

LENFEST OCEAN PROGRAM

RESEARCH SERIES

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Circle hooks have reduced turtle deaths in some trials, but are not universally successful at reducing the accidental catch of sea turtles.

ARE CIRCLE HOOKS EFFECTIVE?

A SUMMARY OF NEW SCIENTIFIC ANALYSIS:

Read, A.J. 2007. "Do Circle Hooks Reduce the Mortality of Sea Turtles in Pelagic Longlines? A Review of Recent Experiments." *Biological Conservation* 135: 155–169.

ACCIDENTAL CAPTURE, or bycatch, of sea turtles in pelagic (open ocean) longline fishing gear is a global conservation concern and the greatest threat to these ancient animals. Scientists, managers and fishermen are working co-operatively to develop mitigation measures to reduce this mortality. At the top of the list is a new type of fishing hook, designed to keep turtles from being hooked or from swallowing the hook. However, research to date on the effectiveness of circle hooks has concluded differing results.

Andrew Read from Duke University reviewed all available studies to examine the efficacy of these hooks as a global sea turtle conservation measure. Read concludes that circle hooks have reduced turtle deaths in some trials, but they have not been universally successful at reducing turtle bycatch. He recommends that if the hooks are to be employed as a turtle conservation measure, rigorous field studies should first be conducted to ensure that they produce conservation benefits. Read's review, funded by the Lenfest Ocean Program, resulted in a paper published in the journal *Biological Conservation*. This *Lenfest Ocean Program Research Series* report is a snapshot of the study's findings.

THE FOUR CIRCLE HOOK STUDIES REVIEWED BY READ:

Western North Atlantic
- Watson et al. (2005)

Azores
- Bolton et al. (2002)
- Bolton and Bjorndal (2003)
- Bolton and Bjorndal (2004)
- Bolton and Bjorndal (2005)

Gulf of Mexico
- Garrison (2003)
- Watson et al. (2005)

Ecuador
- Largacha et al. (2005)

THE IMPACT OF PELAGIC LONGLINE FISHING ON SEA TURTLES

Within the United States, all sea turtles are classified as either threatened or endangered under the Endangered Species Act, reflecting the fact that these populations are in need of protection. Turtles face many threats to their survival both on land and in the ocean, but accidental capture (or bycatch) in pelagic longline fishing gear represents one of the largest impediments to their recovery.

Longline vessels set up to 40 miles of mainline, from which are suspended thousands of shorter lines, each with a baited hook. Pelagic longlines are used to target open ocean fish species and are responsible for most of the world's swordfish (*Xiphius gladius*) and a large proportion of global tuna (*Thunnus*) catches. Longline vessels also accidentally catch sea turtles, including the threatened loggerhead (*Caretta caretta*) and the endangered leatherback (*Dermochelys coriacea*). Most turtles are either hooked as they attempt to eat the bait or are entangled in the line. A recent study estimated that more than 200,000 loggerheads and 50,000 leatherbacks were taken as bycatch in pelagic longline fisheries in 2000 (Lewison et al (2004). In addition to turtles and the fish targeted by the vessel, longlines also accidentally capture sharks, dolphins, and other marine species.

Fishery managers have focused considerable attention on circle hooks as a way to reduce turtle bycatch. Circle hooks reduce turtle mortality because the size and shape of the hooks makes it more difficult for the turtles to swallow, avoiding damage to internal organs. These hooks are typically wider than traditional hooks and have barbs pointed back towards the shaft of the hook, making ingestion more difficult. Circle hooks are currently being tested in many fisheries and have been proposed by fishery managers as a practical and economical measure to reduce sea turtle mortality in pelagic longline fisheries.

It is not possible to predict whether—or to what extent—the use of circle hooks will reduce sea turtle mortality in a particular fishery.

CIRCLE HOOK EFFECTIVENESS STUDIES

In conducting his assessment, Read critically reviewed all available studies examining the effects of circle hooks on the catch of target species and, wherever possible, on other species caught accidentally. He identified only four scientific studies with sufficient information about design and results to allow a detailed review. The four studies reviewed include experiments in the western North Atlantic, the Azores, the Gulf of Mexico, and Ecuador (see box). Only the experiment in the Western North Atlantic has been completely analyzed and published in a refereed journal.

Two different sizes of circle hooks.

ARE CIRCLE HOOKS THE ANSWER?

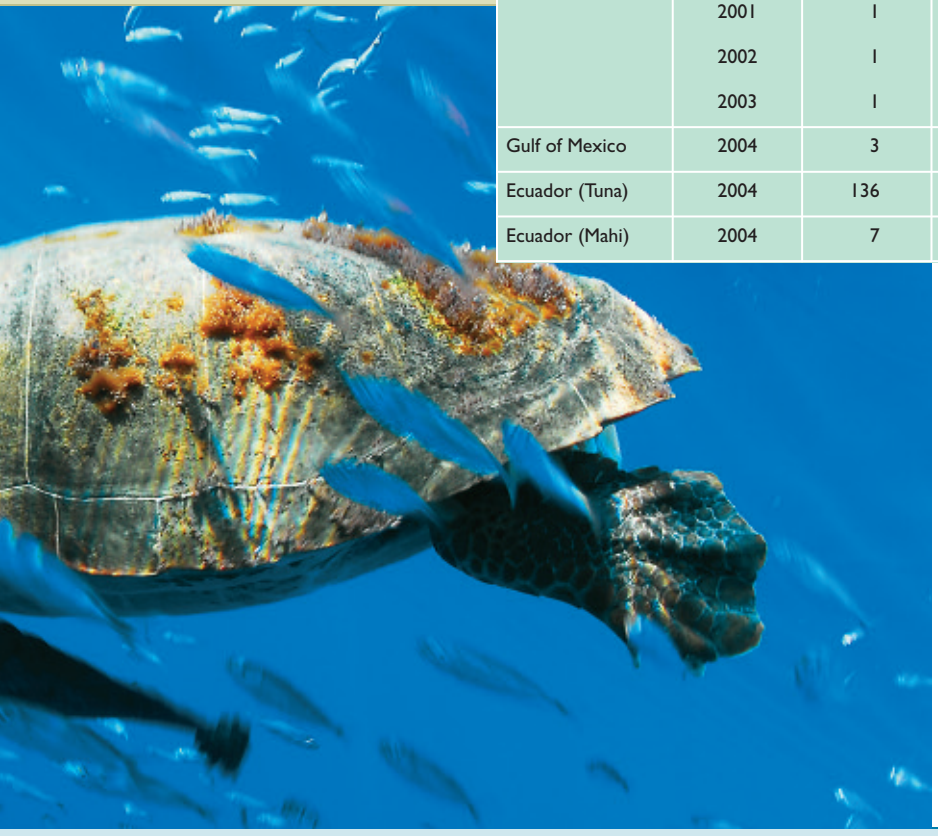
Based on his review of the details and experimental design of the four research studies, Read makes the following conclusions:

- **Circle hooks have the potential to reduce the mortality** of sea turtles captured in some—but not all—pelagic longline fisheries.
- Circle hooks are more likely to reduce turtle mortality by **preventing the swallowing of hooks**, rather than by avoiding hooking altogether. This is particularly true for loggerhead turtles.
- The conservation benefits of circle hooks **may be limited primarily to turtle species that consume bait**, such as loggerhead turtles. There is not enough information to determine the impact of circle hooks on other bycatch species, such as sharks and marine mammals.
- The impact of circle hooks on the **catch rate of target fish species varied in the studies.** In some studies, catch rate increased and in others it decreased, sometimes to levels that made their use impractical.
- Because of the mixed results of the studies, **it is not possible to predict whether—or to what extent**—the use of circle hooks will reduce sea turtle mortality in a particular fishery.
- If circle hooks are intended to be employed or required as a conservation measure to reduce sea turtle bycatch, **they should first be field tested** in that fishery to ensure that bycatch will be reduced.

SUMMARY OF EXPERIMENTS

Summary of experiments designed to assess the efficacy of circle hooks in reducing the mortality of sea turtles. LH, LB and OTHER refer to numbers of captured loggerhead, leatherback and other species of turtles, respectively.

Location	Year	Vessels	Sets	Hooks	LH	LB	Other
Western Atlantic (NED)	2002	13	489	427,382	96	148	0
	2003	11	539	578,050	92	79	1
Azores	2000	1	93	138,121	232	4	1
	2001	1	60	88,150	44	1	0
	2002	1	48	75,511	18	3	0
	2003	1	73	114,417	143	5	0
Gulf of Mexico	2004	3	61	29,570	0	3	0
Ecuador (Tuna)	2004	136	185	20,570	0	0	16
Ecuador (Mahi)	2004	7	126	32,200	0	0	58



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About the Author

DR. ANDREW J. READ is the Rachel Carson Associate Professor of Marine Conservation Biology at the Duke University Marine Lab.

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LENFEST OCEAN PROGRAM

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The Lenfest Ocean Program brings the best scientific research to bear on identifying the causes, consequences and solutions to problems facing the global marine environment.

1025 F Street NW, Suite 900, Washington, DC 20004 • ph: 202.552.2131 • fx: 202.552.2299
email: info@lenfestocean.org • www.lenfestocean.org

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