Using a Compact Hydraulic ROV System to Conduct Assessment of Priminoa Thicket Habitat in the Gulf of Alaska – A successful proof of concept

Liz Taylor
DOER Marine

In July of 2013 NOAA awarded a contract to conduct an ROV (remotely operated vehicle) assessment of the Priminoa thicket habitat in the Gulf of Alaska. Priminoa are collectively a group of deep-water corals commonly known as "sea fans". In cold- water regions such as those found off the coast of Alaska, these fans are more akin to a small tree, with some more than six feet in height. They also favor areas with substantial currents due to the high volume of planktonic food that sweeps over them in these locations. From a biological perspective, this environment is one rich in biodiversity- highly desirable from a sampling and observation standpoint. For an ROV operator, it is an environment fraught with peril of entanglement with a potential for damage to the equipment and/or study subjects. For a vessel captain, such missions are especially challenging and require exceptional ship handling skills, especially if a non-DP (dynamic positioning) vessel is utilized. It was one of the first times that an ROV survey and sampling mission would be conducted in this region.

The project was bid by the contractor with the intention of using it as a proof of concept for their model of supplying rapidly deployable, containerized applied science ROVs that could be used from vessels of opportunity. The system they originally intended to use was to be supplied by a Maritime Institute. However, the vessel selected for the project by NOAA was a stern trawl catch type and not suitable in size to safely accommodate the system. The contractor elected to bid the project in collaboration with Tiburon Subsea Services for the ROV system and DOER Marine for ROV technical support. However, at the time of award, Tiburon's ROV had already been contracted by the Navy. Because of that time sensitive obligation they were forced to withdraw from the project.

DOER was asked to find a solution and approached the Scripps Institute of Oceanography about collaboration utilizing the compact hydraulic ROV system that DOER had built for them under contract to Ocean Innovations. The 7.5HP system carried a DOER Sea Mantis five-function manipulator, Multi sea lights and cameras from Deep Sea Power and Light and an HD video camera. DOER was tasked with making some modifications and additions to the system in preparation for operations in the Priminoa thicket. In the spirit of public-private partnerships, Scripps would supply one marine technician to DOER in order to gain additional experience in ROV operations and scientific sampling techniques. Both the contractor and NOAA were agreeable to this solution and the project received a green light.

The H2000 ROV system arrived in its 20ft van at DOER for the upgrades and modifications. These included a hydraulically actuated sampling basket along with integration of NOAA supplied stereo cameras, sensors, lasers, tracking and water

sampling tools. Other tasks, such as servicing the ROV, calibrating and testing sonars, HD camera, and sensors, updating software and increasing spares levels for remote deployment were all carried out ahead of shipping. A tracking pole was supplied by DOER for the transducer and installed on board the ship.

The contractor arranged transport via truck and ferry to the mobilization site in Ketchikan and met the system there for system mobilization. The value of utilizing a standard 20ft ISO container footprint for the van was readily recognized and shipping costs were easily controlled. The mobilization proceeded and the project commenced as planned.

The red tree corals were of particular interest to the science party. The objectives were to measure abundance, determine the use of the corals as habitat by other species, fishes and crabs in particular, estimate recovery rates of corals that had been subjected to damage/disturbances, and to take samples that would allow scientists to determine the connectivity of the thickets via their DNA. Some larger specimens would also be collected as representative "vouchers" of each study area. Other samples, including rocks, sponges and other geologically or biologically interesting items would also be collected in the bio-box sampling basket. DOER's design allowed the bio-box to be tucked safely away under the ROV to help protect the samples during recovery to the deck.

The majority of the sites were known to harbor red tree corals based on previous work done with trawls or via by-catch data. Some areas had been mapped with multi-beam, a real help in understanding the terrain and potential for strong currents. Others were known to be heavily trawled in past. Understanding recovery and regrowth was key in making recommendations about future fishing in the region and with what gear.

As early work commenced, it quickly became apparent that currents were far greater than the scope of work had anticipated. The ROV was equipped with an intelligent clump-weight that helped considerably in high current conditions. At some sites, they proved too strong for safe operations so dives were conducted during slack tides. Although this impacted daily time in the water, it did result in very productive dives while minimizing risk of damage to the ROV and subject corals.

The H2000 ROV was equipped with six each two horsepower thrusters. These thrusters, like DOER's larger four and five horsepower units, have proportional control. This feature allows the operator to apply thrust where and when it is needed most. This helped the ROV to work in conditions that would have been nearly impossible for electric ROVs.

Numerous dives were conducted with excellent ship handling contributing to the success of the mission. Some remarkable voucher specimens were collected along with smaller pieces of specimens for DNA testing. Video images documented a

variety of fishes along with many invertebrates. Lasers provided reference measurement information. The Sea Mantis five-function manipulator proved very effective both for the discrete sampling and whole specimen collection tasks. Proportional control again played a part in this, allowing the operator to use as much or as little force as necessary for collection. Scripps geologists experienced this earlier during their "Young Volcanoes'" cruise where the Sea Mantis was able to break off pieces of in situ rock for very accurate dating purposes.

The overall results of the cruise were successful and proved that a very compact hydraulic ROV could be successfully deployed to a remote location with minimal downtimes and excellent collection capabilities. The science team would have liked to have more diving hours per day. Those objectives can be accomplished with one of DOER's larger applied science systems. These ROVs are available with motors ranging from 20-75HP and larger thrusters, 4 or 5HP each. A true, dynamically positional, tether management system (TMS) is another option with these systems. The science team was excited at the prospect of having one of DOER's larger systems available for future work but understood a different vessel would be required. Happily, the Pacific Northwest has many suitable platforms for offshore operations. The breadth and tailored nature of DOER's compact hydraulic ROVs gives clients the ability to customize systems, bringing greater overall value over the life of the ROV.

The proof of concept for a containerized, rapidly deployable compact hydraulic ROV system was a hands-down success. DOER's larger 20+HP ROV systems are also containerized. Some ROV systems of comparable capability to the 20hp unit, such as Ropos or Jason are labor and logistically intense operations. Some cruises in past have required up to ten dedicated personnel and a half dozen ISO containers. That the proof of concept cruise was accomplished with one container and three personnel was a real plus. The larger system requires two ISO containers and depending upon the vessel selected, a winch. Launch/recovery strategies are determined on a case-by-case basis.

Another of these systems will be available in 2014. Purchased by Pelagic Research Services, it will broadly benefit the science community by providing an asset that is not burdened by institutional or government constraints. Rather, it is "on demand" – ready as funding and vessels allow. Beyond science and conservation, this ROV will also be a ready response asset in the event of an environmental disaster such as the Macondo/BP blow out or an emergency response to a downed aircraft or disabled submarine.

DOER looks forward to supporting future work with the red tree corals of the Gulf of Alaska and other scientific endeavors, worldwide.

Photos:

- Lead scientist posing with red tree coral voucher specimen

- ROV with voucher specimen in sea mantis manipulator
- ROV with bio-box open showing individual sample bottles