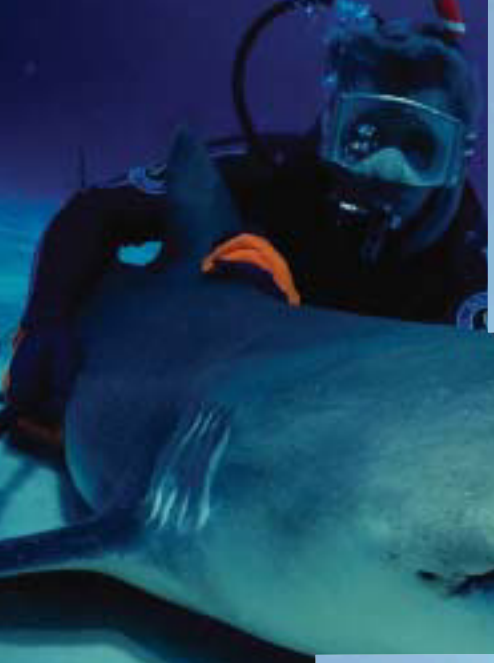
Shark Protection

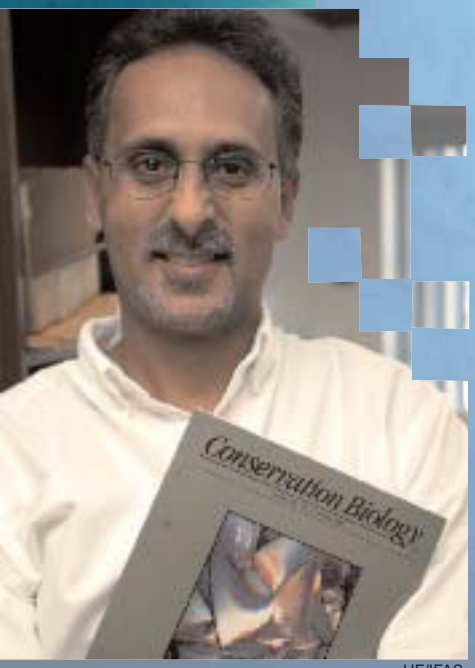
Rapid shark DNA test puts the bite on crime



Here's a riddle: How do you properly manage populations of animals that play vital roles in ocean ecosystems but are heavily fished, if you cannot even determine how many of the animals are being caught?

The answer is you can't. But one Florida researcher is diligently applying new and innovative marine biotechnology techniques to correcting the situation.

The animals in question are sharks, and while images of them may strike fear in some, warranted or unwarranted, in reality sharks should be far more wary of the humans who have fished many species' populations into serious danger, even the brink of extinction. Because sharks play critical roles in ocean ecosystems as top predators, such declines pose a serious ecological threat. The situation is especially dire considering that sharks take on average 12 to 15 years to reach sexual maturity, meaning that depleted populations can take decades to recover even if good management practices are put in place.



UF/IFAS

Mahmood Shivji's work has been featured worldwide.

A key barrier to proper management of shark populations is that managers and scientists worldwide have not been able to accurately gauge just how much damage is being done to the populations of specific species and by whom. Shark parts, especially the fins prized in Asian markets for use in soups, tend to arrive at docks and markets already removed, so that identifying the species they came from is all but impossible visually. And, no scientific method has been available to determine species quickly enough to make monitoring feasible. This has rendered prosecution of illegal shark part dealers difficult, but that is now set to change.

Shark Signatures

When Mahmood Shivji and his colleagues at Nova Southeastern University's Guy Harvey Research Institute in Ft. Lauderdale set out to solve this important but perplexing problem, they knew they would need to develop an identification process that was rapid, accurate, and economical.

First the group zeroed in on a region of DNA common to all sharks. Next, for each targeted shark species they identified sequence segments within the region that were the same for all sharks of the same species, regardless of where on the globe they lived, but that were different for other species. Once these segments were identified, the team could then use the Polymerase

"Virtual" statewide department of faculty connected via Internet listserv.

Florida Marine Biotechnology Summit II convenes with 45 attendees.

Chain Reaction (PCR) technique, which detects the presence of specific DNA sequences in a sample.

To prevent overlap, each of the sequences targeted for use identifying a species was carefully chosen so that it was from a distinct spot that does not overlap with the identifying segment for another species. This has made it possible to test a sample for the presence of nine different identifying sequences at once, allowing discrimination between nine shark species with just a single PCR reaction.

Shivji's team has now established genetic signatures for dozens of common species such as bull (*Carcharhinus leucas*), and great white (*Carcharodon carcharias*) sharks.

Already the shark identification technique has been used to study the global trade in shark parts in places such as China. There researchers have used the technique to identify the shark parts sold in markets, where approximately 100 different trade names exist, but no information has been available about what species corresponded to what name.

By analyzing samples from markets in Hong Kong, the group created a concordance linking species to trade name. With that information, Shivji and his research collaborator Shelley Clarke of the Imperial College, UK, were able to analyze Hong Kong market records to determine the quantity of various species being caught to support the fin trade, giving a good measure of its impact on various populations. Further identification work of this type in other countries will yield vital information about global shark catches to aid resource managers and others in establishing better practices for shark conservation.

On the Docks

Florida Sea Grant has funded some of the work to develop the species identification techniques, but the importance of Shivji's work has also been widely recognized in the form of funding awards from the Wildlife Conservation Society, the David and Lucille Packard Foundation, and the Pew Institute for Ocean Science. The research has also led to significant press coverage by The New York Times, New Scientist, Science, Nature, NationalGeographic.com and others.

Through that exposure, the Shivji group caught the eye of the National Oceanic and Atmospheric Administration's Office of Law Enforcement, which called to enlist their help in identifying illegally harvested shark fins confiscated from U.S. fishing vessels. The Shivji team now works regularly with officials in various regions to identify the species for seized shark parts. Typically, fins from prohibited shark species are found during these investigations, illustrating the work's importance, although the technique also leads to the exoneration of innocent traders.

Because the same basic methods developed for sharks can also be applied to any type of wildlife, including both fish and land animals, researchers are already developing genetic signatures for billfish and tuna species at the request of law enforcement officials. With billfish, officials have to deal with the sticky problem of bans on selling Atlantic billfish while the same species can be legally imported from the Pacific and sold. So the Shivji team is working to identify sequences that will allow not only identification of species, but also separation of Atlantic and Pacific populations.

With the necessary techniques now in hand, compliments of Florida marine biotechnology, our understanding of human impacts on populations of vital fish and other animal species, and our ability to manage them wisely, is now on a path toward dramatic improvement.

Shark fins used to be unidentifiable without time-consuming analysis. A rapid test by the Shivji group can identify those harvested illegally.

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Florida team secures national award for marinebiotech.org web site development.

Industry needs assessment survey by Florida Sea Grant identifies five Florida companies already involved in marine/aquatic biotechnology and several others interested in becoming involved.