Videotaping Antarctic midwater fish through the "eyes" of Weddell seals

Development of a video/data recorder that can be mounted on marine mammals has led to a novel study of the behavior of important pelagic fish species under the Antarctic ice. This video/data recorder was developed under a 1998 grant to Randall Davis (Texas A & M Univ.) from the West Coast & Polar Regions Undersea Research Center, and has been deployed on Weddell seals during NSF-sponsored research in Antarctica. Earlier publications have discussed insights into the behavior of the seals themselves (see web site below). New results about Antarctic fish species, as seen from the seal's point of view, are reported in the 5 January 2002 online edition of the journal *Marine Biology**.

The two pelagic fish species are among the most abundant in the Southern Ocean. One is the Antarctic silverfish, *Pleuragramma antarcticum* (adult size 20-25 cm), regarded as a keystone species in the food web of the High Antarctic Zone. The other is the much larger Antarctic toothfish, *Dissostichus mawsoni* (adult size 1-2 m). Despite their abundance and importance in the regional ecology, little is known about the behavior of these species, especially in the inaccessible environment beneath the pack ice and shore-fast ice. Weddell seals prey on both species, and in this study they essentially acted as remote, high-speed observation platforms.

The video/data recorder consisted of a pressure housing containing the video tape recorder, micro-controller and batteries that was mounted on the backs of 15 adult seals. A cable connected the pressure housing on the back to a video camera with near infra-red LEDs mounted on the seal's head. They recorded encounters with prey along with the seal's position, depth, compass heading, flipper stroke frequency, and swimming speed. These data allowed the researchers to compute the seal's three-dimensional movements and assess swimming effort. During three field seasons, the project was set up at an artificial hole and haul-out shelf cut into the sea ice of McMurdo Sound, over a water depth of 570 m.

Among the discoveries about the fish species are these: It turns out that both species migrate vertically on a daily cycle; however, while the timing of the silverfish migration corresponds to changes in light levels, toothfish migration does not. The silverfish occur in loose aggregations, spaced about 2-4 meters apart, and tend to flee upward when chased by a seal. Their maximum estimated swimming speed was 1.1 meters per second, in line with the low speeds of other Antarctic fishes. By comparison, the toothfish is a speedy creature; one individual sustained a swimming speed of 3.4 meters per second for nearly half a minute while being chased by a seal. Additional results may be found in the article in *Marine Biology* and at the web site listed below.

This project, like other innovative applications of undersea video technology, yielded unparalleled insight into the marine environment. Although there have been significant advances in miniaturized video technology and virtual reality data assessment, their use in the study of large marine animals has lagged considerably behind applications for ROVs and other submersible platforms. There is great potential for using marine mammals as "biological autonomous underwater vehicles" to study their behavior and the ocean environment. Further development and miniaturization of the video/data recorder by Randall Davis and his collaborators is currently supported through a combination of grants from the West Coast & Polar Regions Undersea Research Center (NURP) and NSF Polar Programs.

* Fuiman, L.A., R.W. Davis, and T.M. Williams, "Behavior of midwater fishes under the Antarctic ice: observations by a predator." *Marine Biology*, paper DOI 10.1007/s00227-001-0752-y; online edition 5 January 2002, and print edition March 2002.

URL for additional information:
http://msi40.utmsi.utexas.edu/staff/fuiman/antarctica/