MONTEREY BAY NATIONAL MARINE SANCTUARY
LOST FISHING GEAR PROJECT
CRUISE REPORT

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MBNMS Lost Fishing Gear Webpage

OBJECTIVES

During October 2009, NOAA's Monterey Bay National Marine Sanctuary (MBNMS) staff and partners conducted a thirteen-day research mission to survey the deepwater habitats of MBNMS and test new methods to remove lost fishing gear from the seafloor using a Phantom HD2 remotely operated vehicle (ROV). The ROV was used to locate, document and retrieve lost fishing gear off the Monterey Peninsula. The objectives of the mission were to:

- Conduct video surveys of selected areas of the MBNMS to document and increase knowledge of the degree to which lost fishing gear is impacting the deepwater habitats and living marine resources;
- Determine our ability to relocate gear that was located during previous submersible surveys;
- Develop and test methods and procedures to successfully retrieve lost fishing gear in deepwater (50 to 150 meters);
- Provide images and video for education and outreach purposes;
- Provide MBNMS staff with technical experience using ROVs for application to future projects.

The cruise was conducted aboard the F/V *Donna Kathleen* with operations focused on Portuguese Ledge State Marine Conservation Area (SMCA) at depths of up to 100 meters. Portuguese Ledge is a state marine protected area created in September 2007 to protect habitat for several deepwater rockfish species and help promote their recovery.

BACKGROUND

MBNMS is working with partners to design and implement a multi-year project to remove lost fishing gear from the MBNMS. The primary goals of the project are: 1) to reduce benthic and pelagic hazards to marine organisms posed by fishing debris lost on the bottom, and 2) provide outreach through public images and video. Lost fishing gear has been documented by the National Marine Fisheries Service (NMFS) during *Delta* Submarine dives in 2003, 2004 and 2007. This gear includes long lines, gill nets, crab and fish traps, and trawling gear, which can become lodged or entangled on the seafloor and extend into the water column.

Lost fishing gear is identified as fishing nets, lines, pots, traps, and other commercial and recreational fishing gear that sits on the seafloor, gets caught on rocky reefs, or floats in the water column. Gear can create long-term entrapment mechanisms that continuously kill mobile fauna for many years. Net materials are constructed to be strong and resilient, thus preventing escape of entangled wildlife and persisting in the environment for decades. Their pliable form combined with water movement from storms and currents make them active entrapment systems. Lost cage traps continue to catch prey on a continuing cycle as predators enter the traps to feed on dead and dying entrapped organisms. Nets and traps can physically scrape organisms off of hard reef habitat or sweep immobile invertebrates

from sandy areas. Nets and traps have been documented to entangle bottom feeding whales and other marine mammals, becoming ensnared on flukes and fins, causing stress and loss of energy that leads to exhaustion and death. Lost fishing gear can also cause hazards to fishermen. For example, lost traps may snag additional traps being set nearby.

This cruise was made possible by a number of key partners. Cordell Bank National Marine Sanctuary (CBNMS) implemented a successful fishing gear removal project in August 2008, and were able to test methods using the same ROV. This project has built upon CBNMS efforts, as well UC Davis' SeaDoc Society's efforts along the west coast (SeaDoc has worked in OCNMS, CINMS, & MBNMS). SeaDoc Society offered input and support for the cruise as well as supported the pilot through grant funds. California Department of Fish & Game (CDFG) provided input on state MLPA sites, trawl intensity data and advice on where to locate gear. National Marine Fisheries Service (NMFS) provided coordinates for fishing gear targets that had been sighted by the *Delta* Submarine during their surveys. The Nature Conservancy (TNC), Marine Applied Research and Exploration (MARe) provided inkind support through lending a hydraulic arm to attach to the ROV. Overall, this was a team effort that was made possible by support from all these groups, as well as the crew of the fishing vessel *Donna Kathleen*.

The cruise was funded through a federal settlement that focuses on mitigating impacts to benthic habitats, and grant funds from SeaDoc Society. A web page containing photos and a description of the project can be found at http://montereybay.noaa.gov/resourcepro/resmanissues/lostgear.html

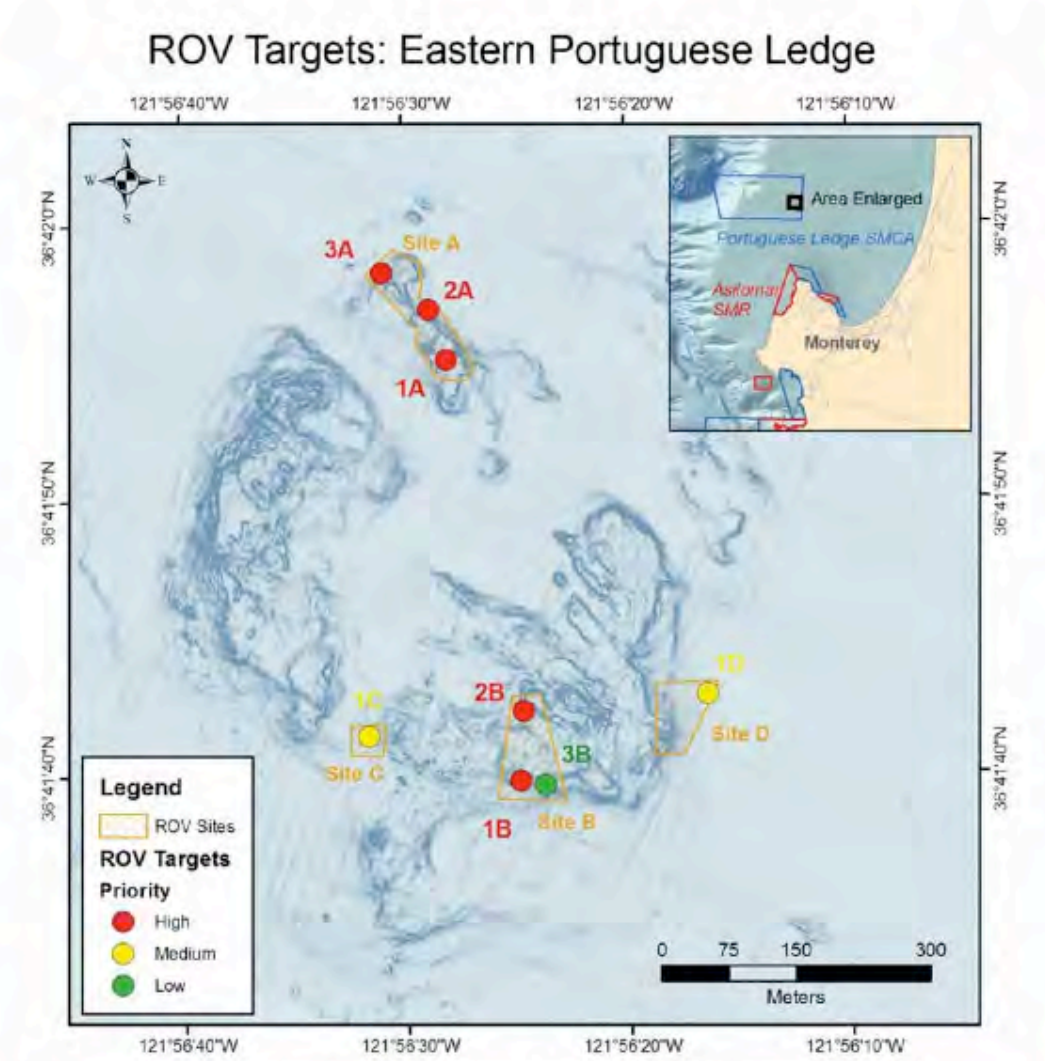
METHODS

Study Sites

ROV operations focused primarily on Portuguese Ledge SMCA with additional ROV dives conducted off Cypress Point and in Carmel Bay. Operational depths ranged from 45 to 260 meters.

Dives locations were selected based on lost fishing gear positions that had been previously documented by MBNMS and NMFS during *Delta* Submarine dives in 2003, 2004 and 2007 and by information provided by local fishermen. Targeted gear included long lines, gill nets, crab and fish traps, and trawling gear.

Figure 1: A rockfish gill net recovered from Portuguese Ledge SMCA.



ID	Cruise	Lat	Long	Depth_m	Notes
1A	2003	36.698632	-121.941162	80	Net extending between med/high relief rock.
2A	2007	36.699139	-121.941376	91.892	Net between boulders and in water column
3A	2007	36.699514	-121.941964	94.284	Gillnet between boulders
1B	2003	36.694378	-121.94028	75	Net with some growth draped over R/B
2B	2004	36.69508	-121.940238	80	Audio confirms net could be 30 ft long
3B	2004	36.694337	-121.939972	80	Heavy line- unknown- draped over R/B
1C	2003	36.694837	-121.942177	85	Unkown Fishing Gear
1D	2004	36.695247	-121.937937	90	Unidentified Round Trap (Bad Nav data?)

Figure 2: Gear targets for ROV surveys at Eastern Portuguese Ledge SMCA.

Cruise Personnel

Table 1: Affiliations and Roles

Name	Affiliation	Role
Craig Bussel	UR	Chief Pilot
Michael Carver	CBNMS	CL & Nav
Paul Chetirkin	ONMS	Topside Video
Sophie De Beukelaer	MBNMS	Nav & Data
Jean de Marignac	MBNMS	CL, Data, Deck & Nav
Lisa de Marignac	MBNMS	Deck & Data
Kristine Faloon	MBNMS	Deck & Video
Karen Grimmer	MBNMS	CL, Data & Video
Dave Lott	ONMS	Nav
Donna Maricich	F/V DK	Mate & Cook
Tim Maricich	F/V DK	Captain
Tyler Maricich	F/V DK	Mate

Role abbreviations: Cruise Leader (CL), Data Manager (Data), Navigator (Nav), Tether Handler (Deck), and Videographer/Photographer (Video).

Table 2: Cruise Schedule

Day		Date	CB	DL	JdM	KF	KG	LdM	MC	PC	SDB	Total
Day_01	Sun	10/18	x						x			2
Day_02	Mon	10/19	x	x					x		x	4
Day_03	Tue	10/20	x				x		x		x	4
Day_04	We	10/21	x		x		x		x		x	5
Day_05	Thu	10/22	x		x			x	x	x	x	6
Day_06	Fri	10/23	x		x		x	x	x		x	6
Day_07	Sat	10/24	x		x	x	x					4
Day_08	Sun	10/25										
Day_09	Mon	10/26	x		x			x			x	4
Day_10	Tue	10/27	x		x		x	x			x	5
Day_11	We	10/28	x		x	x	x				x	5
Day_12	Thu	10/29	x		x	x	x				x	5
Day_13	Fri	10/30	x		x	x	x		x		x	6

Note: F/V *Donna Kathleen's* crew not included.

Role Descriptions

- Captain: Responsible for oversight of overall operation; ensured safe working conditions; operated vessel.
- Chief pilot: Responsible for piloting the ROV and supervising ROV operations.
- Cruise leader (CL): Responsible for oversight of cruise preparation; responsible for decision-making in the field (location, methods, etc.), communications to science party and crew, and assisting the team as needed (switching out tapes, daily progress summaries, etc.).
- Data manager (Data): Responsible for managing and mapping all sources of data, recording notes on transect starting and ending coordinates, special conditions, target locations, etc.

- Deck supervisor (Mate): Responsible for supervision of deck operations; operated winch and crane.
- Navigator (Nav): Responsible for navigation including communications with the captain and deck crew; trouble shooting; managing digital and spatial data.
- Tether handler (Deck): Responsible for management of tether and clump weight and monitoring weather and sea conditions; recovery operations required an additional person to assist with tether.
- Videographer/photographer (Video): Responsible for recording cruise operations, in particular, ROV and retrieval operations for public relations.

ROV Operations

The Sanctuary Program's Phantom HD2 ROV was fitted with a grabbing arm and a cutting device, as well as a 500ft spool line and carabineer. Upon arrival at station, the vessel stopped and remained in neutral to assess local drift and determine the optimal transect start point and orientation. The exact survey start point depended on available target coordinates, wind and currents.

Figure 3: Sanctuary Phantom HD2 ROV

The ROV was launched along with a clump weight from the crane, boom and winch. The vessel set up to drift with the wind and current towards the general target area. The ROV was lifted by the crane and boom, lowered into the water, released from the winch line, and motored out 40 meters from the vessel prior to launching a 300-lb. clump weight that was attached to the winch cable and lowered into the water a few meters. At this point, the ROV tether was secured to the clump weight down line (winch line), and thereafter every 3 meters until the clump weight reached 5 to 10 meters from the bottom (more in high relief areas) to prevent contact with the seafloor. Simultaneous with the lowering of the clump weight, the ROV dove to the bottom, with the pilot and navigator monitoring its depth and altitude.

Depending on visibility, the ROV operated 0.5 to 2 meters from the seafloor at speeds ranging from .5 to 1.5 knots. The ROV proceeded along a determined transect or search pattern, but its course was altered depending on the bottom relief and presence of lost fishing gear. Observations of gear were recorded and potential targets of interest were carefully documented.

Removal criteria were modeled after the SeaDoc Society's shallow water removal prioritization. The science team decided whether or not to retrieve fishing gear based on the following criteria: Impacts to animals and habitat with a high priority given to endangered or protected species and sensitive habitats; threats to fishing operations; impacts to habitat as a result of removal; and feasibility of removal.

Two retrieval methods were tested:

1. A snipping device attached to the manipulating arm snipped the line and the grabbing device grasped the net fragment and pulled it up as the ROV was retrieved.
2. A carabiner (metal hook) was clipped onto the net or trap with the grabbing arm, and as the ROV was retrieved, the spool line paid out to the surface. The spool line was then transferred to the boat's hydraulic winch and the gear was hauled up to the surface.

Selected gear was set free from the seafloor with the ROV arms (grab and cut). The ROV was also equipped with 200 of 3/8'' spectra line loaded on a spool. The line was attached to the gear to assist in recovery. A detailed recovery plan was created on a case-by-case basis after careful visual examination of the selected target and local conditions at the time of retrieval.

At the completion of the dive, the deck supervisor, in concert with the captain and ROV pilot, directed the recovery of the ROV. The vessel set up to drift with the wind. The ROV began its ascent while the winch raised the clump weight with the tether handler, with assistance from another scientist managing the umbilical. Once recovered, the crane boomed in to place the clump weight on the deck. It boomed back out for ROV recovery. The ROV flew along the surface into recovery position and the tether handler attached a recovery carabineer to the ROV via a boat hook, while the pilot kept the ROV away from the vessel's hull. The winch was taken in, and the crane boomed in to deposit the ROV on the deck with the assistance of the tether handler. While the tether handler recovered the ROV, a scientist managed the tending and coiling of the umbilical. The deck supervisor operated the crane and boom, and provided oversight of deck operations.

Data Recording and Management

Video images were recorded on mini digital videotapes. ROV depth, date and time were overlaid on the video feed. Date and time can be used to cross-reference the video and navigational data. Position of the ROV was monitored using a Trackpoint system, a GPS and Hypack surveying package. Geo-referenced brief annotations were entered into Hypack and a detailed log was kept in a notebook.

Specimen Collection

Selected invertebrates associated with the retrieved gear were collected and/or photographed. Some selected specimens were preserved in a 90% ethanol solution. The remaining invertebrates were released as feasible. The preserved specimens were brought for identification to Dr. Robert Vansyoc with the California Academy of Sciences.

RESULTS

During October 18-30, 2009, we completed 22 ROV dives over eight days. The first three dives were conducted in relatively shallow water (40 m) off Cannery Row to test and fine-tune the ROV's buoyancy. The majority of the dives (15) were conducted over Portuguese Ledge State Marine Conservation Area (SMCA) at depths ranging from 75 to 100 meters. The remaining dives were conducted in Carmel Bay (3) and off Cypress Point (1) at depths ranging from 45 to 260 meters.

Lost fishing gear was successfully retrieved and removed from the MBNMS by ROV during five different dives in the Portuguese Ledge SMCA. The total removed gear weighed approximately 500 lbs, and included one crab pot, an anchor, two 100ft rockfish gillnets and a 40-ft rockfish gillnet fragment. CDFG personnel identified the nets as "legacy" gear from the 1980's. Monofilament was the dominant fishing gear recorded, particularly at Portuguese Ledge SMCA, but no attempt was made to recover monofilament. Over 70 monofilament targets were marked while conducting one ROV transect.

Retrieved gear was heavily encrusted but did not appear to be actively fishing. Specimens collected and/or documented included sponges, worms, corals (including *Lophelia petursa*), white plumed anemones, crustaceans, tunicates and other encrusting organisms.

Video footage, navigation files, and photographs of the invertebrates associated with the recovered gear are still being analyzed and cataloged. Video highlights have been created for outreach and educational purposes.

Figure 4: Strawberry Anemones (Corynactis californica) on Portuguese Ledge.

Figure 5: Portuguese Ledge SMCA survey area for the fishing gear project. Yellow stars are recovered nets, and the pink star represents the crab pot. Blue lines are ROV surveys.

RESULTS (continued)

The education and outreach associated with this cruise was a very important element, and complimented the research and resource protection components. The following outreach elements were accomplished:

1. A press release was issued on October 27th to announce the preliminary results of the cruise. Newspapers that covered the cruise included The Monterey County Herald - "GHOST FISHERS REMOVED: Ocean Going robot cleans seafloor" on October 29th and the Santa Cruz Sentinal's article - "Robot cleaning trash from floor of Monterey Bay." The Monterey County Weekly reported on October 22nd - "New program lets NOAA scientists use ROV to remove industrial fishing gear from sensitive habitat."
2. News coverage also included a TV interview on November 2nd with project leader Karen Grimmer and Captain Tim Maricich on CBS5 News.
3. A new web page was added to the MBNMS website focused on the effort. The link is: http://montereybay.noaa.gov/resourcepro/resmanissues/lostgear.html
4. A one-page handout was developed for a presentation to the Sanctuary Advisory Council, and for other information requests by the public.
5. Google Ocean information was submitted with the cruise results.

EVALUATIONS AND RECOMMENDATIONS

Staging and Pre-Cruise Preparations

Due to Michael Carver with CBNMS leading the staging operations, they went smoothly and effectively. This included prepping and testing the ROV and umbilical, transporting equipment from Romberg Tiburon to Moss Landing and onsite staging, as well as the eventual demobilization. Michael also covered the cruise leader role for the first 2 days. Andy Lauermann, who was leading a prior CDFG project on the same vessel, loaned the team various critical pieces of equipment and helped ensure a smooth transition between CDFG's project and the Lost Fishing Gear Project. Critical equipment that was loaned included a backup tether and clump weight; hydrophone pole and mount; heading sensors, GPS and antennae setup; Hypack surveying software, video monitor and cables for ROV video feed to the wheelhouse; and a control van.

The Monterey Harbor public hoist on Wharf II was a convenient location to load and offload heavy equipment. Note that access to the public hoist may be limited and that special training is required to operate the hoist. Only a trained operator can purchase a token to operate the hoist. Two days are recommended for mobilization depending on how much gear is already on the vessel, and one day is sufficient for demobilization.

It is highly recommended to schedule a day in a pool to test the ROV with all its attachments at least two to four weeks prior to mobilization. Although we tested the ROV at the Monterey Bay Aquarium Research Institute (MBARI) and solved some thruster issues during that test, the ROV was not equipped during the pool test as it was in the field. Three

test launches were required on the first day at sea before the buoyancy and the thrusters of the ROV were fine-tuned, including reversing two of the four thrusters.

Support Vessel

The F/V *Donna Kathleen* proved to be a great platform for the project. There was sufficient deck space for the ROV control van, storing the ROV, its tether and related gear and managing the recovered nets and handling the associated invertebrates encrusted on the nets.

The vessel was stable and able to maintain station as long as the ROV pilot and the navigator communicated efficiently with the captain. The combined uses of a boom with the crane during launch and recovery of the ROV were efficient and limited the risk of loosing control of the ROV and the clump weight. In addition, operating the ROV from mid-ship limited the risk of the tether becoming wrapped in the propeller. However, the vessel's slow speed (<10 knots) limited the range of our day trips and the number of sites visited during the cruise. It would be necessary to have longer workdays than the standard 8 hours and/or overnights to operate in the Big Sur area or North of Santa Cruz, when roundtrip transits could exceed 6 hours.

The crew of the F/V *Donna Kathleen* - Tim, Donna and Tyler Maricich - were outstanding. They were fully dedicated to the project and shared their knowledge and expertise of the sea. They were flexible and eager to assist, and it was a delight to work with them. In addition, Donna was an exceptional cook and ensured that morale was high throughout the cruise.

Adding 2-4 contingency days for future cruise schedules is recommended to allow for weather days, maintenance and down time for the boat crew.

ROV

The Phantom HD2 was an adequate tool to locate targets and remove traps and gill nets at a depth of about 100m. The Hydrolek manipulator arm was not evaluated because an electrical failure caused the flooding of the high-definition camera. It is unclear whether the dexterous manipulator arm would have enhanced our ability to retrieve lost fishing gear because its relative large size and weight might have significantly reduced the ROV's maneuverability. Some improvements are recommended to enhance the ROV's

performance:

- Add sonar: The existing sonar did not work and impaired the ROV pilot's ability to navigate by removing any point of reference beyond the field of view of the video camera. There was a close call when the ROV got briefly stuck under a ledge. Luckily, there was no damage but the situation could have been catastrophic. A working sonar would have prevented such a situation. Reference points detected with sonar can be used as navigational aids and assist in conducting search patterns. In addition, a sonar can detect potential targets in the vicinity of the ROV.
- Modify retrieving spool: The spool attached to the top of the ROV was a great asset to retrieve gear. It is recommended increasing the size of the spool to allow more line to be wrapped around to enable gear retrieval at greater depths. With the current design, there is a significant risk the line may get sucked in the vertical thruster. A protective casing or other device is needed to eliminate this risk.
- Improve carabiner control: During the cruise, the pilot had only one chance at grabbing a target per dive. Once the carabiner was tripped, it had to be brought up on deck to be reset.
- A high-definition camera with a wide-angle adaptor would provide high quality video footage and the ability to record hi-resolution still pictures. This may not be critical to locate and retrieve gear but it would be invaluable to the outreach components of this study and would considerably increase our ability to characterize the benthic communities associated with lost fishing gear.
- A cable meter to troubleshoot shorts in the tether and a re-termination kit for the tether (extra connectors, potting compound, solder, solder flux, soldering iron, wire strippers, wire cutters and other tools).
- Label the tether every 10 meters to enable comparisons of the amount of tether in the water with the amount of cable wire from the winch and to the ROV depth.
- A high-quality high resolution screen for the ROV pilot, and an additional screen in the galley for other observers.

ROV Pilot

The skills and experience of the ROV chief pilot, Craig Bussel, were essential to the success of the mission, especially with the lack of working sonar. In the near future, Sanctuary staff should be trained to pilot the ROV in order to relieve the chief pilot during transit and to follow transect lines. However, it is critical to have a skilled pilot while maneuvering around overhangs, lines and nets. The pilot's experience was invaluable in monitoring sea conditions and currents in conjunction with the working depth and habitat type to determine whether ROV operations were safe and productive.

The ROV chief pilot should be hired for 10 to 12 hour days, especially when transit times increase; and that one of the chief pilot's tasks is to provide "on the fly training" to sanctuary staff when possible.

Navigation, Data Management, Checklists and Protocols

The gear provided by CDFG was critical for tracking the ROV's movements. The Hypack surveying software was adequate for the mission. However, other navigation software such as Winfrog and YoNav should not be overlooked, as Hypack was not ideal. Once navigation software has been selected, it is imperative for Sanctuary staff to get the appropriate training.

Data collection protocols were acceptable for this cruise but should be reviewed and improved based on the revised mission objective and preliminary data analysis. Excellent record keeping is essential to continuity among data managers and cruise leaders to ensure that the data is collected properly and consistently. Change of staffing for the data recorder and cruise leader positions should be reduced to a minimum during a cruise but there should be opportunities for less experienced staff to be trained. Less experienced staff should be supervised as appropriate. It is imperative that the data manager and the cruise leader debrief and review the data collected at least at the end of each day and after each dive if possible to make sure that the data is stored properly and to address any issues while fresh in mind.

Data collection, recording protocols and checklists should be developed and followed for all aspects of the field operations including:

- A pre-dive checklist to ensure that all the appropriate steps are followed prior to launching the ROV. It is likely that the flooding of the HD camera could have been prevented if a thorough pre-dive check had been conducted. The cruise leader is responsible for designating someone to ensure that the checklist has been completed prior to each dive.
- During-dive checklist:
    - Data to be collected, including data to be recorded on the fly.
    - Data recording procedures, including naming conventions.
- Post-dive checklist including a dive review and evaluation, data download and storage, charging equipment, ensuring that the gear is stored properly before transiting to next site, etc.
- It is recommended to develop "tagging" systems to create quick data summaries and to rapidly compile cruise highlights.

Video Survey and Gear Retrieval

Depending on visibility, the ROV operated at 0.5 to 2 meters from the seafloor at speeds ranging from .5 to 1.5 knots. The ROV was able to follow predetermined routes very well in the Portuguese Ledge SMCA. Routes were designed to intercept potential targets, following specific habitat types where likelihood of encountering lost fishing gear was high (e.g. rocky outcrop, pinnacle, overhang and ledges). ROV routes over steep slopes off Cypress Point and in Carmel Bay were designed to follow specific isobaths to maximize the chance of intersecting anchor lines of spot prawn traps that were typically set down slope perpendicular to the isobaths.

Monofilaments (from recreational hook and line fishing) were the most abundant type of gear recorded throughout the cruise, but it was challenging to quantify this gear because of the:

- Inability to measure the line when lodged around or under rock outcrops, or wrapped in a ball;
- Inability to distinguish between different monofilament strings when they co-occurred;
- Shear amount and length of the monofilament was overwhelming for the time allocated to this project.

During the survey dive in the Portuguese ledge SMCA, the team arbitrarily decided to annotate presence of monofilament no more than once per 30 seconds. The ROV will not be efficient at removing monofilament, but we needed to develop a method to quantify the occurrence of this type of gear.

The science team identified gear to be removed as surveys were being conducted and attempted retrieval at that time as opposed to returning to the locations on subsequent days. Initially, removal criteria were modeled after the SeaDoc Society's shallow water removal prioritization. The science team decided whether or not to retrieve fishing gear based on the following criteria:

1. Impacts to animals and habitat with a high priority given to endangered or protected species and sensitive habitats.
2. Threats to fishing operations.
3. Impacts of removal (is there a negative impact to habitat if removed?).
4. Feasibility of removal.

There was no evidence that the gillnets removed were still catching fish. They were old nets from the rockfish gillnet fishery and were likely to have been on the seafloor for 10 to 30 years according to Tim Maricich and Paul Reilly from CDFG. There is a remote chance that they may have been an entanglement hazard to marine mammals. The retrieved crab pot was not a threat to wildlife. A small rockfish was observed in the trap prior to removal but the fish was no longer in the trap when it was brought on deck as mesh was missing from one side of the trap. The removed gear was no longer a threat to fishing operations, as it was located in an area closed to fishing

We resurveyed two sites after we retrieved lost fishing and did not notice negative impacts resulting from gear removal operations, except for the impact on the organisms that were encrusted on attached to the retrieved gear. We also decided to attempt to remove the nets and traps to determine the abilities of the team, the ROV and the F/V *Donna Kathleen*. The removal operations were a success as we were able to retrieve the targeted gear with the ROV as our primary tool – proof of concept was determined. However, the criteria for removal needs to be reviewed prior to the next cruise. Every potential target for removal needs to be assessed using a well thought out set of criteria, but final determination will probably always be done on a case-by-case basis.

We recommend extending the study sites to areas that are still currently fished because in these areas, recent lost fishing gear is an entanglement hazard for fishing gear. Recently

lost fishing gear is more likely to be ghost fishing soon after it is lost because the gear is likely to be less damaged and may even still contain bait.

During this cruise, the team received coordinates from a Monterey spot prawn fisherman. He provided coordinates for some lost traps. Unfortunately, we had difficulties converting his coordinates and were not able to fully operate at the depth of his lost fishing gear. The coordinates can easily be addressed before the next cruise and we could adapt the ROV set up to work at greater depths.

Study Sites and Target Locations

ROV dives were conducted at Portuguese Ledge SMCA, off Cypress Point, and in Carmel Bay. We initially planned to go to Pt. Sur but determined that with the uncertain marine forecast and the long transit time to consider this site for another cruise. Longer workdays and/or overnights would be required to go to Point Sur.

Targets previously recorded from the *Delta* Submersible by NMFS staff were typically located within 3 to 30 minutes, whereas other targeted gear was not found. It was remarkable how accurate the *Delta*'s positions were. In addition, all data positions were plotted and carefully checked prior the beginning of the cruise.

We opportunistically tried to locate and recover a clump that CDFG had previously lost in Carmel Bay, but without any success. There was some confusion in getting the coordinates from CDFG, and it turned out that we did not conduct our search in the right area. This could have easily be prevented if we had plotted the confirmed the coordinates prior to the cruise.

The team attempted to locate spot prawn traps that were recently lost by Monterey fishermen, but we experienced a similar challenge in getting good locations. We were unable to translate the Loran readings and plot the position the fishermen gave us. Once again this problem could have been easily be prevented if we had been able to plot and confirm the coordinates prior to the cruise. However, the area where the spot prawn traps were lost was over steep, high relief terrain deeper than Portuguese Ledge. Based on the best available information at the time, we conducted searches following isobaths as deep as 260 meters. In addition to deep water, currents and swell limited the ROV's ability to maneuver. This combination resulted in shorting the ROV tether.

The Phantom ROV set up proved to be effective at locating and retrieving lost fishing gear to a depth of up to 100 meters in relatively good sea conditions. However, the combination of deeper water, currents, swell, high relief topography, poor quality target locations, and lack of sonar resulted in some conditions that were beyond the capabilities of the setup.

As mentioned previously, it is necessary to plot and confirm the best available locations prior leaving the dock. It is recommended to plot all potential target positions and data layers in a GIS project using the WGS84 projection, prior to a cruise.

Collection

The team collected a variety of the net encrusting specimens and took images of some of the invertebrates associated with the recovered fishing gear. An interesting light pink coral was collected and identified by MBARI and the Smithsonian Institute as a deepwater forming scleractinian that are common in the NE Atlantic and off the SE US coast – *Lophelia pertusa.*

Figure 6: Deepwater coral Lophelia pertusa. found encrusted on gill net

A variety of preserved specimens were brought to Dr. Robert Vansyoc at the California Academy of Sciences in San Francisco for identification. We are also in the process of identifying observed invertebrates from images.

Due to the number of encrusting organisms found during this cruise, we will develop a detailed sampling plan for the next cruise. This project may provide a unique opportunity to characterize invertebrate communities associated with lost fishing gear.

We are looking for partners that will take the lead and provide expertise for this project. Potential partners include:

- California Academy of Sciences
- California State University Monterey Bay
- Hopkins's Marine Station
- Monterey Bay Aquarium
- Monterey Bay Aquarium Research Institute
- Moss Landing Marine Laboratories
- Steinhart Aquarium in San Francisco
- Brian Tissot's Lab at Washington State University in Vancouver

The Sanctuary's Research Activities Panel could identify additional potential partners.

Safety and Communication

Overall communication among team members was very good and operations were safe. The safety of the vessel crew and science party was of the utmost importance. The captain and cruise leader conducted daily safety briefings. Operational procedures were reviewed prior to launches and recovery as conditions and crew composition varied. The captain, cruise leader, ROV pilot and deck manager were to interrupt ROV operations whenever they determined that operational conditions were unsafe for the personnel or the equipment. All crewmembers were encouraged to express any safety concerns and to only perform tasks for which they were qualified and comfortable with.

It was critical to keep good communication among the ROV van, the wheelhouse and the deck. The ROV video feed to the wheelhouse allowed the captain to see when the ROV was altering its course and changing its speed. This improved the captain's ability to maneuver the vessel close to the ROV.

Radio communication among the team members were adequate, yet an effort should be made to increase communications between the ROV pilot and the captain. The cruise leader needs to ensure that all team members are properly informed and understand the objective of each dive.

Operations tended to be smoother when crew switches were minimized. However, one of the goals of this cruise was to provide training opportunities to Sanctuary staff.

Figure 7: White sponge species on left and squat lobster on right

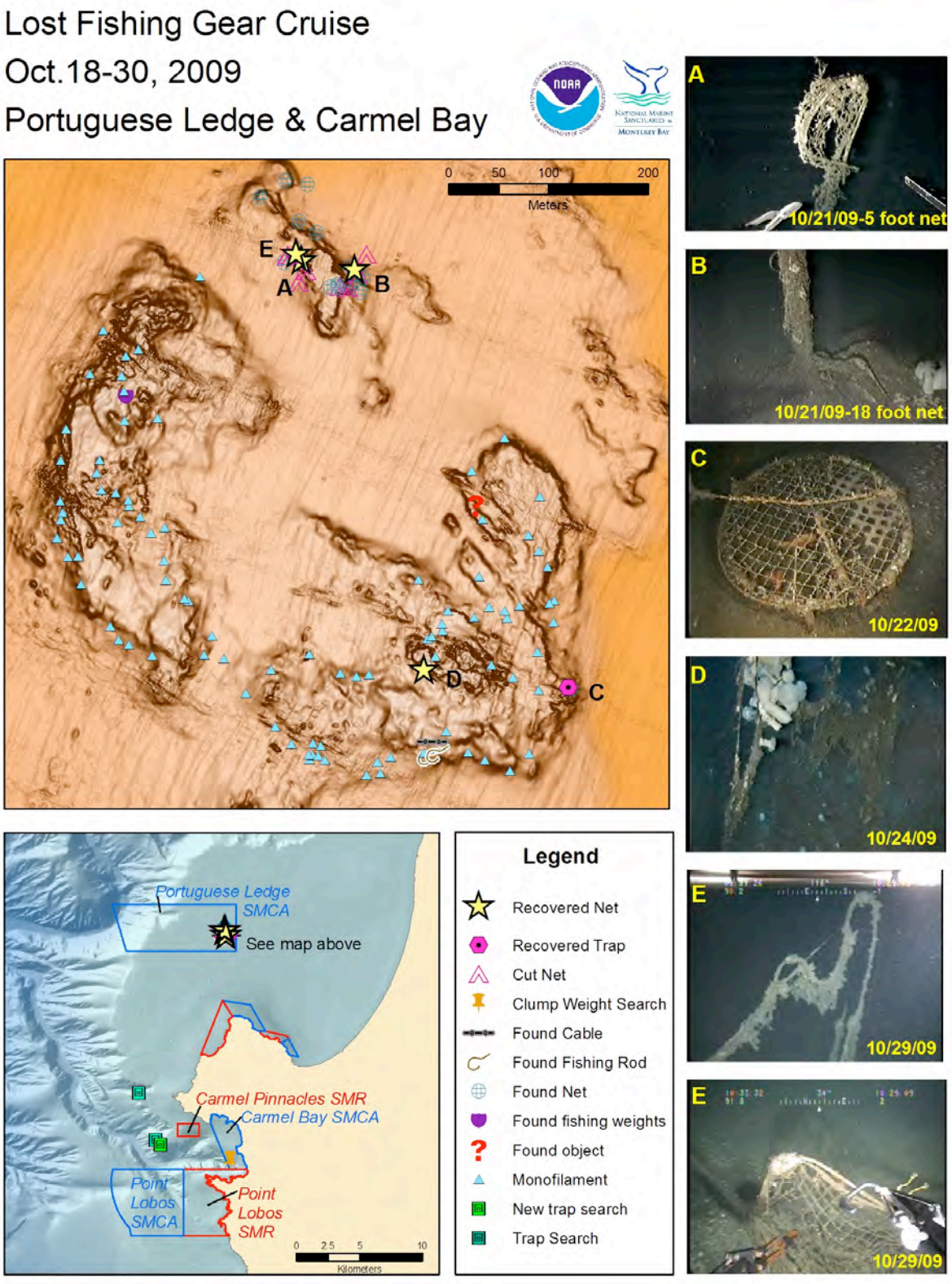


Figure 8: Summary of retrieved lost fishing gear locations and images