all Atlantic coast fish species or
successful restoration well in progress by the year 2015*

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Introduction

For decades recreational anglers have practiced catch and release, driven by the desire to aid in species conservation and adhere to size and bag limits. While the conservation benefits of this practice are known, there is concern regarding the extent of release mortality in some fisheries. Research has shown that injuries to internal organs as a result of deep hooking or hooking in locations other than the mouth significantly increase release mortality. A fish that appears healthy after an angling battle may not necessarily survive. For example, the Commission's Striped Bass Technical Committee estimated that 1.3 million striped bass were lost due to recreational hook and line release mortality in 2000, more than the number landed by the commercial fishery that year.

Gear configuration, angler skill, enforcement issues and manufacturer concerns must all be taken into account when developing strategies to improve release mortality. One gear type that holds promise is the use of circle hooks. Around for centuries, circle hooks are not a recent phenomenon. Pre-Columbian Indians in Latin America, early Japanese fishermen, and Pacific coast Native Americans each used hooks that looked and fished similarly to modern circle hooks.

To further explore issues related to circle hooks, the Commission's Interstate Fisheries Management Program (ISFMP) Policy Board last fall called for an analysis of release mortality issues and the development of an enforceable definition of a circle hook. A Management and Science Committee (MSC) Workgroup comprised of hook manufacturers, ASMFC Commissioners, law enforcement representatives, recreational stakeholders, and technical personnel, was formed to address these charges.

The following definition, research recommendations, and source document were approved by the ISFMP Policy Board on June 12, 2003. The document will be provided to the Striped Bass Management Board and Technical Committee for consideration of inclusion in the management process. Although this document is in response to a request from the Striped Bass Management Board, the definition and research recommendations may be applicable to several Commission managed species.

ASMFC CIRCLE HOOK DEFINITION AND RECOMMENDATIONS

In late 2002, the Striped Bass Management Board and the ISFMP Policy Board recommended the development of an enforceable definition of circle hooks. An MSC Workgroup was formed that included policy, enforcement, and technical personnel, and hook manufacturers. A source document including a circle hook research summary was utilized by the Workgroup to develop the following definition and research recommendations.

ASMFC Definition of Circle Hooks

A circle hook is defined as a non-offset hook with the point turned perpendicularly back to the shank.

The Workgroup, Management and Science Committee, and Law Enforcement Committee recommended that an angler education/advisory approach should be taken with the issue rather than a regulatory approach. The recommended definition was developed after substantive discussion of the basic parameters that make circle hooks effective, to offer the clearly demonstrated conservation benefits as quickly as possible, and taking into account manufacturer, enforcement, and scientific perspectives. Detailed circle hook specifications may negate those benefits, since they would be extremely confusing to anglers, extremely difficult to enforce if regulatory action is chosen, and would take much longer to develop and approve. Law enforcement members of the Workgroup believed this definition would be enforceable if regulatory action was taken. All manufacturers currently market hooks that meet the recommended definition.

Recommendations for Angler Education

To obtain the conservation benefits offered by circle hooks, angler education is very important. Manufacturers, the enforcement community, and technical personnel should collectively develop outreach strategies and materials. The following outreach recommendations are offered:

- All Atlantic coast fishery management agencies and angler groups should endorse and encourage the use of circle hooks.
- A slideshow or video that could be presented by agency or fishing club personnel should be developed for general distribution. The presentation should include photos or drawings of circle hooks that meet the approved definition, a summary of the scientific evidence showing that circle hooks reduce release mortality, baiting techniques, and other appropriate information.
- Coordinate in-person presentations at larger fishing and conservation shows, the Outdoor Writers Convention, and other state, regional, and coastwide forums. Agencies should promote individual presentations to local fishing clubs.
- Work with hook manufacturers to continue to offer trial packages of hooks for distribution to recreational anglers.
- Influential recreational fishing organizations should be utilized in the outreach efforts.

Recommendations for Future Research

- Additional research should be conducted to determine the effect of hook eye orientation on circle hook effectiveness.
Some data suggests that the orientation of the hook eye (in-line with the hook shank or angled up/down) is important to insure that circle hooks work as intended. Snelling also may be used to influence this orientation.
- Hook offset and its effect on release mortality should be investigated in more detail.
For some species, research suggests that hook offset can influence release mortality rates. Studies on billfish suggest that severe offset negates the effectiveness of circle hooks, while no or very little offset decreases gut-hooking. Studies on striped bass found no significant difference in release mortality when using hooks with some or no offset.
- Species and hook size-specific research should be conducted.
Evidence suggests species and/or hook size may affect the conservation benefits offered by circle hooks.
- Manufacturers should work to standardize hook sizes.
Hook size measuring convention varies widely between manufacturers and even between hooks made by individual manufacturers. A 5/0 hook from one company may be the same size as an 8/0 hook from another, which can be very confusing to anglers. However, there are parts of the hook that could be used to develop standards (gap width - the distance between the point and the shank; throat – the distance from the tip of the point to the bottom of the hook bend; etc.).
- Hook setting method (fishing style) and its effect on mortality should be investigated.
The effectiveness of reducing hook mortality depends on the hook setting method performed by the angler. Anecdotal evidence suggests that fishing circle hooks in the wrong way may not reduce release mortality.
- The use of circle hooks in bait fisheries should be quantified.
Reductions in release mortality (for use in stock assessments) based on the use of circle hooks should be implemented in proportion to the number of anglers using circle hooks relative to those using J hooks.

The research recommendations will be incorporated into the Commission's Prioritized Research Needs Document, and forwarded to the National Sea Grant branches to promote future work.

Circle Hook Source Document

Size and bag limits are common modern fishery management practices used to reduce harvest and fishing mortality. As a result of those strategies and a growing impetus for conservation of all natural resources, many species have been the beneficiaries of catch and release (Skomal et al. 2002). However, release mortality rates in some fisheries are cause for concern. Underestimation of release mortality rates may cause an underestimation of fishing mortality and falsely inflate the stock size (Lukacovic 2000).

The Commission's Striped Bass Technical Committee estimated that 1.3 million striped bass were lost due to recreational hook and line release mortality in 2000, more than the number landed by the commercial fishery during that year. Several researchers have undertaken studies to test the effectiveness of circle hooks as a method to reduce release mortality in this and other species.

When developing Amendment 6 to the Interstate Fishery Management Plan for Atlantic Striped Bass, the Striped Bass Management Board asked for public comment on potential management strategies to reduce hook and line release mortality, including the mandatory use of circle hooks in bait fisheries. Amendment 6 (approved February 2003) also notes states and jurisdictions should encourage the use of circle hooks to reduce mortality associated with hooking and release of striped bass. To promote the use of circle hooks, states are encouraged to develop public relations and/or educational campaigns. The ASMFC's Policy Board agreed that the issue of circle hooks should be examined.

In an October 2002 memorandum to the ASMFC's Management and Science Committee, the Maryland Department of Natural Resources requested that the Committee work with hook manufacturers, knowledgeable fishermen, and researchers to define circle hooks and to investigate the possibility of standardizing circle hook specifications. A Work Group was formed and preliminary plans were made to address the issue.

The Striped Bass Management Board offered additional clarification in December 2002 and asked that an enforceable definition of circle hooks be developed. The Board noted that manufacturers, industry representatives, and the marine law enforcement community should fully participate in the initiative.

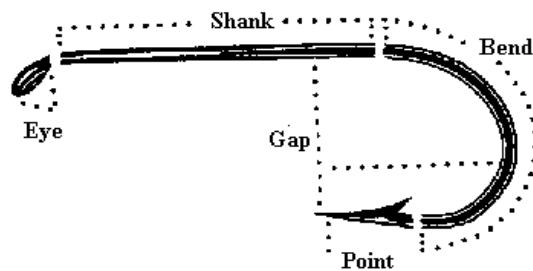
Other Issues for Consideration

- There is no widely accepted definition of a circle hook and no industry standards for hook size.
- Possible issues related to the effectiveness of offset circle hooks.
- The perspectives/concerns of the enforcement community should be addressed.
- Recommendations for future work should be discussed, including angler education and possible species-specific strategies.

Generic Hook Description

The parts of a generic hook are noted in Figure 1, which are referenced in many of the studies noted in this document. An excellent diagram of many different hook styles is hyperlinked in Appendix 2 from <http://www.eagleclaw.com/fishhookterms.html>.

Figure 1 Parts of a generic hook (from Kaimmer, Stephen 1996 (draft). *Fishing Gear and Hook Removal Techniques Used in the Longline Fisheries in Alaskan Waters; a Discussion Paper*. International Pacific Halibut Commission, P.O. Box 95009, Seattle, WA 98145-2009. Found at <http://www.iphc.washington.edu/staff/stevek/basic2.htm>



History of Circle Hooks

Circle hooks are not recent phenomena. Excavations of graves from pre-Columbian Indians in Latin America uncovered hooks made from seashells that resemble modern circle hooks. Early Japanese fishermen tied pieces of reindeer horn together in the shape of a circle hook, while a similar design has been found from Easter Island (Moore 2001). Pacific coast Native Americans also used hooks that fished similarly to modern circle hooks. The configuration of the tackle promoted hooking as fish tried to expel bait they could not swallow (Stewart 1977, *in* Trumble et al. 2002). Modern commercial longline fishermen have been using circle hooks for many years (Moore 2001; Prince, et al. 2002).

Circle Hook Description and How They Work

Figure 2 Circle hook, from <http://www.ownerhooks.com>



Circle hooks are generally circular in shape, with the hook point pointing back at the hook shaft. California statute defines a circle hook as, "...a hook with a generally circular shape and a point which turns inwards, pointing directly back at the shank at a 90° angle" (see Page 5 for citation). Prince et al. (2002) defined a circle hook as "hooks having a point that is perpendicular to the main hook shaft, whereas "J"-hooks are defined as hooks having a point parallel to the hook shaft." Many manufacturers offer variations of the design (Appendix 1). When looking at the barb from behind the hook shank, the greater the "offset" angle, the more the barb is visible (the barb and the shank are not in the same plane). The amount of "offset" may be important in the evaluation of hooking location, however, Lukacovic (2001) detected no difference in deep-hooking rates in striped bass between offset and non-offset hooks.

(Figures 3 and 4 from <http://www.catfishin.net/bent.html>).

Figure 3 Hook with no offset angle



Figure 4 Hook with offset angle



Circle hooks are designed to prevent the exposed barb point from puncturing internal organs if the hook is swallowed. Fish swallow the baited hook and begin to move away. This movement pulls the hook from the throat, decreasing the chance of gut hooking. As the hook shaft begins to exit the mouth, the shape of the hook causes the shaft to rotate towards the corner of the mouth and the barb embeds in the corner of the jaw (Florida Sea Grant College Program 1999; Artmarina Fishing Fleet 2002).

Similar Designs

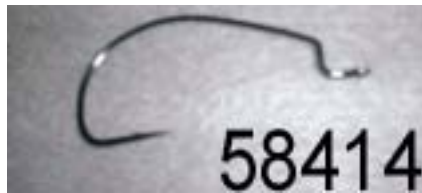
A "Kahle" hook appears to be a circle hook at first glance. However, the barb points toward the hook eye and the distance between the barb and the shaft is much greater than that of a true circle hook. Eagle Claw (website) notes that the design places the hook much farther back in the fish's mouth to eliminate tearing out through the lip, and that the hook is much easier to remove. United Kingdom researchers testing different varieties of hooks in a shark tagging program noted that Kahle hooks are known for their ability to deep hook fish (Drake and Drake 2002).

Figure 5 Kahle Hook from <http://www.jandhproducts.com/eagclawlazsh2.html>



Malchoff et al. (2002) noted that New York anglers use a “sproat” hook for striped bass, which appears to be a local name for a “J” hook (M. Malchoff, personal communication). This differs from the sproat hook described by Eagle Claw as “.... a parabolic bend hook with a straight point. It is one of the best and strongest early designs for freshwater fishing and is very popular with bass fishermen for use with plastic baits (Figure 6).”

Figure 6 Sproat Hook



From <http://www.buyfishingstuff.com/hooks.html>

Current Statutes Requiring the Use of Circle Hooks

Maine requires commercial hook and line fishermen participating in the groundfish fishery to use no more than 2000 circle hooks of size 12/0 or greater. The use of de-hookers or “crucifiers” with less than 6-inch spacing between the fairlead rollers is prohibited. Species in the groundfish fishery include cod, witch flounder, American plaice, Atlantic halibut, yellowtail flounder, haddock, pollock, winter flounder, windowpane flounder, redfish, ocean pout, red hake, white hake, and silver hake.

Chapter 34.10 Maine Groundfish Management Plan - EMERGENCY ACTION, effective May 22, 2002. Final rule effective October 22, 2002.

In its state waters Atlantic halibut fishery, **Maine** requires the use of size 14/0 circle hooks or larger, a maximum of 450 hooks allowed per vessel per day, and a commercial vessel limit of 4 fish per day with a total allowable catch of 50 fish per season. There also is a tagging requirement associated with these permits **Chapter 34.14 (b), Maine Groundfish Regulations** (K. Kanwit, ME DMR, personal communication).

In its experimental Atlantic halibut longline fishery (2002 was the third year of the study), **Maine** requires the use of size 14/0 circle hooks or larger, a maximum of 700 hooks allowed per vessel per day, and trip limits set annually by the NMFS Northeast Regional Administrator (2002 limit of 234 fish total). There also is a tagging requirement associated with these federal permits (D. Libby and K. Kanwit, ME DMR, personal communications).

New Hampshire requires the use of circle hooks on any vessel commercially rigged for "hook gear" (fishing gear that is comprised of a hook or hooks attached to a line) shall use circle hooks of size 12/0 when using bait, not use more than 800 circle hooks, and have fairlead rollers that have at least 6 inch spacing between the rollers. Further, no person shall take commercially any species of fish listed in FIS 602.06(a) by hook gear during April, May, and June. **Source: Rule #7753, effective 8-19-2002.**

New Jersey requires the use of non-offset circle hooks (size 2/0 and larger) while fishing with natural bait during the striped bass spawning area closure (no take area, April and May) within the Delaware River (downstream of the Rt. 1 Bridge to the Commodore Barry Bridge under the purview of the Bureau of Freshwater Fisheries. The Division of Marine Fisheries extended the closure area downbay from the Commodore Barry Bridge to include the Salem River and its tributaries, the southern limit of the striped bass spawning area in the Delaware Bay). **Section 7:25-6:20(a) 7., New Jersey State Fish and Game Code. Marine Fisheries action amended Section 7:25-18.1 (h)1, adopted August 19, 2002.**

In a limited area of its coast, *California* requires that when angling for salmon with bait and using any means other than trolling, no more than two single point, single shank, barbless circle hooks must be used. The hooks must be hard-tied to the line and the distance between the two hooks must be no greater than five inches (from the top of the eye of the top hook to the inner base of the curve of the lower hook). California statute defines a circle hook as a hook with a generally circular shape and a point which turns inwards, pointing directly back at the shank at a 90° angle. **Section 27.80, Title 14, CCR**

Since the early 1990s, the minimum hook size for groundfish longliners in *Canada* is a #12 circle hook or equivalent (DFO, 2002).

In 2001, *Canada* required commercial fishermen directing for white hake (*Urophycis tenuis*) in area 3LNOPs to use circle hooks size #14 or equivalent (Kulka and Simpson 2002).

Agencies that Encourage the Use of Circle Hooks

In 1998, the *Maryland* Department of Natural Resources encouraged anglers "... to use a "circle hook" while chumming and bottom fishing for striped bass. Anglers are also encouraged to exercise skill when catching and releasing striped bass to insure survival of the released fish."

The *Florida* Fish and Wildlife Conservation Commission is currently working with organizations such as the International Game Fish Association, Florida Guides Association and the Miami Billfish tournament to promote the use of (non-offset, less than 4°) circle hooks. The FWCC also has developed a fact sheet to promote the use of circle hooks.

The *North Carolina Wildlife Resources Commission* recommends that striped bass anglers use circle hooks when fishing with live or natural baits.

The *New Hampshire* Fish and Game Department recommends the use of circle hooks when using live or cut bait for striped bass or other species. The Department also has developed a color brochure on the topic.

The *Georgia* Department of Natural Resources' Recreational Fisheries Section has encouraged the use of circle hooks for red drum and other species. In the past two years, Eagle Claw and Mustad circle hooks have been distributed to Georgia anglers at boat ramps, by creel clerks and law enforcement officers (S. Woodward, GA DNR, personal communication).

The state of *New Jersey* annually reminds anglers of the benefits of using circle hooks in reducing hook and release mortality through publication of its *Fish and Wildlife Digest*, in addition to specific regulations noted above.

The *Massachusetts* Division of Marine Fisheries developed a color brochure outlining the advantages of using circle hooks.

The *South Carolina* Marine Resources Division is developing a brochure on the topic (D. Theiling, SC DNR, personal communication).

The *National Marine Fisheries Service* (Recreational Fisheries Division) distributes a brochure on the use and advantages of circle hooks, which was developed by the *Florida Sea Grant Extension Program* (http://edis.ifas.ufl.edu/BODY_SG042). The complete brochure includes a synopsis of work done by Maryland DNR biologist Rudy Lukacovic (Lukacovic 1999).

In 1999 the *Gulf of Mexico Fisheries Management Council* encouraged recreational and commercial anglers to use circle hooks when fishing for red snapper and other reef fish, in order to reduce fishing mortality. From <http://www.gulfcouncil.org/newslet/nlet1199.pdf>

Research Papers on Circle Hooks, Mortality Rates, and Related Issues

Studies by the Maryland Department of Natural Resources indicated significantly lower release mortality in striped bass when using non-offset circle hooks, as opposed to conventional “J” hooks (Lukacovic 1999, 2000, 2001; Lukacovic and Uphoff 2002). Caruso (2000) also noted significantly lower mortality in striped bass when circle hooks were used. Significant decreases in release mortality have been noted for other species when circle hooks are utilized, including salmon (Grover, et al. 2002), billfish (Prince, et al. 2002), red drum (Aguilar, et al. 2002), bluefin tuna (Skomal, et al. 2002), yellowfin tuna (Faltermann and Graves 2002), and Pacific halibut (Trumble, et al. 2002). Cooke, et al. (2003) noted that circle hooks offer the potential for reducing release mortality in rock bass. However, the use of circle hooks on bluegill and pumpkinseed showed no discernable benefit (Cooke, et al. in press).

Please see Table 1 for a synopsis of circle hook research studies.

**Table 1: Research Paper Summaries
Circle Hooks, Hook Mortality Rates, and Related Issues**

Study	Species	Hook Type	Total Caught (n)	Jaw/mwth	Hook Location			% Mortality
					Deep	Foul/Gills	Unkn	
Caruso, 2000	Striped	Circle	60	58 (97%)	1 (1.6%)	1 (1.6%)	0	3%
	Bass		58	35 (60%)	14 (24.1%)	9 (15.5%)	0	15.50%

Summary - Release mortality appears to be significantly lower with the use of circle hooks than that estimated for J-hooks (12.5% lower). Incidence of potentially lethal wounding was extremely low among fish captured with circle hooks versus J-hooks. Use of circle hooks could significantly reduce the likelihood of wounding at sites that can result in trauma to major organs and subsequent death. Fisheries managers should seriously consider promoting the use of circle hooks in the Massachusetts striped bass fisheries.

Study	Species	Hook Type	Total Caught (n)	Jaw/mwth	Hook Location			% Mortality
					Deep	Foul/Gills	Unkn	
Lukacovic and Uphoff, 2002	Striped	October	90	73 (81%)	17 (18.9%)			12% (11/90)
	Bass	June	131	61 (46.6%)	70 (53.4%)			36% (47/131)

Summary - High mortality of large, shallow hooked striped bass in June suggests a broader catch and release problem not confined to chumming. Deep hooking percentage decreased approximately four fold in June when circle hooks were used instead of standard chumming (J) hooks. Circle hooks provide anglers with an option that lowers deep hooking and their use should be promoted.

Study	Species	Hook Type	Total Caught (n)	Jaw/mwth	Hook Location			% Mortality (includes sub legal fish)
					Deep	Foul/Gills	Unkn	
Lukacovic 2000	Striped	Circle	640	96.6%	3.4%			0.8%
	Bass		476	82.8%	17.2%			9.1%

*- Only 287 circle hook caught and 384 J-hook caught fish were used in the mortality portion of the study

Summary Average size and % of legal sized (>18") did not differ appreciably between the two hook types. Sub-legal striped bass were gut hooked 15.2% of the time by J-hooks and 2.0% of the time by non-offset circle hooks, figures consistent with the author's 2001 study. Projected mortality of sub-legal striped bass caught in this study was 93.8% lower with non-offset circle hooks than with J-hooks.

Study	Species	Hook Type	Total Caught (n)	Hook Location			% Mortality (includes sublegal fish)
				Jaw/mwth	Deep	Deep	
Lukacovic 2001	Striped Bass	Circle	392*	94.4%	5.6%	3.3%	1.9%
		"J"	467*	85.0%	15.0%	10.9%	8.7%
				(all sizes)	(all sizes)	(sub-legal)	

* - Only 241 circle hook caught and 264 J-hook caught fish were used in the mortality portion of the study.

Summary - Overall deep hooking frequency was nearly three times lower when non-offset circle hooks were used (5.6% vs 15.0%).

Study	Species	Hook Type	Total Caught (n)	Hook Location		% Mortality (estimated) (sublegal fish)
				Jaw/mwth	Deep	
Lukacovic 2002	Striped Bass	Circle	173	93.4%	6.6%	0.80%
		"J"	260	83.2%	17.1%	7.40%

Summary - Anglers using "J" hooks landed a fish 42% of the time they detected a strike. When using a non-offset circle hook they landed a fish 27% of the time. "J" hooks were 52% more efficient than non-offset circle hooks in landing a fish once a strike was detected.

Study	Species	Hook Type	Total Caught (n)	Hook Location			% Mortality
				Jaw/mwth	Deep	Foul/Gills	
Prince et al., 2002	Billfish (Guatemala)	Circle	235	230 (98%)	4 (2%)	1 (0.4%)	0
		"J"	125	55 (44%)			
	Sailfish (South Florida)	Circle	75				
	(Test of hook offset catches)			15 Deg 28% (5/18)	44% (8/18)		0 18% (3/18)
				Combined 44% (30/69)	9% (6/69)		0 34% (23/69)

Combined = 4degree and no offset
(authors used # hooked, not caught, to calculate % above)

Summary - Circle hooks had hooking percentages 1.83 times higher than J-hooks. Significantly more sailfish hooked in corner of mouth with circle hooks (85%) than with J-hooks (27%). More sailfish deep hooked in throat or stomach (46%) than with circle hooks (2%). Percentage of deep hooking with severe offset hooks were comparable to J-hooks in the Guatemala portion of the study (44% and 46%, respectively). One sailfish (1%) was foul hooked with circle hooks while 11 (9%) were foul hooked using J-hooks. Sailfish caught on J-hooks are 21% more likely to suffer hook-related bleeding than those caught on circle hooks. Circle hooks minimized deep hooking, foul hooking, and bleeding.

Study	Species	Hook Type	Total Caught (n)	Hook Location				% Mortality
				Jaw/mwth	Deep	Foul/Gills	Unkn	
Falterman, al., 2002	Pelagics	Circle	62	59 (95%)	2 (3%)	1 (2%)	0	
		"J"	101	66 (65%)	9 (9%)	11 (11%)	15 (15%)	

Summary - Mortality rates were calculated for hook locations. Mortality for all species jaw hooked was 25%, while rates of 70-83% were observed for fishes hooked on all other locations. Circle hooks consistently had a higher frequency of jaw hooking and a lower frequency of gut hooking than J-hooks. All yellowfin tuna caught on circle hooks (n=38) were hooked in the corner of the mouth, compared to 61% (37/61) caught on J-hooks. All species CPUE for circle hooks was nearly double that of J-hooks (5.05 fish/100 hooks versus 2.28 fish/100 hooks). CPUE for yellowfin tuna caught on circle hooks was nearly tripled that of J-hooks. Preliminary results suggest that the use of circle hooks in the pelagic longline fishery targeting yellowfin tuna may not only increase CPUE and survival of this species but also improve the survival of incidental catch and bycatch.

Study	Species	Hook Type	Total Caught (n)	Hook Location				% Mortality
				Jaw/mwth	Deep	Foul/Gills	Unkn	
Grover, et al., 2002	Salmon	Circle	276 (includes 21 fish with no wounds)	161	53	41	0	33% (all hook locations)

Summary - Mortality rates were calculated over a four day period for each hooking location. No mortality occurred in mouth hooked fishes until the third day, when 3/67 fish died. Cumulative four day mortalities ranged from 9% to 22% for jaw and mouth hooked fish. Mortalities in the eye/gill hooked animals was high (46.3%). Mortalities in the gut hooked animals was 56.6%. An additional fifteen gut hooked fish survived for four days that the authors believed would have died in the short term. When added to the gut hooked category, the total mortality from that group would have been 84.9%. The mooch fishing technique lends itself to deep hooking, and mortality in the fishery could be reduced by educating anglers on the use of methods that lessen the probability of gut hooking. The effect of hook size on mortality depends on fish length. In general, fish were not gut hooked when caught on appropriately-sized hooks.

Study	Species	Hook Type	Total Caught (n)	Hook Location				% Mortality (estimated)
				Jaw/mwth	Deep	Foul/Gills	Unkn	
Skomal, al., 2002	Bluefin tuna	Circle	51	48 (94%)	2 (4%)	1 (2%)	0	4%
		"J"	50	31 (62%)	17 (34%)	2 (4%)	0	28%

Summary - The study found that 94% of the bluefin tuna caught on circle hooks were hooked in the jaw and 4% were hooked in the pharynx or esophagus. These figures compare with 52% jaw hooked and 34% esophagus or pharynx hooked with J-hooks. Based on necropsy examination, the estimated mortality for J-hooks was seven times higher than that estimated for circle hooks. Circle hooks cause less physical damage than straight (J) hooks and can be a valuable conservation tool in these recreational fisheries.

Study	Species	Total Caught (n)	Hook Location			% Mortality
			Jaw/mwth	Deep	Foul/Gills	
Malchoff, al., 2002	Summer Flounder	623				9.50%
	NC/VA	376				6.10%
	NY	247				14.60%

Summary - In this study, hook type was not found to be a significant predictor of mortality. Sproat hooks and circle hooks were used by New York charter vessel crews and all were removed regardless of hook location. In NC/VA, gut hooked fish had leaders cut and hooks left in fish. Authors note the use of circle hooks with 15 degree offset, which may have negated the normal jaw hooking pattern seen with circle hooks. Also, circle hooks were found to be particularly difficult to extract from gut hooked fish in New York (removal of all hooks is a routine practice of the fleet participating in the study). There was a strong interaction between bleeding and hook type found. Observations underscore the importance of proper techniques when preparing to release fish alive. Authors found that leader status, wound location, bleeding, and water temperature were significant predictors of mortality.

Study	Species
Trumble, al., 2002	Pacific halibut

Summary - Circle hooks cause less hooking damage than J-hooks because circle hooks predominantly catch in the jaw, while J-hooks catch more in the throat and gills. The study estimated release mortality from tagging, using injury type as the mitigating factor. "Careful release" practices (rolling the hook out with a gaff and cutting the ganglion close to the hook) improve release mortality rates. Limits on bycatch mortality, which closed fisheries had exceeded, provided an incentive for the longline fleet to practice careful release regulations

Study	Species	Hook Type	Total Caught (n)	Hook Location			% Mortality
				Jaw/mwth	Deep	Foul/Gills	
Zimmerman and Bochenek, 2002	Summer flounder	Circle	64	>80%	4.70%	1.60%	
		"J"	96	77.10%	15.60%	2.10%	

Summary - No statistical difference was found between circle and standard hook sets for both hook location and release condition. In this study circle hooks were not more effective at keeping hook sets confined to the jaw area. However, instances of gut hooked summer flounder were lower in fish caught with circle hooks than in fish caught with standard hooks (4.7% and 15.6%, respectively). Angler participants noted that summer flounder were more prone to deep hooking from circle hooks when the rig was slowly drifted. Angler experience may have had an effect on the amount of time a fish was allowed to manipulate and ingest the hook.

Study	Species	Total CH	% CH	Total JH	% JH
		Tagged	Returned	Tagged	Returned
Burns, Karen	Red snapper	425	6.6 (n=28)	1234	6.2 (n=76)
	Red grouper	189	5.8 (n=11)	3756	2.7 (n=103)
	Gag	164	2.4 (n=4)	965	5.9 (n=57)

CH = Circle Hook JH = J-Hook

Summary - MOTE Marine Laboratory has an ongoing (since 1998) circle hook mortality study. Data through 10/22/02. CH + Circle Hook Project began as an investigation into venting practices and associated mortality. Circle hooks were brought into the study in 1999. Recreational anglers and for-hire captains in FL (West and East coasts), and a few in AL, MS, TX have been fishing with circle and J-hooks. Mortality estimates are based on tag returns. Quarterly newsletters are produced and sent to all participants. Authors note the low sample sizes and recommend the data be considered preliminary.

Study	Species	Hook Type	Total Caught (n)	Hook Location			Foul/Gills	Unkn	% Mortality (risk)
				Jaw/mwth	Mwth roof	Deep			
Cooke, et al. 2003	Largemouth bass	<i>Circle</i>	125	56.80%	2.40%	4.80%			5.1
		<i>Octopus</i>	134	40.30%	17.20%	9.70%			6.6

Summary - Comparison of injury rates, hooking efficiency, and mortality potential of circle hooks versus octopus hooks. Data Fish caught on circle hooks were hooked less deeply, bled less, and were more easily removed than those caught on octopus hooks. Mortality risk was estimated similarly for both hook types. Data showed that capture efficiencies (# fish lost for every fish landed) was much higher for octopus hooks than circle hooks (octopus hooks landed nearly 50% more fish per fish lost). The results indicate that circle hooks provide some conservation benefit, but because mortality rates are similar, preferential support for circle hooks is not shown in this study.

Study	Species	Hook Type	Total Caught (n)	Hook Location			Foul/Gills	Unkn	% Mortality
				Jaw/mwth	Mwth roof	Deep			
Aguilar, et al. 2002	Red drum	<i>Circle</i>	24	95.80%		4.20%			0
		<i>"J"</i>	88	47.90%		52.30%			8.54

Summary - Hook position was significantly related to mortality in this study and was also highly dependent on hook type. Based on the results the authors believe that the conservation goal of reducing post-release mortality in adult red drum can be achieved through directed efforts at promoting or requiring certain terminal gear (particularly the use of circle hooks) to reduce the incidence of deep hooking. Catching effectiveness between "J" and circle hooks was not evaluated.

Study	Species	Hook Type	Total Caught (n)	Hook Location				Ease of Hook Removal (%)	
				Jaw/mwth	Mwth roof	Deep	Eye	Easy	Difficult
Cooke, et al. 2003 (uncorrected proof)	Rock bass	Circle	25	76.00%	24.00%	0.00%	0.00%	96.00%	4.00%
		Aberdeen	24	71.00%	21.00%	4.00%	4.00%	71.00%	29.00%
		Baitholder	21	71.00%	10.00%	14.00%	5.00%	71.00%	29.00%
		Wide Gap	21	52.00%	48.00%	0.00%	0.00%	86.00%	14.00%

Summary - Injury rates and hooking efficiency was tested on rock bass (*Ambloplites rupestris*). Fish were not held to assess short-term or delayed mortality. Bleeding related to depth of hook penetration and hooking location was assessed after hook removal. Those individuals hooked in a vital organ or bled excessively were considered potential mortalities. Circle hooks were found to be roughly twice as difficult to hook fish as were the others tested. The authors note that circle hooks have the potential to minimize injury and thus, potential mortality in rock bass, but the angling community may not embrace them readily due to reduced capture efficiency.

Enforcement Issues

Without a clear definition of a circle hook, no regulatory language will be enforceable. Issues related to measurement of hook offset angles and hook sizes alone would be formidable. The O. Mustad and Son website (<http://www.mustad.no/#>) notes:

“Unfortunately, there is no uniform system of hook measurements. Visual familiarity with the various hook patterns is the only workable gauge for the serious angler. Although attempts have been made to set a standard by measuring the hook in fractions of an inch, the system has never been successful because it merely represents the length of the shank. A hook is really two-dimensional since the gap (distance between point and shank) can vary greatly from one pattern to the next.”

California’s statute requires that the barb must point directly back at the hook shaft. However, this definition seems to allow the use of offset hooks, as they point directly back at the shaft but not on the same plane as the shaft (J. Lucy, VIMS, personal communication). Offset circle hooks are postulated to negate the conservation benefits that non-offset circle hooks offer (Grover et al. 2002; Malchoff et al. 2002).

Angler Education Issues

The Commission’s Striped Bass Management Board suggests that states and jurisdictions should encourage the use of circle hooks through development of public relations and/or educational campaigns. Many agencies have developed, or are developing brochures or fact sheets related to the issue (noted on Page 8). Many websites encourage the use of circle hooks as well (Page 22, Online Sources).

Angling and Rigging Techniques

Many Internet sources suggest that anglers must relearn how to fish with circle hooks. Some tackle manufacturers and fishermen note that the instinct to “set” the hook will render the circle hook useless. Actively jerking the rod tip to set a circle hook actually will pull the hook completely out of the fish’s mouth. Anglers are encouraged to allow the fish to take the bait and move away. As the line tightens, the fish will hook itself. Two visual demonstrations illustrate how the hook works.

1. Tie a leader to a circle hook and grasp it in the palm of your hand, to simulate the hook is in a belly of a fish. When pulled straight up the hook will pull out of your hand without hooking you. If the leader is pulled to one side or the other (pretending the fish has the bait and turns to swim away) the hook will slide up your hand and then start hooking as it comes out of your hand.

From http://www.heyfish.com/tips_tricks/whycirclehooks.htm

2. Tie a circle hook to a piece of line and drop it down a cardboard paper towel or toilet tissue tube. Angle the tube slightly away as the hook is pulled out of the tube. Invariably the hook will catch the edge.

From <http://www.outdoorlife.com/outdoor/fishing/panfish/article/0,13285,194908,00.html>

Much anecdotal information exists on the Internet that recommends not “hiding” the circle hook barb with bait. Rather, live bait should be tied onto the bottom of the circle and allowed to swim or act normally. Several websites provide detailed examples of baiting techniques (ex. <http://www.sue-jeri.demon.co.uk/chr.htm>). The Yamaha Contender Miami Billfish Tournament (YCMBT) donated \$2,500 (with Eagle Claw and the Presidential Challenge - “The Circle Hook Movement”) to print charts outlining details on the use of circle hooks, for international distribution. The full-color charts are distributed by Tightlines Publications for \$2.99 each, at <http://www.outdoorcharts.com/batrigging.html>

Prince et al. (2002) noted a dehooking device used to remove circle hooks from the jaws of bluefin tuna. A wire loop is passed under the protruding hook barb and the hook is pulled through the hook wound. The hook is cut from the leader, which is pulled back through the wound to release the fish. This technique may be applicable to other species. Shelton Products has developed a circle hook with a self-release device that has been used successfully on several species, including striped bass, without having to remove the fish from the water (B. Shelton, personal communication. Also see Appendix 1 for the company website).

The relationships between circle hook size on hooking efficiency, injury, and size selectivity has been examined in bluegill, suggesting that gap width (distance between the hook point and the shaft – Figure 1) and hook size are important considerations to maximize hook effectiveness and to maintain conservation benefits (Cooke, et al., in review).

Tournament Issues

Potential educational opportunities exist in the realm of fishing tournaments. Many billfish tournaments utilize a catch and release format and many charter captains actively encourage the use of circle hooks as well as catch and release fishing. Specific examples include:

The Presidential Challenge of Central America is recognized as the first in the world to switch to an all circle hook format to promote the safe release of billfish (Marlin International Association Tackle Talk website, <http://www.marlininternational.com/tackle.htm>).

The YCMBT was the first fishing tournament in the United States to adopt a circle hook format (circle hooks must be used with live or dead baits. “J” hooks may be used but only with unbaited artificial lures). Leading up to the 2003 tournament, the event sponsors are planning a series of seminars to educate anglers on the benefits of circle hooks (April 3-6, 2003). Similar seminars were sponsored in 2001. As of January 7, 2003, the Tournament has approved (*hook approval criteria has been requested*) several hooks eligible to be fished in its 2003 event, including:

Eagle Claw L2004EL (*recommended*)
Eagle Claw Penn International Billfish P170 Circle Sea Hook (*recommended*)
Mustad UltraPoint 39950BL
Gamakatsu “Big Eye Circle” #12050
Owner Hooks are not yet approved
(from http://www.miamibillfish.com/circle_hook/CIRCLEHOOKRULE.htm)

In 2003, the “Big Rock” Billfish Tournament (North Carolina) is awarding bonus points for releasing billfish caught on circle hooks. (from <http://www.thebigrock.com>)

Recreational Organizations

The Billfish Foundation endorses the use of circle hooks with live and dead bait.
(www.marlinmag.com)

The Recreational Fishing Alliance (RFA) has called for phase-in of circle hooks for anglers using bait to target striped bass, and note that any regulations are a state by state decision.
(www.basspond.com/news)

The Coastal Conservation Association of Connecticut endorses the use of non-offset circle hooks for any type of bait fishing. (www.ccaconn.org)

The New York Sportsfishing Federation strongly recommends the use of circle type hooks when bait fishing for striped bass. (<http://www.nysf.org/fisheries.htm>)

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<http://www.ccaact.org>

<http://www.eagleclaw.com/fishhookterms.html> (Appendix 2, hook style diagram)

http://www.heyfish.com/tips_tricks/whycirclehooks.htm (Example of circle hook action)

<http://www.marlininternational.com/tackle.htm> (Presidential Challenge of Central America Tournament)

<http://www.marlinmag.com> (The Billfish Foundation endorses the use of circle hooks with live and dead bait)

<http://www.miamibillfish.com/news> (Information related to the YCMBT Tournament, circle hook educational seminars and list of YCMBT approved hooks)

<http://www.outdoorlife.com/outdoor/fishing/panfish/article/0,13285,194908,00.html> (Example of circle hook action)

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Appendix 1

Circle Hook Manufacturers

Owner American Corporation

3199-B Airport Loop Drive
Costa Mesa, CA 92626
(714) 668-9011 FAX (714) 668-9133

<http://www.ownerhooks.com>

Product – Mutu™ Circle Hooks

Rapala VMC Inc.

1901 Oakcrest Avenue
Saint Paul, MN 55113
(651) 636-9649 FAX (651) 636-7053

<http://www.vmchooks.com>

Product – V7381BN and V7384BN Sport
Fishing Circle Hooks

Eagle Claw

Wright & McGill Co.
4245 East 46th Avenue
PO Box 16011
Denver, CO 80216-6011
(800) 628-0108 FAX (720) 941-8778

<http://www.eagleclaw.com>

Product – Circle Sea™ Hooks

Bear Paw Tackle Company

4904 Aero Park Drive
P.O. Box 355
Bellaire, MI 49615
(231) 533-8604 FAX (231) 533-9974

www.bearpawtackle.com

Product –

Shelton Products

5279 Salisbury Drive
Newark, CA 94560
(510) 797-6596 FAX (510) 792-0792

<http://www.sheltonproducts.com>

Product – Shelton Release™ Circle Hooks

Gamakatsu, USA

SPRO Corporation
3900 Kennesaw
75 Parkway, Suite 140
Kennesaw, GA 30144
(770) 919-1722 FAX (770) 919-8141

<http://www.gamakatsu.com>

Product – Octopus™, Circle Fly™, and Live
Bait HD™ Circle Hooks

MOMOI

*Noted in an International Pacific Halibut
Commission (IPHC) paper (ref to MOMOI
#39965).*

*Information on leader material found, but
no information on MOMOI hooks found.*

Millward

*Noted in an IPHC paper.
Found one reference to a company that sold
Millward hooks, but no company
information found.*

O. Mustad and Son, Inc.

P.O. Box 838
Auburn, NY 13021
(315) 253-2793 FAX (315) 253-0157
www.mustad.no/#
Product – Mustad Demon™ (#39960BL)
and #39960 Circle Hooks

TTI Companies

100 Red Eagle Road, P.O. Box 1177
Wetumpka, AL 36092-1177
(334) 567-2011 FAX (334)
<http://www.daiichihooks.com>
Product – D74Z, D75Z, CircleWide, and
Bleeding Bait Circle Hooks

Appendix 2 Fishhook Terminology

The following terminology is reproduced from the Eagle Claw web site (<http://www.eagleclaw.com/Pages/hooktermMain.html>, [Fishhook Terminology page 1.htm](#), [Fishhook Terminology page 2.htm](#)).

There are literally thousands of patterns and styles of fishhooks available today from Eagle Claw®. This fact often makes the selection and use of fishhooks complicated and confusing to even the most ardent and knowledgeable fisherman.

Our world-famous Eagle Claw® fishhooks are produced in countless shapes, sizes, lengths, strengths, finishes, points and other variations for every kind of fishing. Knowing how to choose the proper hook for the many kinds of fish and methods of catching them will lead to more successful fishing trips. As you will see, Eagle Claw® offers the best variety of fishhook styles to suit every fisherman's needs

THE EAGLE CLAW® DESIGN

This American design, often termed the greatest modern improvement for hooking and holding fish, correctly places the hook point in the direct line of pull giving quick, sure penetration. The "Eagle Claw" hook is undoubtedly the most popular design for bait fishing. These hooks are available in a variety of finishes and packaging.



THE O'SHAUGHNESSY HOOK

This hook resembles the Sproat and the Limerick except that its point is bent slightly outward. It is usually made of heavy wire for extra strength. Fishermen prefer it for bait fishing for heavy-mouthed, slow-biting fish and for trot line fishing. We recommend O'Shaughnessy hooks plated with our highly corrosion-resistant Sea Guard finish for use in saltwater.



THE ABERDEEN HOOK

This light wire hook has a slightly squared round bend, much like the European-made "Model Perfect" bend. The extra width between the point and shank of the Aberdeen makes them perfect for baiting with minnows. Its Light Wire avoids excessive puncturing, which helps to keep the minnow alive longer. Eagle Claw® Aberdeens are specially tempered to flex before breaking, making them ideal for fishing in brushy water for Panfish and Crappie.



THE SALMON EGG HOOK

The extra-sharp point insures instant penetration at the slightest nibble. Designed and field tested especially for Trout fishing with Salmon eggs, worms and grubs.



THE AUTOMATIC ROTATING HOOK

The point on this hook rotates away from the bait and into the fish. The special compound curve automatically rotates the hook when a fish bites down on it. The sweeping rotational curve places the point in position for penetration from any angle. The automatic rotating hook twists, holds bait better and hooks fish better.



THE BAITHOLDER HOOK

This style of hook is designed for the serious bait fisherman. It is made with slices on the shank in order to hold the bait on the hook more effectively. The baitholder is the most popular hook style made.



THE WEEDLESS HOOK

This hook allows the fisherman to fish right in the weeds, logs, trees, stumps, rocks, lily pads and moss. Eagle Claw® makes them in three styles: The Long Plain Shank, The Kahle® and the popular Baitholder.



THE CIRCLE SEA HOOK

This functionally-shaped fishhook results in more fish being hooked. Fishermen are learning that the Circle Sea is catching 60% more fish than conventional J shaped hooks, including a 95% lip hook rate so the fish cannot escape. The Circle Sea hook is scientifically proven to reduce fish mortality. Hook set is not required. This hook has greater holding power, more hookups, fewer drop-offs and it holds bait better. Ideal for all freshwater and saltwater fish species.



THE SIWASH HOOK

This is a short, extra-strong, round bend hook with a very long point. It was designed for commercial, saltwater bait fishing to penetrate the hard tough mouths of big fish to prevent them from throwing the hook. The Siwash hook has excellent holding power for jumping Steelhead and Salmon. The open eye style insures easy hook replacement on lures.



THE EAGLE CLAW® SNELLED HOOKS

The **CLASSIC SNELL** is made with Eagle Claw® hooks, extra strong loop bonding and is snelled with superior quality monofilament line.



THE LAZER SHARP® SUPER SNELL

Utilizes Eagle Claw® hooks, with a patented technique to mold superior strength nylon to exclusive Eagle Claw® tempered hooks for the finest Snelled Hook



OUR SALTWATER SNELL

Is specifically designed for saltwater fish species where a highly-corrosion resistant hook is needed and is snelled with superior quality mono/steel wire.





THE JIG HOOK

This hook is specially engineered for lead head jigs and other molded applications. This jig hook design has proven to be very effective when going after Crappies and Bass.



THE SPROAT HOOK

This is a parabolic bend hook with a straight point. It is one of the best and strongest early designs for freshwater fishing and is very popular with bass fishermen for use with plastic baits.



THE KAHLE® HOOK

The unique Kahle® Design, which is illustrated by the wider gap, horizontal hook (the eye and point are on the same plane) places the hook farther back in the fish's mouth to eliminate tearing out through the lip. The hook, secure as it is in the fish's mouth, is much easier to remove.



THE STEELHEAD AND SALMON HOOK

This hook is designed with a long, sharp point and extra-strong shank for powerful Steelhead and Salmon. The turned-up eye increases the gap for better hooking.



THE LIMERICK HOOK

This hook is utilized for trot line fishing. It is made with a big eye for tying to the trot line and has a long shank for extra deep penetration. The Limerick hook is ideal for Catfish.



THE TITAN HOOK

This Lazer Sharp®, welded eye, big game ocean hook is the strongest hook ever produced by Eagle Claw®. This hook incorporates a special welding process that yields a smooth, yet exceptionally strong eye. The large wire diameter and new forging techniques make the Titan hook ideal for heavy duty, large fish operations. It is the finest swordfish longlining hook available in the world today.



THE EAGLE CLAW® WIDE BEND

This hook is designed with a wide bend to provide extra hooking space. The extra sharp claw-shaped points give quick hooking and sure penetration. The CLASSIC SNELL is made with Eagle Claw® hooks, extra strong loop bonding and is snelled with superior quality monofilament line.



THE EAGLE CLAW® TREBLE

This hook is the finest treble made. Used for large baits as well as upgrading lure hooks, it is forged for strength and manufactured with micro-ground points. This hook is perfectly tempered and brazed for strength. Eagle Claw® makes this hook in bronze, nickel, gold, and Sea Guard in a wide range of sizes.



THE OCTOPUS-STYLE HOOK

This hook has an extra-wide gap rounded shape for a higher percentage hookup. Built with a forged, reverse offset, it has the strength to handle large fish. It is manufactured with an up eye and is perfect for tying snells on mooching rigs. This hook is ideal for Salmon/Steelhead, Walleye and a wide variety of saltwater and freshwater species.



THE EAGLE CLAW® CARLISLE

This round-bend hook has an extra-long shank and a straight offset point. It is especially designed for minnow and night crawler fishing because of its length which helps prevent the fish from swallowing the hook.



THE EAGLE CLAW® FLY TYING HOOK

This hook is the finest of its kind available today. The Featherlite® fly hook series has the finish for faster penetration and perfect natural presentation due to its matt non-reflective finish.

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ASMFC Vision Statement: Healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015