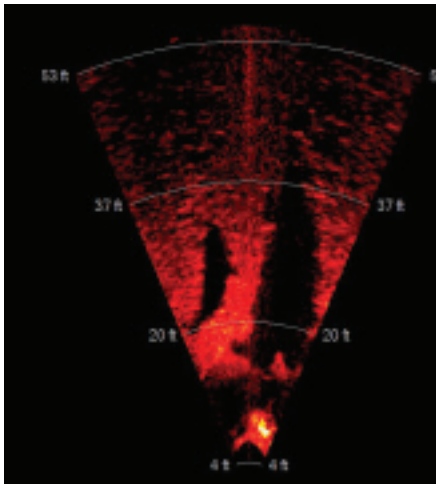
Feature Story

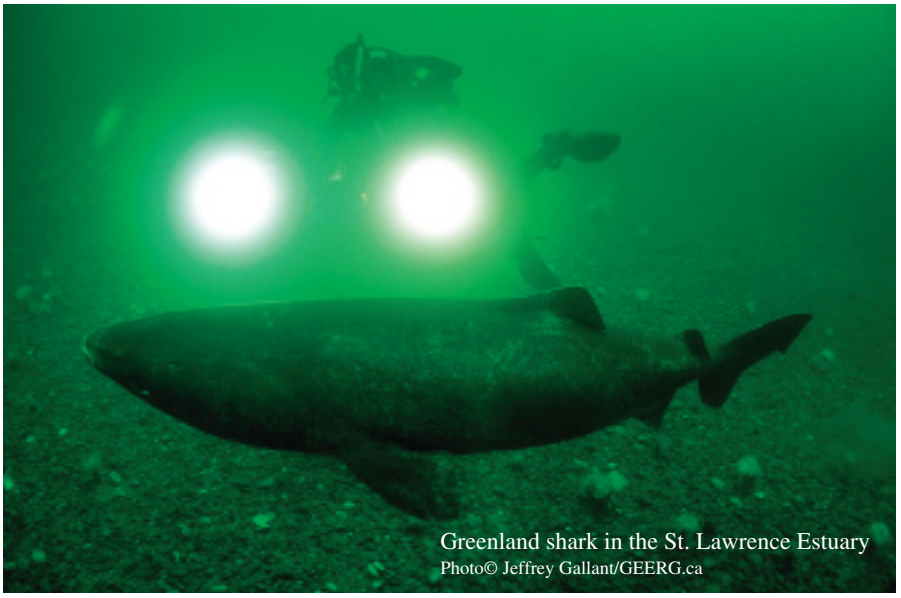
ROVs and Sonar Help Diving Scientists Study Rare Deep Sea Sharks

By Jeffrey Gallant (GEERG), Dr. Chris Harvey-Clark (University of British Columbia) and Brian Luzzi (VideoRay)

When scientific divers Jeffrey Gallant and Dr. Chris Harvey-Clark decided to look for giant seal-eating sharks at night, they felt they needed some backup. Since 1996, the researchers have been studying the Greenland shark, *Somniosus microcephalus*, which at over 6 m (20 ft) is the largest carnivorous shark after the great white (*Carcharodon carcharias*) and the only large shark found under polar ice. "The real worry in diving with this shark" says Harvey-Clark, "is that we have no idea how these seemingly slow-moving animals can catch agile, evasive, smart prey like seals."

After first documenting an unstudied population of the sharks in the St. Lawrence Estuary in 2003, Gallant and Harvey-Clark were joined by Dr. Michael Stokesbury (Dalhousie University) the following year to track the movement and behavior of these giant sharks using VEMCO V16 hydroacoustic tags and Wildlife Telemetry PSAT satellite tags. Gallant says, "We would swim up to the sharks and implant transmitters into the skin of the slow-swimming sharks. We were not sure how they would react, but in most cases the sharks shuddered and then





Greenland shark in the St. Lawrence Estuary
Photo© Jeffrey Gallant/GEERG.ca

bolted away into the darkness. What is intriguing is that the telemetry results show us the sharks exhibit remarkably different behavior during the day versus night time. During the day time, the sharks stay close to the bottom, moving quite slowly at about 20 cm (0.65 ft) per second. As dusk turns into night, telemetry shows the sharks becoming much more active and in some cases migrating almost to the surface, then back to the bottom in 60 m (200 ft) of water every 20 to 30 minutes. This fits with a marine mammal hunting pattern, as it is the same "bandwidth" of water the sharks share with seals."

The researchers theorize that the sharks spend daylight hours cruising close to the bottom to hunt benthic fish like Greenland halibut (*Reinhardtius hippoglossoides*), then use stealth under cover of darkness to hunt seals. Almost every shark on which they have conducted a postmortem has had large amounts of seal tissue in its stomach; in this species the stomach can contain 20 percent of the total bodyweight. Harvey-Clark, a veterinarian and marine biologist observes, "In 2006, we conducted a postmortem examination of a Greenland shark that weighed 230 kg (508 lbs) and had a stomach weighing 34 kg (75 lbs), and over 30 percent of that weight was seal remains."

"We wanted to try to observe the change in night-time behavior in the sharks, but we were concerned about safety when diving in limited visibility," says Harvey-Clark. "Experience has taught us that even in daylight, the sharks are quite curious about divers and repeatedly double back behind us in conditions of poor visibility. Sometimes we aren't quite sure who is studying whom." This gives pause to the dive team who uses video frames of scars to identify and sex individual sharks and laser measurement to determine their size. So they turned to VideoRay's Director of Sales & Marketing, Chris Gibson, for some technological help and to evaluate the potential for using a remote operated vehicle (ROV) in studying the sharks.

According to Harvey-Clark, "The region where we find the sharks is influenced by freshwater runoff, and the visibility is typically only 3 to 5 m [10 to15 ft], really dark, murky water. This makes it very hard to see the sharks until they are right on top of you. It also means we may be missing large numbers of sharks when we rely exclusively on divers to survey the area visually. When Jeffrey indicated that a sonar-equipped VideoRay could possibly locate sharks outside our visual range, then lead us to the targets, we realized we potentially had an effective tool to study the movement and behavior of the sharks at night, not to mention someone to watch over us."

In July 2008, VideoRay marketing manager and ROV pilot Brian Luzzi accompanied the researchers to their study site near Baie-Comeau, Quebec on the north shore of the St. Lawrence Estuary. They conducted a number of dives with the VideoRay working in tandem with the divers. "With an expert like Brian at the controls, VideoRay quickly found sharks on sonar, ascertained their position, confirmed the targets visually, and then fetched the divers to come and record the animal," says Gallant. "It was like having a bird dog underwater," says Harvey-Clark. "VideoRay would find the sharks, then we would hear a buzz, the ROV would appear, flash its lights three times and whiz off. We would follow the tether to the shark."

For this mission, the VideoRay Pro 3 GTO ROV outfitted with a BlueView ProViewer P-900E high definition imaging sonar proved to be a potent tool in locating and imaging the Greenland shark in a limited visibility underwater environment. With a maximum range of 55 meters (180 ft.), the imaging sonar had no problems locating sharks in the area, which appeared as bright torpedo-shaped blooms on the screen. Upon marking a target, the powerful VideoRay GTO thrusters could easily catch up with the shark, alert divers to their presence, and capture both video and sonar data of the animal before they disappeared into the blackness.

Powered by a small, portable, 2,000 W gasoline generator and with minimal set-up time, the VideoRay ROV could be in the water in minutes scouting the waters for sharks while the divers were suiting up. The small "footprint" of the VideoRay ROV control panel also allowed for easy, unobtrusive operation off of the research vessel. Given the somewhat small circumference of area the sharks had been spotted in, only 120 m (400 ft.) of bright yellow neutrally buoyant tether was necessary between the ROV and the control panel. This particular tether length was ideal for locating the sharks and giving the divers a highly visible line to follow right up to the animals.

In fact, VideoRay was able to spot sharks the divers missed. During one night dive, the ROV operator spotted a shark on sonar within 4.5 m (15 ft) of the divers but was unable to alert them to its presence before the shark disappeared. "Our visual ability to see the sharks at night is limited. Diving at night with lights is like turning on your high beams in a snowstorm" said Gallant. "It was a little disconcerting knowing sharks were that close and we couldn't see them."

The researchers were also impressed at the resolution of the sonar image on the tiny ROV, which weighs only 4.5 kg (10 lbs). "We could see the dorsal, caudal, and pectoral fins of the shark, count tail beat frequency, and see sharks and divers at same time," says Luzzi.

This is not the first time the team of Gallant and Harvey-Clark has used VideoRay to image sharks. In 2000, they shot some of the first footage of salmon sharks (*Lamna ditropis*) feeding using VideoRay in Alaska on a Discovery Channel film shoot. That same year, they used VideoRay to help record the first ever dives with pelagic sharks off Canada. In 2001 they used the VideoRay under ice to look for Greenland sharks in the Saguenay Fjord, and in 2003 the team first used the VideoRay to look for sharks in the St. Lawrence Estuary.

What's next? The researchers are convinced it is feasible to use small, portable ROVs like the VideoRay to monitor shark behavior and ecology and possibly to deliver telemetry tags to sharks and take skin biopsy samples for DNA analysis with less risk to the divers. "We like the portability and ease of use of the VideoRay," says Harvey-Clark. "It may not be able to do what a Volkswagen-sized ROV can do in terms of heavy construction work, but for our purposes, for transportation, maneuverability, quick deployment, and observation, it can, in some cases, exceed the performance of a diver."

For more information, visit www.geerg.ca and VideoRay, www.Videoray.com