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FINAL REPORT

OLYMPIC COAST NATIONAL MARINE SANCTUARY DERELICT FISHING GEAR REMOVAL PROJECT

PREPARED FOR:

THE OLYMPIC COAST NATIONAL MARINE SANCTUARY

PREPARED BY:

NATURAL RESOURCES CONSULTANTS, INC.

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Introduction

The area encompassing Olympic Coast National Marine Sanctuary (Olympic Coast NMS) has traditionally supported a number of fisheries utilizing most major gear types. As a compatible use in the context of marine sanctuary designation and regulations, ongoing fisheries within the sanctuary continue. These include treaty Native and non-native commercial fisheries and sport fisheries. This area is composed of natural conditions and bottom features (natural and cultural) that are subject to gear entanglement and loss. Given the enormous fishing effort the area has seen historically, very little effort has been made toward surveying and removing derelict gear or assessing its impacts on marine resources. Olympic Coast NMS staff has observed derelict gear in the course of remotely-operated vehicle surveys of the sanctuary. In addition, there is substantial anecdotal information about widespread derelict gear, some of which has been reported as an imminent threat to marine mammals. No systematic surveys have occurred.

Given the fact that little or no effort has been directed at derelict gear problems in Olympic Coast NMS, a project was developed to address the needs of the Sanctuary and the Makah Tribe by answering the following questions:

1. **How can we locate derelict gear?** Establish survey methodologies appropriate to the setting and conditions.
2. **How serious is the threat?** Assess the extent of the threat within a discrete area of the sanctuary.
3. **Where, when and how is removal feasible?** Establish operational parameters for derelict gear removal given the range of conditions and environments in the sanctuary.
4. **What proven methods work?** Replicate program elements from the successful Northwest Straits derelict gear removal program.
5. **Who can safely do this?** Train a cadre of divers who can safely and effectively operate within established protocols and parameters.
6. **How can fishing gear loss be reduced?** Promote best fishing practices developed by the Washington Department of Fish and Wildlife (WDFW) and the Northwest Straits Commission through a public outreach and information program.

The Olympic Coast NMS received a grant award to fund the proposed project from NOAA's Marine Debris program in 2005.

Scope of Work

The scope of work for the project included six major tasks listed below.

1. Survey potential target areas for nets and crab pots, based on potential target areas identified by tribal and sanctuary staff, NOAA Fisheries, and local residents. Surveys would be conducted to identify concentrations of crab pots using side scan sonar and magnetometers, and identify net accumulation areas by overlaying WDFW fishing effort data on bathymetry charts to identify potential concentration sites.
2. Identify priorities areas for gear removal from survey information. Prepare a removal plan to be submitted to Washington Department of Fish and Wildlife to obtain permit exemption.
3. Adapt operating parameters from existing Puget Sound and Northwest Straits programs.
4. Train Makah Tribal commercial certified divers in protocols for safe removal procedures. This would be coordinated with partners and NOAA dive program at Sand Point in Seattle. There will also be opportunities for tribal divers to observe and train on actual operations. The key is safety.
5. Makah Tribal trained divers remove derelict gear.
6. Document all elements of the program. Develop and implement education, outreach and media plans to support the project and inform the public.

Participants

The Olympic Coast NMS was the project sponsor. The Olympic Coast NMS cooperated with the Makah Tribe (Mr. Jim Woods) on the implementation of all aspects of the derelict gear project. Natural Resources Consultants, Inc. (NRC), was contracted by the Olympic Coast NMS to manage the field aspects of the project and conduct project reporting. Fenn Enterprises was contracted by NRC to undertake side scan sonar surveys, dive surveys, and underwater camera photography. NRC contracted Doug Monk and the commercial vessel *Bet-Sea* for derelict gear removal work. The Olympic Coast NMS contracted for public relations/public education services. Dr. Tom Good, NOAA Northwest Fishery Science Center, and Dr. Michael Etnier identified all seabird specimens collected during the project. Mr. Pat Gearin, NOAA National Marine Mammal Laboratory,

identified all marine mammals collected during the project. Mr. Dennis Lucia, a Master Diver, developed the Tribal diver derelict fishing gear removal training curriculum. The Cousteau Ocean Futures Society documented the survey and removal of derelict fishing gear during the project as part of a national television program on the U.S. National Marine Sanctuaries.

Methodology

Sidescan Sonar Survey

Fenn Enterprises performed the sidescan sonar survey during the project. A Marine Sonic sidescan sonar system operating at 600 kHz with a differential global positioning system (DGPS) was used during the survey to locate derelict fishing gear. The sonar system employed a heavy towfish towed off the bow of a 24-foot survey vessel. A hydraulic wench and cable controlled the depth of the towfish. The survey image was projected on a monitor onboard the vessel and recorded onto a computer hard drive for later processing.

Generally, the sidescan sonar survey was conducted at 4.63 km/hr (2.5 knots) with a path width of 50 m on either side of the boat for an approximate area swept of 90 m (295 ft). The survey path width was occasionally decreased to 10 to 20 m on either side of the boat in shallow water (less than 5 m deep) or when a more detailed image of an object was desired. Survey depths generally ranged from about 3 m (10 ft) to 32 m (105 ft) in order to identify derelict fishing gear within the dive depth capabilities of the recovery team.

The intent of the sidescan sonar survey was to cover areas with suspected derelict fishing gear as reported by Olympic Coast NMS staff, Makah Tribal fishers and other state and federal scientists working in the area. Derelict crab pots, woody debris and sunken vessels were readily identified on the sidescan sonar images. Counts and precise locations of derelict fishing gear were recorded during post-survey processing of the data that allowed greater time to examine the images. The products from the sidescan sonar survey included a trackline file of the area surveyed, calculation of the amount of the fishing grounds covered and the positions (latitude and longitude) of likely derelict fishing gear targets found.

Dive Surveys

Fenn Enterprises performed the dive surveys for derelict gillnets during the project. Two person dive teams were deployed to swim pre-determined transects using SCUBA to find derelict nets. Survey depths ranged from less than 3 m (10 ft) to approximately 30 m (90 ft). Divers stayed within sight of one

another during the surveys. When derelict fishing gear was encountered both divers would surface at the gear location and the dive boat would record the latitude and longitude from an onboard GPS system.

Underwater Camera Surveys

Fenn Enterprises conducted underwater camera surveys for reported deepwater derelict fishing gear accumulation sites. An underwater video camera, lighting system and clump weight was deployed over the side of the survey vessel and the vessel was either motored slowing (less than 1 knot) along a pre-determined transect line or allowed to drift. The downward looking camera was maintained approximately 1 m (3 ft) off bottom. The time and position of the vessel was continuously recorded on the video at the surface. The depth and position of any derelict fishing gear encountered was recorded when encountered.

Gear Recovery

Doug Monk was contracted to conduct the dive recovery operations. Two divers equipped with surface supplied air operated off a 40-foot dive support and gear recovery vessel, the F/V *Bet-Sea*. Locations of known derelict fishing gear identified during the surveys and previously reported to the WDFW derelict gear reporting system were targeted for removal. The derelict gillnets identified were located near important salmon, steelhead and bull trout migration corridors used by species designated as threatened under the Endangered Species Act and, thus, were of high removal priority. Additionally, two of the derelict gillnets removed were observed to be causing both marine mammal and sea bird mortalities, both protected species groups. The derelict crab pots removed were identified during the sidescan sonar survey.

The dive support and gear recovery vessel employed a wide area augmented global positioning system (WAAS GPS) to locate the reported position of the derelict gear. Once a derelict gillnet was located, a variety of information was collected prior to and after removal. Divers were equipped with a two-way verbal communication system in order to communicate with a biologist on the dive vessel. The diver first walked the perimeter of the gillnet and estimated the total length and width of the net covering the seabed and the number and height of any suspensions of the net off the seabed. The diver reported the minimum and maximum water depth along the net and provided a general characterization of the habitat in the vicinity of the gear such as high relief rocky substrate, rock pinnacle, gravel/sand with boulders, reef edge, wreck, etc. The diver also identified and counted animals entangled in the net and indicated whether they were alive or dead. Additionally, other evidence of gear induced mortality such as bones on the seabed in the vicinity of the net and impacts of the derelict net

on the habitat were also reported. Only animals actually entangled in the nets were counted as direct impacts in this report. The biologist on the dive vessel estimated the location of the net relative to the vessel and derived the approximate latitude and longitude of the net location.

Once the required information was reported, the diver attempted to locate one end of the net or, if necessary, cut the net to make an end. The net was then removed from the seabed by hand and bundled or rolled into a tube. The diver then attached a strap and an airlift bag and partially filled the airlift bag with air to place an upward tension on the freed end of the net. This procedure was repeated down the length of the net until a manageable length of net was freed from the seabed. The diver then connected a "bag line" from the vessel's boom winch to the last airlift bag and instructed the vessel to place tension on the freed portion of the net. The diver then cut the freed portion of the net away from the remaining net on the seabed and the vessel hauled the freed end to the surface and aboard the vessel. The bag line and airlift bags were then sent back down to the diver via the air hose and the procedure was repeated until all of the nets and lead lines in an area were removed. In some cases, multiple nets were entangled on top of one another at the same location and the diver repeated the data reporting and removal operation as additional nets were revealed.

At the surface, a biologist and the deck hands laid the gillnet on the deck and inspected it from one end to the other. The biologist recorded the general condition of the net and made a subjective determination of whether the net was newer or older based on the construction material, strength of the webbing and the amount of growth on the net. Newer nets were assumed to have been lost within the past two to three years, while older nets were assumed to have been lost for more than three years.

All organisms alive or dead entangled in the net were identified and counted and either immediately returned to the sea after identification or collected as scientific specimens (dead animals only) at the request of either state or federal agencies under scientific collection permits. In most cases, entangled or entrapped animals were readily identified to species but for some specimens, such as bird bones or fish flesh, they were simply recorded as unidentified to the lowest possible taxonomic group such as "seabird unidentified." For some species such as barnacles and bivalves, it was difficult to determine if the shells entangled in the net indicated mortality caused by the net or whether the shells had become caught in the net after the animals died. In many cases, the shells were too numerous to count by the diver and were lost in the retrieval process. However, their occurrence was noted on the data forms.

As much biological material as possible was removed from the nets and returned to the sea. The nets were then placed in heavy plastic bags and stored in the cargo hold of the vessel until offloaded. The weight of the disposed gear was measured at the landfill scale.

A similar approach was used for derelict crab pot recovery. The list of the precise locations of derelict crab pots detected during the sonar survey was used by the biologist and dive team to locate the derelict pots using a WASSGPS and electronic chart software (Nobeltec®). Derelict gear target locations derived from the sidescan sonar survey were transferred into the Nobeltec charting software as waypoints and plotted over a navigation chart of the area.

Highest priority was given to locations with multiple derelict gear targets to maximize the number of derelict gear units recovered during each dive operation. Using the WASSGPS system, the dive support vessel was directed to the exact location of the potential derelict gear target identified by the sidescan sonar survey. As the vessel arrived at the target location a clump weight with a line and float were deployed as near as possible to the derelict gear location. The dive support vessel was then anchored in the vicinity of the clump weight or drifted nearby and a single diver was deployed. The other diver stood by on deck as a safety backup diver. A 30 m (100 ft) length of rope was passed through a loop on the rope near the clump weight and the other end was held by the diver. When poor water visibility conditions were encountered, the diver would drag the 30 m rope around the clump weight in a circle until it tangled with the derelict fishing gear and then the diver worked back along the rope to the gear.

Prior to recovery of the derelict fishing pot a variety of information was reported to the biologist on board the support vessel by the diver. Information collected included whether the derelict pot was commercial or sport, whether it was fishing or disabled, whether it was equipped with rot cord (pots), whether the gear was actively fishing or not, the number of live and dead Dungeness crab, other crab and fish entrapped. Also reported was information about the overall condition of the gear and the depth and type of seabed where the gear was located. Gear to be recovered was freed by hand by the diver, a recovery line from the vessel was attached and it was hauled aboard the recovery vessel with the aid of a hydraulic winch. Pots buried more than 1/3 of their height in the seabed were disabled and left in place. The onboard biologist further inspected the gear at the surface and looked for owner identification information.

The derelict fishing gear was stored in the fish hold of the recovery vessel until offloaded at a secure location and either returned to the owner or disposed of in the Port Angeles solid waste disposal unit.

Survey and Derelict Gear Removal Results

A total of 29 days of field operations were conducted between October 2005 and December 2007, including seven days of side scan sonar surveys, eight days of divers surveys, one day of underwater camera survey work, five days of derelict gear removal work and eight days of mobilization, demobilization, vessel transit and gear offload operations.

Sidescan Sonar Surveys

Sidescan sonar surveys were conducted over seven days during the project covering approximately 5.83 km². Sidescan surveys were conducted off Sail Rock, in Neah Bay, and off Makah Bay (Figure 1). Although primarily designed to locate derelict crab pots and nets, numerous marine debris, wood debris and several sunken vessels were also encountered. Two derelict crab pots were detected in Neah Bay. No other derelict fishing gear was detected with the sidescan sonar during the surveys.

Diver Surveys

Diver surveys were conducted over eight days during the project period and covered 11.24 km² of seabed. Diver surveys were conducted off Sail Rock, Neah Bay, Waadah Island, Cape Flattery, Makah Bay and the Arches (Figure 1). Two derelict gillnets, one derelict purse seine net and numerous gillnet anchors were identified during the diver surveys. Derelict nets were found in Neah Bay and off Waadah Island. A local Makah Tribal fisher reported a derelict gillnet in Makah Bay one week before a diver survey of the area was conducted. The gillnet was not found during the dive survey although a set gillnet anchor was recovered. A period of heavy surf conditions in the area in the week prior to the dive survey may have washed the derelict net onto the beach, covered it with sediment or washed it out into deep water. The status of the net is unknown.

Underwater Camera Survey

One day of underwater camera survey work was conducted at a reported derelict fishing gear accumulation site off Midway Bank. The survey included two survey transects that covered 1.44 km². No derelict fishing gear was encountered.

Derelict Crab Pot Removal

Two derelict crab pots were found during the October 10, 2005, sidescan sonar survey in Neah Bay. Both derelict crab pots were removed on October 19, 2005.

Both crab pots were commercial crab pots. One was actively fishing and was not equipped with legal escape cord and the other was not actively fishing and had been equipped with legal escape cord that had disintegrated. The crab pot that was actively fishing contained three dead male Dungeness crab, *Cancer magister*. The inactive pot contained one live red rock crab, *Cancer productus*, that was released.

Ownership could not be determined for the two derelict crab pots removed and the pots were turned in to the Makah marine enforcement officers.

Derelict Gillnet Removal

Divers conducted five days of removal operations, four days of vessel transit and one day of derelict gear offload and disposal for a total of ten days of derelict gear removal operations during the project. Removal operations were conducted on October 18, 19 and 20, 2005, and on September 27 and 28, 2006. Derelict net removal operations occurred within Neah Bay and off Waadah Island (Figure 1). Operations were staged out of Neah Bay, Washington.

A total of three derelict gillnets and one derelict purse seine net with a total surface area of 3,133.2 m². (0.78 acres) were removed during the project. Of the four nets removed, two (50%) were characterized as newer nets and two (50%) were considered older nets. Three (75%) of the four nets removed were considered in reasonable good condition and one (25%) was considered in poor condition. Two (50%) of the nets were considered to offer some level of lethality to animals and two (50%) of the nets were not considered potentially lethal.

There was some degree of suspension in the water column on three (75%) of the four nets ranging from 0.9 m (3 ft) to 6 m (20 ft). The derelict nets were removed from water depths ranging from 5.5 m (18 ft) to 13.7 m (45 ft). Two of the nets removed were in mud habitat and partially buried, one net was in rocky reef and kelp habitat and one recently lost net was removed from kelp habitat. Two of the nets removed (one gillnet and the purse seine net) were found during the sidescan or diver surveys and one gillnet was reported by a private kayaker. These three derelict nets were removed within eight to ten days of being found, although one of the gillnets and the purse seine net had probably been lost months or possibly years before removal. One derelict gillnet removed off Waadah Island had been reported by a diver on October 10, 2001, 1,479 days prior to removal.

Two (50%) of the four derelict nets removed contained at least one live or dead entangled animal. The derelict gillnet reported in October 2001 was mainly headline with some scraps of gillnet material and contained no entangled animals

when the net was removed. The derelict purse seine net was associated with a derelict vessel and also did not contain any entangled animals when removed. However, there were numerous Dungeness crab shells in the vicinity that may have died from entanglement in the purse seine net. A total of 52 animals were entangled in the remaining two derelict gillnets removed during the project including 17 live and 35 dead animals (Table 1). Eight dead marine mammals were recovered, including one dead adult California sea lion, *Zalophus californianus*, one dead harbor porpoise, *Phocoena phocoena*, and six dead harbor seals, *Phoca vitulina*. Eight dead seabirds were removed from the two derelict gillnets including three dead unidentified cormorants, *Phalacrocoracidae* spp., and five dead common loons, *Gavia immer*. Eight dead and one live cabezon, *Scorpaenichthys marmoratus*, were found entangled in the two gillnets. Additionally, numerous dead and floating black rockfish, *Sebastes melanops*, were observed in the vicinity of the derelict gillnet recovered from the kelp west of Waadah Island and were likely killed by entanglement in the gillnet. A total of 27 invertebrates were found entangled in the two derelict nets removed including 16 live and 11 dead crab (Table 1). One live and eight dead red rock crab, *Cancer productus*, and fifteen live and three dead kelp crab, *Pugettia producta*, were identified in the two derelict nets removed during the project. All live animals were released. Eleven animal specimens were collected during the project under federal and state scientific collection permits. The specimens collected included three specimens of harbor seals, one harbor porpoise, five common loons, one cormorant and bones from several cabezon. All of the specimens were delivered to Dr. Tom Good with the NOAA Northwest Science Center for verification of identifications and archiving.

Ownership could not be determined for three of the four derelict nets removed during the project. The derelict gillnet removed from west of Waadah Island had a Makah Tribal identification number on a buoy on one end of the gillnet. The buoy was provided to the Makah Tribal enforcement officers. All of the recovered derelict nets were bagged and disposed of in the Port Angeles solid waste disposal facility. The total weight of the derelict gillnets removed was estimated at 650 kg (1,430 lbs).

Scope of Work Accomplishments

The scope of work for the project included six major tasks listed below and the accomplishments during the project.

- 1. Survey potential target areas for nets and crab pots, based on potential targets areas identified by tribal and sanctuary staff, NOAA Fisheries, and local residents. Surveys would be conducted to identify concentrations of crab pots using side**

scan sonar and magnetometers, and derelict net accumulation sites by overlaying WDFW fishing effort data on bathymetry charts to identify potential concentration sites.

The WDFW and the Makah Tribe were contacted and areas where commercial and recreational fishing were identified. Local fishers were interviewed about fishing practices, fishing locations and probable derelict fishing gear locations. A total of 18.5 km² was surveyed for derelict fishing gear during the project including 11.24 km² by diver survey, 5.83 km² by sidescan sonar survey and 1.44 km² by underwater camera survey. In most instances, no derelict fishing gear was found at suspected high concentration areas. In three cases, areas were surveyed where Tribal fishers reported specifically losing a set gillnet within the past three years and yet nothing was located. Two derelict gillnets, a derelict purse seine net and two derelict crab pots were found during the survey work. A reported fishing gear accumulation site on Midway Bank was not located during an underwater camera survey in deepwater. Derelict crab pots were not detected in offshore waters where crabbers reported losing crab pots although several crab lines were observed with sidescan sonar indicating crab pots may be buried in the seabed at these locations. Two derelict gillnets were located from public reports.

2. Identify priority areas for gear removal from survey information. Prepare a removal plan to be submitted to Washington Department of Fish and Wildlife to obtain permit exemption.

A derelict fishing gear removal plan was prepared for the project, submitted to the WDFW and a permit exemption letter for the project was received. A permission letter to conduct survey and derelict gear removal operations within the Olympic Coast NMS was also obtained from NOAA. Derelict gillnets were given the highest priority for removal operations and all known derelict gillnets within the Olympic Coast NMS were removed during the project.

3. Adapt operating parameters from existing Puget Sound and Northwest Straits programs.

Adaptations to the WDFW derelict fishing gear survey and removal guidelines for operations in the Olympic Coast NMS and other areas on the Washington Coast and the outer Straits of Juan de Fuca were developed and are included in the conclusion and recommendation sections of this report.

4. Train Makah tribal commercial certified divers in protocols for safe removal procedures. This would be coordinated with partners and NOAA dive program at Sand Point in Seattle. There will also be opportunities for tribal divers to observe and train on actual operations. The key is safety.

A training curriculum for Tribal diver training in derelict fishing gear removal was developed by Master Diver Dennis Lucia, an experienced dive instructor. The training curriculum follows the guidelines published by the WDFW for derelict fishing gear removal. The curriculum has been successfully implemented by the Northwest Straits Initiative for Tribal diver training in Puget Sound. An invitation for Makah Tribal divers to participate in the diver training program was presented to the Makah Tribe. Only two divers expressed interest in the dive training program. Master Diver Lucia and the experienced divers associated with the Northwest Straits Initiative derelict gear program reviewed the experience level of the Makah Tribal diver candidates and determined they lacked sufficient current commercial dive experience to be considered for the derelict gear removal diver training. The lack of experienced trainee candidates combined with the apparent lack of abundant derelict fishing gear resulted in a cancellation of the proposed Makah Tribal diver training program.

5. Makah Tribal trained divers remove derelict gear.

No Makah Tribal divers were trained during the project and, thus, no Makah Tribal divers removed derelict fishing gear during the project.

6. Document all elements of the program. Develop and implement education, outreach and media plans to support the project and inform the public.

The Olympic Coast NMS and the Makah Tribe cooperated in the public outreach and media coverage of the project. The Makah Tribe high school outreach program provided students for public outreach and learning about onboard data collection methods. The Makah Tribe posted a chart of the area and requested Tribal and non-tribal fishers locate areas where derelict fishing gear was likely to be located to assist in the derelict fishing gear survey work. Video and still photographic documentation of the project activities were collected by project participants. The Cousteau Ocean Futures Society filmed a documentary of the derelict gear survey and removal project that aired on the Public Broadcast System as part of the national review of marine sanctuaries in the U.S. Photos, underwater video, GIS shape files of areas surveyed, and sidescan sonar images are all available to the Olympic Coast NMS as documentation of the accomplishments of the derelict fishing gear survey and removal project. The Makah Tribe developed a permanent poster for installation at the Neah Bay marina requesting that commercial and recreational fishers properly dispose of unwanted fishing gear in nearby solid waste containers instead of discarding it at sea.

Conclusions

Derelict fishing gear was not abundant during the project in the areas surveyed with the Olympic Coast NMS. The high energy of the Washington coastal environment probably washes most derelict fishing gear onto beaches or buries it in drifting sediment. However, two of the four derelict nets encountered were still capable of entanglement and were causing mortality of marine organisms. Due to the high abundance and diversity of marine animals found in the Olympic Coast NMS, even derelict nets that are capable of actively fishing for even a short time period can do devastating harm, as evidenced by the number of marine mammals, seabirds, fish and invertebrates entangled in the two recently lost derelict gillnets removed. Two of the derelict nets removed also likely presented a hazard to divers and possibly vessel anchoring and navigation.

The data collection effort on board the vessel only recorded what was actually observed entangled in the nets by the divers or what was removed from the nets onboard the vessel. This methodology likely underestimated the overall

entanglement and mortality rate associated with this gear. Several sunflower starfish (*Pycnopodia helianthoides*) were observed in the vicinity of the derelict gillnets and crab pots and some of the seabirds, fish and invertebrates entangled in the nets had been partially eaten by starfish and other animals. Animals that become entangled in the derelict nets and die are believed to either decompose rather rapidly or are eaten by other animals within days. Based on the condition of the gillnet and the amount of biological growth observed, the derelict net removed from Neah Bay had probably been derelict for nearly a year and total number of animals killed by this is likely much higher than reported in this report. The second lethal derelict gillnet removed from west of Waadah Island was probably a net lost during the recent salmon fishing season and had been derelict no longer than a one or two weeks. However, it was still effective at catching marine mammals, seabirds, fish and invertebrates. The derelict gillnets also prevented access by fish and invertebrates to important habitat features. The Waadah Island derelict net was entangled in a shallow water kelp bed and had dislodged a number of kelp plants due to tidal current action.

The Olympic Coast NMS derelict fishing gear project was designed to answer six key questions concerning derelict fishing gear in the Sanctuary. Based on the results of the project the following are answers to those questions.

1. **How can we locate derelict gear?** Establish survey methodologies appropriate to the setting and conditions.

Sidescan sonar was successful in locating derelict crab pots but was less successful at locating derelict gillnets due to the nearshore rocky reef and kelp habitat where the set gillnets are fished. Diver surveys were successful in locating derelict gillnets but were time consuming, expensive and survey areas were limited by weather and ocean conditions. Underwater camera surveys can be useful in identifying known targets at specific locations but are not ideal for random surveys because of the narrow field of view and the difficulty in maintaining the camera within sight of the seabed in high current areas. Deepwater sidescan sonar surveys for derelict crab pots in open ocean conditions where ocean swells are prevalent should employ both a vertical motion dampening clump weight arrangement on the towfish umbilical and an acoustic tracking device to correct for side-drift and layback of the towfish relative the differentially corrected GPS.

The Olympic Coast NMS and the Makah Tribe could cooperate on identifying specific areas where higher concentration of fishing gear are deployed. Knowing the location of these areas could reduce the amount of survey time required to locate derelict fishing gear. Fishers should be

encouraged to participate in the WDFW derelict fishing gear reporting program.

2. **How serious is the threat?** Assess the extent of the threat within a discrete area of the sanctuary.

Based on the results of the surveys conducted, derelict fishing gear does not appear to offer a significant long-term threat to the Olympic Coast NMS. The high energy environment along the Washington Coast and the outer Straits of Juan de Fuca probably significantly reduces the residency time of derelict fishing gear in the Sanctuary compared with lower energy environments like inner Puget Sound where derelict fishing gear may persist for years. Crab pot loss offshore may be significant based on conversations with local fishers. It is likely derelict crab pots are eventually washed ashore or covered by seabed sediment. Crab pot lines were observed offshore during the sidescan sonar survey and may be an impediment to salmon trolling operations. However, it is unlikely that the derelict crab pots are actively fishing for any significant period of time. They are more likely sanded in and become inoperable after one or more winter storms that are prevalent during the winter crabbing season.

Recently lost gillnets offer the greatest threat to humans, vessel navigation and marine animals in the sanctuary. It is important that the Olympic Coast NMS and the Makah Tribe participate in the Washington State no-fault derelict fishing gear reporting system and coordinate with existing derelict fishing gear removal programs for immediate removal of derelict nets. A crab pot escape cord education program for commercial and recreational fishers may increase the compliance with State of Washington regulations and reduce the effective fishing time for crab pots that become derelict.

3. **Where, when and how is removal feasible?** Establish operational parameters for derelict gear removal given the range of conditions and environments in the sanctuary.

Ocean conditions in the Olympic Coast NMS can be extremely difficult for derelict fishing gear survey and removal work. Safety should be the primary factor in planning any survey or removal operations. Removal operations using divers can be particularly difficult due to often prevailing swell conditions. The WDFW derelict fishing gear removal guidelines specify that derelict net removal operations should be conducted by surface air supplied divers. Based on experience gained during this project, it may be more appropriate in some instances for derelict net

removal operations to be conducted by divers using SCUBA to prevent the jerking of the hose as the dive vessel rides over swells. Divers using SCUBA should dive in two-person dive teams with one diver designated as a work diver and the other as a standby safety diver watching the work diver at all times. Divers should have communication with each other and the surface. A third standby safety diver should be ready on the deck of the dive boat equipped with surface supplied air as a rescue diver.

In general derelict fishing gear removal operations should not be attempted in exposed waters of the Olympic Coast NMS when ocean conditions meet or exceed Beaufort sea condition scale 5 or higher (20 knots of wind, 1.0 m wave height). Special safety consideration should be given to derelict fishing gear removal operations on the inshore areas of the Olympic Coast NMS south of Cape Flattery. Only extremely experienced professional divers with extensive open water and surf diving experience should be considered for removal operations in these areas. High currents, wave surge, entangling kelp and dangerous rocky reef faces present significant challenges to derelict fishing gear removal in these areas.

4. **What proven methods work?** Replicate program elements from the successful Northwest Straits derelict gear removal program

Although the Northwest Straits Initiative's derelict fishing gear program is a proven, successful program model for the inner marine waters of Puget Sound and the Strait of Juan de Fuca, the recently developed California coastal derelict fishing gear program operated by the SeaDoc Society and the University of California at Davis may offer some additional guidance in derelict fishing gear survey and removal operations in open ocean conditions.

5. **Who can safely do this?** Train a cadre of divers who can safely and effectively operate within established protocols and parameters.

Only the most experienced surveyors and divers should attempt derelict fishing gear survey and removal operations in the Olympic Coast NMS. Vessel operators should be familiar with weather and sea conditions in the area and have extensive experience in both offshore open ocean conditions as well as nearshore surf conditions. Only extremely experienced professional divers with extensive open water and surf diving experience should be considered for removal operations in these areas.

6. **How can fishing gear loss be reduced?** Promote best fishing practices developed by the Washington Department of Fish and Wildlife (WDFW) and the Northwest Straits Commission through a public outreach and information program.

Commercial and recreational fishers operating in the Olympic Coast NMS should be familiar with the WDFW “best fishing practices” guidelines for the reduction in loss of fishing gear. Information on fishing methods that prevent loss of fishing gear should be readily available to the public at key commercial and recreational use areas to the sanctuary. During the project conversations with commercial crabbers indicated there is a conflict in the area used for commercial crabbing and transit zones for cargo and tug and barge traffic. The Olympic Coast NMS should work cooperatively with the U.S. Coast Guard, Tribal and commercial crabbers and the marine transportation industry to resolve this conflict and reduce crab pot loss. The commercial crabbers should be made aware of the location of the transit lanes. The operators of marine transportation in the area should be made aware of the problem of transiting outside the established transit lanes. Pilots should be provided information on where commercial crabbing is occurring and advise marine transport vessels to avoid these areas. The Coast Guard should monitor the location of marine transportation vessels and advise them if they are leaving a transit zone and entering a commercial crabbing area. The Makah Tribe developed a permanent poster for installation at the Neah Bay marina requesting that commercial and recreational fishers properly dispose of unwanted fishing gear in nearby solid waste containers instead of discarding it at sea.

Recommendations

Based on the observations and results of the derelict gear removal project, the following are recommendations to further reduce the impacts of derelict fishing gear on the marine environment.

- **Local salmon trollers complained of derelict crab pot lines entangling their trolling gear offshore. Local crabbers also reported significant crab pot loss offshore in the Olympic Coast NMS due to cargo vessels and tug and barge operators violating the transit lanes. Sidescan sonar surveys could be conducted in these areas to assess the degree of the derelict crab pot problem. A public information campaign could be conducted with the cargo and tug operators to educate them about the importance of avoiding actively**

fishing crab pots.

- **One of the two derelict crab pots recovered from Neah Bay was not equipped with legal escape cord was continuing to actively fish. The use of legal escape cord on crab pots should be enforced and possibly an escape cord education program similar to that being conducted in Snohomish County should be conducted in Neah Bay directed at both commercial and recreational fishers.**
- **Recently lost derelict gillnets offer the greatest threat to marine animals, vessel navigation and human safety. The Makah Tribal gillnet fishers should be provided information on how to immediately report lost gillnets. The Olympic Coast NMS and the Makah Tribe should coordinate with other derelict fishing gear removal projects, such as the Northwest Straits Initiative, for emergency derelict net removal operations.**

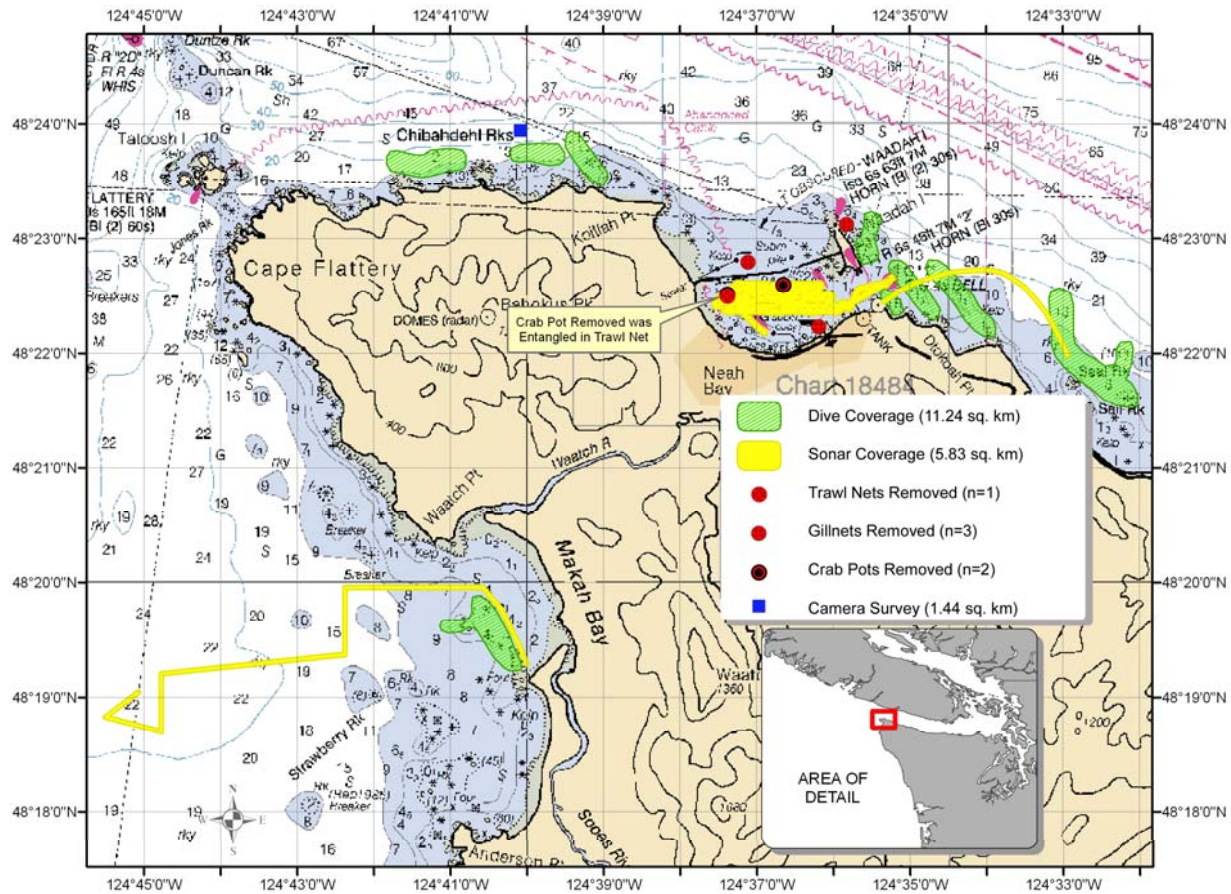


Figure 1. The location of areas surveyed and derelict fishing gear removed during the Olympic Coast National Marine Sanctuary Derelict Fishing Gear Project. Source: NRC, Inc.

Table 1. Number of live and dead organisms encountered in derelict gillnets removed during the Olympic Coast National Marine Sanctuary Derelict Fishing Gear Project. Source: NRC, Inc.

Species Group	Common Name	Scientific Name	Number Alive	Number Dead	Total
Marine Mammals					
	California Sea Lion	<i>Zalophus californianus</i>	0	1	1
	Harbor Porpoise	<i>Phocoena phocoena</i>	0	1	1
	Harbor Seal	<i>Phoca vitulina</i>	0	6	6
			0	8	8
Seabirds					
	Cormorant Unid.	<i>Phalacrocoracidae spp.</i>	0	3	3
	Common Loon	<i>Gavia immer</i>	0	5	5
			0	8	8
Fish					
	Cabezon	<i>Scorpaenichthys marmoratus</i>	1	8	9
			1	8	9
Invertebrates					
	Kelp Crab	<i>Pugettia producta</i>	15	3	18
	Red Rock Crab	<i>Cancer productus</i>	1	8	9
			16	11	27
		Grand Total	17	35	52