2014 Ocean Sciences Meeting
27 February 2014
8:45 a.m.

Accompanying images and video can be found at: http://news.agu.org/press-release/a-sharks-eye-view-witnessing-the-life-of-a-top-predator/

A "shark's eye" view: Witnessing the life of a top predator

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HONOLULU – Instruments strapped onto and ingested by sharks are revealing novel insights into how one of the most feared and least understood ocean predators swims, eats and lives.

For the first time, researchers at the University of Hawaii and the University of Tokyo outfitted sharks with sophisticated sensors and video recorders to measure and see where they are going, how they are getting there, and what they are doing once they reach their destinations. (Click here for video: http://www.youtube.com/watch?v=UHDOAmXRw-0&feature=youtu.be).

Scientists are also piloting a project using instruments ingested by sharks and other top ocean predators, like tuna, to gain new awareness into these animals' feeding habits. The instruments, which use electrical measurements to track ingestion and digestion of prey, can help researchers understand where, when and how much sharks and other predators are eating, and what they are feasting on.

The instruments are providing scientists with a "shark's eye" view of the ocean and greater understanding than ever before of the lives of these fish in their natural environment.

"What we are doing is really trying to fill out the detail of what their role is in the ocean," said Carl Meyer, an assistant researcher at the Hawaii Institute of Marine Biology at the University of Hawaii at Manoa. "It is all about getting a much deeper understanding of sharks' ecological role in the ocean, which is important to the health of the ocean and, by extension, to our own well-being."

Using the sensors and video recorders, the researchers captured unprecedented images of sharks of different species swimming in schools, interacting with other fish and moving in repetitive loops across the sea bed. They also found that sharks used powered swimming more often than a gliding motion to move through the ocean, contrary to what scientists had previously thought, and that deep-sea sharks swim in slow motion compared to shallow water species.

“These instrument packages are like flight data recorders for sharks,” Meyer said. “They allow us to quantify a variety of different things that we haven’t been able to quantify before.”

“It has really drawn back the veil on what these animals do and answered some longstanding questions,” he added.

Meyer and Kim Holland, a researcher also at the Hawaii Institute of Marine Biology, are presenting the new research today at the 2014 Ocean Sciences Meeting co-sponsored by the Association for the Sciences of Limnology and Oceanography, The Oceanography Society and the American Geophysical Union.

Sharks are at the top of the ocean food chain, Meyer noted, making them an important part of the marine ecosystem, and knowing more about these fish helps scientists better understand the flow of energy through the ocean. Until now, sharks have mainly been observed in captivity, and have been tracked only to see where they traveled.

These new observations could help shape conservation and resource management efforts, and inform public safety measures, Holland said. The instruments being used by scientists to study feeding habits could also have commercial uses, including for aquaculture, he added.

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Notes for Journalists:

The researchers on these studies will present oral presentations about their work on Thursday, 27 February 2014 at the Ocean Sciences Meeting. The meeting is taking place from 23 – 28 February at the Hawaii Convention Center in Honolulu. For more information for members of the news media, please go to http://www.sgmeet.com/osm2014/media.asp.

Below are abstracts of the presentations. Both presentations are part of Session 091: Advances in approaches to monitoring the occurrence, distribution, and behavior of top predators being held Thursday 27 February from 8 a.m. to 10 a.m. local Hawaii time in room 310 Theater.

Title:
Multi-Instrument Biologging Provides New High Resolution Insight Into Shark Behavior and Biomechanics

Oral presentation
Session #:091
Date: 27 February 2014
Time: 8:45 a.m.
Location: 310 Theater

Authors:
Meyer, C., Hawaii Institute of Marine Biology, University of Hawaii at Manoa, Kaneohe, HI, USA;

Nakamura, I., International Coastal Research Center, Atmosphere and Ocean Research Institute, University of Tokyo, Kashiwanoha, Kashiwa, Chiba, Japan;

Sato, K., International Coastal Research Center, Atmosphere and Ocean Research Institute, University of Tokyo, Kashiwanoha, Kashiwa, Chiba, Japan.

Abstract:
In marine ecosystems, the advent of electronic tags has provided unprecedented new insights into movements of highly mobile sharks. However, until recently we have lacked high-resolution tools capable of revealing fine-scale patterns of behavior and habitat use, or providing empirical insight into swimming biomechanics of free-ranging sharks. Now a combination of high resolution, tri-axial accelerometer-magnetometer data loggers and miniature video loggers is uncovering previously unknown aspects of shark ecology. Recent deployments of these devices on a variety of coastal and deep-sea sharks in Hawaii has revealed complex, three-dimensional movements of these animals over a variety of habitats, provided a clearer understanding of shark swimming biomechanics and yielded a 'sharks-eye' view of interactions with other animals.

Title:
Detection and Telemetry of Feeding Events in Free Swimming Sharks and Tuna

Oral presentation
Session #:091
Date: 27 February 2014
Time: 9:30 a.m.
Location: 310 Theater

Authors:
Holland, K., Hawaii Institute of Marine Biology, University of Hawaii at Manoa, Kaneohe, HI, USA;

Meyer, C., Hawaii Institute of Marine Biology, University of Hawaii at Manoa, Kaneohe, HI, USA.

Abstract:
An ability to directly measure feeding events in top predators (e.g., tuna, sharks) would represent a major advance in quantifying energy flow through marine ecosystems. An appropriate device must detect these events over prolonged periods and be able to withstand large pressure changes. We hypothesized that physical changes occurring during ingestion and digestion should be quantifiable by measuring Bulk Electrical Impedance across paired electrodes. We successfully demonstrated this using a prototype tag (Wildlife Computers Inc.) to record impedance changes occurring inside the stomachs of free swimming captive sharks over multiple feeding events. Feeding and digestion produced characteristic changes in electrical impedance of the stomach contents identifiable as 5 successive phases: (1) Empty stomach, (2) Ingestion, (3) Chemical 'lag' phase, (4) Mechanical 'chyme' phase, and (5) Stomach emptying phase. The duration of the chyme phase was positively related to meal size. We recently observed these same phenomena in yellowfin and bluefin tuna. We are now deploying prototype tags in wild animals and adding accelerometry capabilities to assist in interpretation of feeding events. Preliminary results from these recent events will be presented.

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