LENFEST OCEAN PROGRAM

RESEARCH SERIES

JUNE 2008

Risk Assessment Prompts No-Take Recommendations for Shark Species

ATLANTIC SHARKS AT RISK

SUMMARY OF AN EXPERT WORKING GROUP REPORT:

Simpfendorfer, C., Heupel M., Babcock, E., Baum, J.K., Dudley, S.F.J., Stevens, J.D., Fordham, S., and A. Soldo. 2008. Management Recommendations Based on Integrated Risk Assessment of Data-Poor Pelagic Atlantic Sharks.

POPULATIONS OF MANY of the world's pelagic, or open ocean, shark and ray species are declining. Like most sharks, these species are known to be susceptible to overfishing due to low reproductive rates. Pelagic longline fisheries for tuna and swordfish catch significant numbers of pelagic sharks and rays and shark fisheries are also growing due to declines in traditional target species and the rising value of shark fins and meat. Yet, a lack of data has prevented scientists from conducting reliable population assessments for most pelagic shark and ray species, hindering effective management actions.

Dr. Colin Simpfendorfer and the Lenfest Ocean Program convened an international expert working group to estimate the risk of overfishing for twelve species caught in Atlantic pelagic longline fisheries under the jurisdiction of the International Commission for the Conservation of Atlantic Tunas (ICCAT). The scientists conducted an integrated risk assessment designed for data-poor situations for these sharks and rays. Their analysis indicated that bigeye thresher, shortfin mako and longfin mako sharks had the highest risk of overfishing while many of the other species had at least moderately high levels of risk. Based on these results, the scientists developed recommendations for limiting or prohibiting catch for the main pelagic shark and ray species taken in ICCAT fisheries. This *Lenfest Ocean Program Research Series* report is a summary of the expert group's analysis.

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS (ICCAT)

ICCAT is an inter-governmental organization that is responsible for managing and conserving tunas and tuna-like species in the Atlantic Ocean and its adjacent seas. In recent years, ICCAT has increased its attention to pelagic sharks as these species are caught incidentally in Atlantic tuna and swordfish fisheries and increasingly targeted themselves.

The 46 ICCAT member governments aim to achieve consensus on international, Atlantic fishery management measures. Their primary source for scientific advice is the Standing Committee on Research and Statistics (SCRS) which convenes technical meetings to assess population status and formulate management advice for relevant species.

STATUS OF PELAGIC SHARK POPULATIONS IN THE ATLANTIC OCEAN

In recent years, there has been increasing concern about the deteriorating status of the world's pelagic shark populations, including in the Atlantic Ocean. Because of low reproductive potential (stemming from slow growth, late maturity and low reproductive rates), they are ill-equipped to sustain heavy fishing pressure, and recovery times from overfishing are prolonged. Although there is some uncertainty about the precise status of these species, there is little doubt that populations have declined significantly in the face of intensive fishing and the lack of shark catch limits.

STUDY METHODS AND RESULTS

The expert working group used an integrated risk assessment approach to estimate the risk of overexploitation in pelagic longline fisheries for twelve Atlantic pelagic shark and ray species (Table 1). This approach is not a substitute for population assessment as it does not provide a measure of either exploitation or population abundance, but rather assesses the risk of overexploitation. It is therefore useful for formulating science-based management recommendations when catch data are particularly poor. The analysis incorporated three main approaches: 1) ecological risk assessments, 2) the position of the inflection point in population growth curves and 3) the species' status according to the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species. The expert group then combined the risk estimates from each of these approaches to define the overall risk of overfishing from Atlantic pelagic longline fisheries for each species.

TABLE 1: PELAGIC SHARK AND RAY SPECIES CONSIDERED IN THIS STUDY

Common Name	Scientific Name
Bigeye thresher	*Alopias superciliosus*
Common thresher	*Alopias vulpinus*
Silky shark	*Carcharhinus falciformis*
Oceanic whitetip	*Carcharhinus longimanus*
Shortfin mako	*Isurus oxyrinchus*
Longfin mako	*Isurus paucus*
Porbeagle	*Lamna nasus*
Blue shark	*Prionace glauca*
Crocodile shark	*Pseudocarcharias kamoharai*
Pelagic stingray	*Pteroplatytrygon violacea*
Scalloped hammerhead	*Sphyrna lewini*
Smooth hammerhead	*Sphyrna zygaena*

Porbeagle shark

PRODUCTIVITY AND SUSCEPTIBILITY ANALYSES

The expert group calculated **productivity** using a model that estimates a species' rate of population increase while accounting for variability in birth rates and environmental influences.

The scientists calculated **susceptibility** as the product of four factors:

- Availability—the proportion of a species' geographic range over which the pelagic longline fisheries operate in the Atlantic Ocean
- Encounterability—the proportion of the species' depth range over which encounters with pelagic longline fishing gear are likely
- Selectivity—the proportion of the total population that is susceptible to being caught in the fishing gear
- Post-capture mortality—the proportion of the individuals captured that died (retained or discarded)

Ecological Risk Assessment (ERA)

ERA is an innovative tool for examining and ranking the potential effects of fisheries on a group of species. Risk is considered using two measures—**productivity** (the population growth rate) and **susceptibility** (a species' level of vulnerability to fishing effort) (see insert). The scientists calculated productivity and susceptibility values for each species and plotted them on a graph to show their relative positions. These plots provide a means of ranking the species in terms of overexploitation risk.

Position of the inflection point of the population growth curve

This approach estimates how far a population can be depleted from unfished levels before its ability to sustain a fishery starts to decline. The "inflection point" is the population abundance, relative to unfished levels, that is associated with the maximum population production and thus the maximum sustainable fisheries yield. Species with a higher inflection point are at greater risk of overfishing because their populations must be closer to the unfished level in order to sustain a fishery.

IUCN Red List status

The International Union for the Conservation of Nature (IUCN) uses specialist groups to assess the conservation status of species and determine which are in greatest need of conservation action. Experts classify species according to their risk of extinction using the terms *Threatened* for high risk species, which includes the categories *Critically Endangered, Endangered* or *Vulnerable; Near Threatened* for those which may soon become *Threatened* if conservation action is not taken; and *Least Concern* for those species with a low risk of extinction. Species for which there is insufficient information for assessment are classified as *Data Deficient*.

Integrated risk assessment can estimate the risk of overfishing in data poor populations.

Silky shark

FINDINGS AND IMPLICATIONS

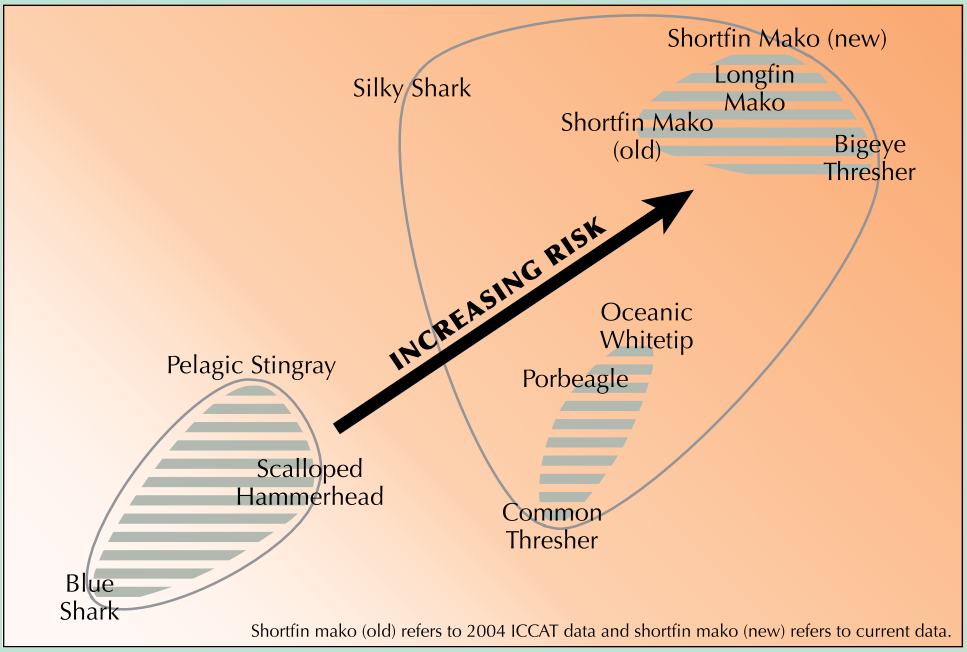
The scientists used several statistical techniques (including cluster analysis) to combine the individual results of all three approaches and estimate an overall risk of overfishing by pelagic fleets in the Atlantic for each pelagic shark species (Note—susceptibility to coastal fisheries was not incorporated into the expert group analysis and thus this method underestimates the risk for coastal pelagic sharks such as porbeagles and hammerheads. Crocodile sharks and smooth hammerheads were not analyzed with this approach due to a lack of data). These approaches group together those species with similar risks. Two main groups were identified by these analyses (see Figure 1). Scalloped hammerheads and pelagic stingrays were grouped with blue sharks according to these analyses as having a lower risk of overexploitation by Atlantic pelagic longline fisheries than the other species. However, the scalloped hammerhead is classified by IUCN as *Endangered*, partly because of its exposure to additional fisheries. All other species grouped together in a second, higher risk cluster. Within the larger, higher risk group, several additional clusters of species emerged. Specifically,

Shortfin mako shark

1. The shortfin mako, longfin mako and bigeye thresher have the highest levels of risk of overfishing by Atlantic pelagic fisheries.
2. The common thresher, oceanic whitetip and porbeagle have moderately high levels of risk of overfishing by Atlantic pelagic fisheries.
3. The silky shark has a risk level similar to the second group above, but was not grouped with those species in Figure 1 because of its different IUCN status.

FIGURE 1: RESULTS OF INTEGRATED RISK ASSESSMENT FOR ATLANTIC SHARK AND RAY SPECIES TAKEN IN PELAGIC FISHERIES

Risk increases from lower left to upper right, and represents the risk of overexploitation by pelagic longline fisheries in the Atlantic Ocean.




Scalloped hammerhead shark

MANAGEMENT RECOMMENDATIONS

Based on the results of these risk estimates, a subset of the expert group (the authors listed here) developed the following management recommendations:

1. **ICCAT should prohibit catches of bigeye thresher and longfin mako sharks, two species with high overfishing risk and exceptionally low reproductive rates,** to ensure that population levels do not fall below optimal levels.
2. **ICCAT should prohibit catches of oceanic whitetip, porbeagle, common thresher and silky shark until there are sufficient data to determine enforceable fishing** limits that maintain or rebuild the populations to optimal levels. Porbeagles should be given priority for stock assessment due to documented depletion.
3. **ICCAT should carefully consider updated population assessments for blue and shortfin mako sharks,** and strictly limit fishing to ensure that populations remain at or are rebuilt to optimal levels.
4. **ICCAT should encourage research related to smooth hammerheads, longfin makos and crocodile sharks as data in these cases are particularly poor. ICCAT should prohibit catches of these species** while more information is gathered. Their status should be revisited once sufficient data have been collected and used to determine fishing limits that ensure that populations are rebuilt to or maintained at optimal levels.

Precautionary management of these species is required to ensure sustainable fisheries, prevent population collapse and maintain ecosystem function.

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Oceanic whitetip shark

This study was funded by the Lenfest Ocean Program.

The Lenfest Ocean Program was established in 2004 by the Lenfest Foundation and is managed by the Pew Environment Group. For more information about the Program or the Expert Working Group on Determining the Risk of Over-Exploitation for Data-Poor Pelagic Atlantic Sharks, please visit www.lenfestocean.org or contact us at info@lenfestocean.org.

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