



NORTHWEST STRAITS
marine conservation initiative

Derelict Fishing Gear Priority Ranking Project

**Prepared by the
Northwest Straits Foundation**

**for
The Russell Family Foundation**

December 31, 2007

Table of Contents

Acknowledgements	2
Executive Summary	3
Map of priority areas with accompanying text	6
Estimate of Gear Accumulations in Puget Sound and Removal Cost Projections.....	7
Recommendations for Institutionalizing Ongoing Surveys and Removals Beyond 2012	14
Appendix A: Northwest Straits Initiative Derelict Gear Program Overview	17
Appendix B: Derelict Fishing Gear Removal Priority Development	26

Acknowledgements

The Northwest Straits Initiative Derelict Fishing Gear Priority Ranking Project was implemented through the Northwest Straits Foundation and was generously funded by a grant from the Russell Family Foundation. Derelict fishing gear surveys necessary to complete the project were funded by grants from the Puget Sound Action Team and the United States Fish and Wildlife Service Coastal Program. The Northwest Straits Commission provided direction and leadership throughout the project. The Northwest Straits Foundation would like to acknowledge the contributions of the following individuals to the success of this project:

Greg Bargmann, Washington Department of Fish and Wildlife
Ginny Broadhurst, Northwest Straits Commission
Rich Carlson, United States Fish and Wildlife Service
Tom Cowan, Tom Cowan Consulting
Rich Doenges, Washington Department of Natural Resources
Tom Good, National Oceanic and Atmospheric Administration
Nick Jones, Puget Sound Gillnetters Association
Jeff June, Natural Resources Consultants
Linda Lyshall, Puget Sound Action Team/Partnership
Nan McKay, The Russell Family Foundation
Wayne Palsson, Washington Department of Fish and Wildlife
Kit Rawson, Tulalip Tribes and Northwest Indian Fisheries Commission
Kevin Ryan, United States Fish and Wildlife Service

Executive Summary

The Northwest Straits Initiative established a goal of ridding Puget Sound from harm caused by derelict fishing gear. To do this, existing derelict fishing gear must be removed and new accumulations of derelict gear must be removed. In addition, prevention practices must be implemented.

The Northwest Straits Initiative has already made significant progress on this goal. It has worked with numerous partners to pilot prevention strategies and establish removal procedures, a reporting system and a locational database. To date, the Initiative has successfully surveyed over 38 square nautical miles of seabed and determined where there are large accumulations of derelict gear. It has successfully implemented 39 separate removal projects representing more than 160 days in the water with divers removing over 1,248 derelict crab pots and 95,000 pounds of nets, restoring more than 144 acres of marine habitat.

The Initiative is recognized as a global leader in addressing the problem of derelict fishing gear. The Initiative's accomplishments have been recognized by the United Nations, the White House, the National Oceanic and Atmospheric Administration and have been highlighted in numerous media programs including television shows by Jean-Michelle Cousteau's Ocean Futures Society, Northwest Indian News and KCTV's *Puget Sound Matters* series.

Nevertheless, in order to strategically plan for and identify the costs of achieving its goal, the Northwest Straits Initiative Derelict Fishing Gear Priority Ranking Project was undertaken in 2007.

The critical tasks associated with this project were:

- Identify the highest priority areas in Puget Sound for derelict fishing gear removal based on objective criteria developed by experts in the field.
- Estimate the total amount of derelict fishing gear accumulations throughout Puget Sound using the WDFW database, estimates based on past experience, and targeted field surveys.
- Estimate the cost of removing 80-90 per cent of derelict fishing gear from the highest priority areas by 2012 based on estimated total accumulations and known removal costs.

Additional tasks included developing recommendations for institutionalizing maintenance of derelict gear removals after 2012 and developing a list of possible funding sources to pay for initial removals and subsequent maintenance removals.

To identify which areas in Puget Sound should be considered high priority for derelict fishing gear removal, an advisory committee of experts in the field was assembled. This committee developed objective criteria with which to rank both geographic areas and individual derelict gear items according to priority for removal. The most important criteria for determining priority ranking are threats to human safety, navigation, species and critical species habitat. Through this ranking process, the San Juan archipelago and north Puget Sound were identified as the highest

priority for derelict gear removal, based on their importance for marine mammals, sea birds and species listed under the federal Endangered Species Act.

This process allows the Initiative to target large areas of gear accumulations as well as address individual gear items that may be outside high priority areas, but still pose considerable risk to human safety, navigation, or species and habitat. For example, while areas outside the San Juan archipelago and North Puget Sound are generally not considered high priority for removal, gear items lost in south Puget Sound, for example, would be considered high priority if they were threats to species of concern there. The attached map shows only the geographic area identified as high priority. There may well be gear items outside those areas that would be considered high priority using the criteria developed for this project.

In addition, based on these criteria, derelict crab pots were not ranked highly for removal. Therefore, estimates of total derelict gear accumulations in Puget Sound and estimates of costs of removals did not include derelict crab pots. As more information emerges about the impact of derelict crab pots, this ranking may change.

To estimate the total accumulations of derelict fishing nets in Puget Sound, an additional ten days of diver surveys were conducted in areas not previously surveyed, including areas in Hood Canal and areas on the west side of San Juan Island. Using this and other survey information, the WDFW derelict gear database, and information about where commercial fishing activity occurred, estimates of total derelict fishing net accumulations in Puget Sound were developed.

It was estimated that 2,855 derelict fishing nets remain in the identified high priority areas. Of the known fishing grounds in these areas, 11% have been surveyed in the San Juan Islands and 18% have been surveyed in north Puget Sound. Further surveys would serve to refine the estimate of remaining derelict nets. There are an estimated 1,038 derelict nets remaining in the lower priority areas of central and south Puget Sound and Hood Canal.

Removal of the higher priority derelict nets would require an estimated 816 operation days (163 days per year over five years) and cost approximately \$3.3 million. Removal of the lower priority derelict nets would require an estimated 297 additional operation days and cost approximately \$1.2 million. The estimated cost of removing the remaining derelict fishing nets is based on established rates of removal and actual removal costs. Currently, the Northwest Straits Initiative removes an average of 3.5 derelict nets per operation day at a cost of approximately \$4,000 per operation day. The removal costs include removal plan preparation, notification, onboard data collection, reporting, disposal and all vessel and crew costs.

The cost of removing 80-90 percent of derelict nets remaining in high priority areas is estimated at \$3.1 million.

As part of this project, the Northwest Straits Initiative developed recommendations for institutionalizing an ongoing derelict gear removal and prevention program after the remaining derelict fishing nets are removed. Such a program would need to include:

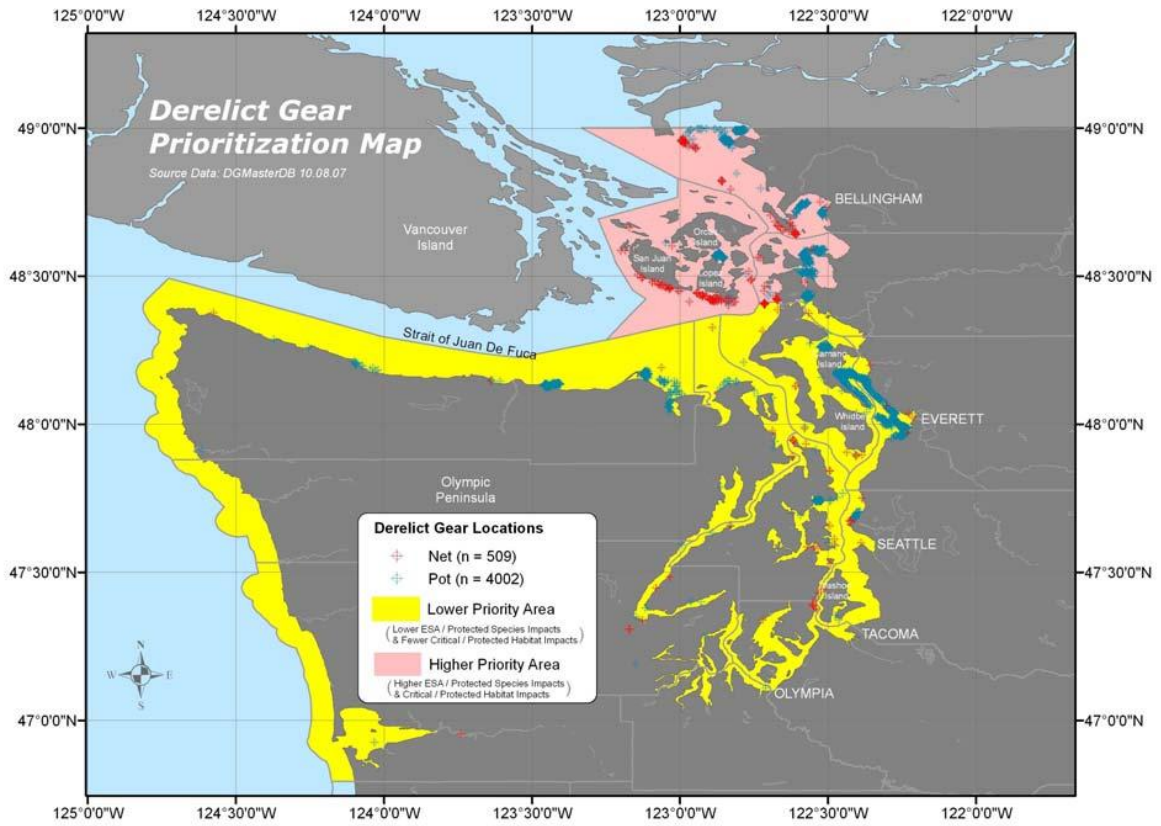
- Ongoing removal of newly lost derelict fishing gear

- Convenient system to report lost gear
- Prevention plan development and implementation
- Secure funding

Such a program could be housed in a state agency, such as Washington Department of Fish and Wildlife or Washington Department of Natural Resources with the option of contracting out program activities similar to how the Department of Ecology administers parts of its oil spill response program. Funding could come from the legislature, augmented by grant funding.

The Northwest Straits Initiative regularly removes newly lost fishing gear when it is reported and identified as an imminent threat to human safety, navigation, or critical species. Based on average annual costs of such removals, it is estimated that future emergency or maintenance derelict net removal operations would cost approximately \$72,000 per year. This cost estimate is for removal only and does not include costs associated with maintaining the state derelict gear database, or any prevention activities.

Derelict Gear Prioritization Map



Estimate of Gear Accumulations in Puget Sound and Removal Cost Projections

Derelict Nets

Puget Sound and Hood Canal have approximately 2,750 miles of coastline. However, not all shoreline areas have been active commercial net fishing areas. The shoreline areas likely to have derelict nets in each area are:

Location	Approximate Shoreline Miles	Approximate Shoreline Miles Fished with Nets
San Juan Islands	400	180
North Puget Sound	360	150
Central Puget Sound	520	200
South Puget Sound	1,220	600
Hood Canal	250	200
Grand Total	2,750	1,330

Projections

Diver surveys for derelict nets have covered approximately 88 miles of shoreline or 3% of the total shoreline of Puget Sound and Hood Canal and 7% of the fishing grounds.

Location	Distance Surveyed (miles)	% of Total Area Surveyed	% of Fishing Area Surveyed
San Juan Islands	20.5	5%	11%
North Puget Sound	26.5	7%	18%
Central Puget Sound	17.5	3%	9%
South Puget Sound	16.0	1%	3%
Hood Canal	7.5	3%	4%
Grand Total	88.0	3%	7%

Highest concentration of derelict nets per area surveyed have been found in the San Juan Islands, followed by North Puget Sound, Central Puget Sound, Hood Canal and South Puget Sound.

Location	Number of Derelict Nets Detected	Density of Derelict Nets (#/mile)
San Juan Islands	264	12.9
North Puget Sound	191	7.2
Central Puget Sound	52	3.0
South Puget Sound	9	0.6
Hood Canal	7	0.9
Grand Total	523	5.9

Based on survey-estimated density of derelict nets (nets/mile), a total of 4,518 derelict nets are projected in Puget Sound. A total of 624 derelict nets have been removed leaving 3,894 derelict nets to be removed.

Location	Total Number of Project Derelict Nets	Number of Derelict Nets Removed to Date	Number of Derelict Nets Remaining
San Juan Islands	2,318	252	2,066
North Puget Sound	1,081	292	789
Central Puget Sound	594	77	517
South Puget Sound	338	3	335
Hood Canal	187	0	187
Grand Total	4,518	624	3,894

A technical advisory panel established the highest priority removal areas as those with critical habitat for ESA listed species, important to marine mammals, seabirds and migrating wild salmon and protected areas. The San Juan Islands and North Puget Sound qualify as high-priority areas for derelict gear removal. A total of 2,855 derelict nets are projected to remain in these two areas. A total of 283 miles of shoreline along probable net fishing areas remain to be surveyed for derelict gear in these two areas. There are 1,038 derelict nets estimated to be remaining in the lower priority areas and 959 miles of shoreline to survey. In both higher and lower priority areas there are an estimated 3,894 derelict nets remaining to be removed and 1,242 miles of shoreline to survey.

Location	Number of Derelict Nets Remaining	Number Shoreline Miles to Survey
Higher Priority Area		
San Juan Islands	2,066	160
North Puget Sound	789	124
Subtotal	2,855	283
Lower Priority Area		
Central Puget Sound	517	183
South Puget Sound	335	584
Hood Canal	187	193
Subtotal	1,038	959
Grand Total	3,894	1,242

Diver surveys can cover approximately three miles of shoreline per day at a cost of about \$2,800 per survey day. The 283 miles of shoreline to be surveyed in the high priority areas would require 94 days of survey effort at a total cost of \$264,133. In lower priority areas, 959 miles of shoreline to survey would require 320 days of survey effort and cost \$895,067. To survey the entire 1,242 miles of shoreline in both higher and lower priority areas would require 414 survey days and cost \$1.2 million.

Location	Number Shoreline Miles to Survey	Number of Days to Complete Survey	Survey Costs
Higher Priority Area			
San Juan Islands	160	53	\$148,867
North Puget Sound	124	41	\$115,267
Subtotal	283	94	\$264,133
Lower Priority Area			
Central Puget Sound	183	61	\$170,333
South Puget Sound	584	195	\$545,067
Hood Canal	193	64	\$179,667
Subtotal	959	320	\$895,067
Grand Total	1,242	414	\$1,159,200

Past experience indicates that on average 3.5 derelict nets can be removed for each removal operation day conducted at an average cost of about \$4,000 per day (including removal plan preparation, notification, onboard data collection, reporting, disposal and all vessel and crew costs). Removal of the higher priority derelict nets would require an estimated 816 operation days (163 days per year over five years) and cost approximately \$3.3 million. Removal of the lower priority derelict nets would require an estimated 297 additional operation days and cost approximately \$1.2 million. To removal all of the projected derelict nets in both the higher and lower priority areas would require 1,112 removal days and cost approximately \$4.4 million.

Location	Number of Derelict Nets Remaining	Number of Days to Complete Survey	Removal Costs
Higher Priority Area			
San Juan Islands	2,066	590	\$2,361,199
North Puget Sound	789	225	\$901,865
Subtotal	2,855	816	\$3,263,064
Lower Priority Area			
Central Puget Sound	517	148	\$591,184
South Puget Sound	335	96	\$382,286
Hood Canal	187	53	\$213,333
Subtotal	1,038	297	\$1,186,803
Grand Total	3,894	1,112	\$4,449,867

Total cost to survey and remove 90% of the derelict fishing nets over the five-year period through 2012 is estimated at \$3.2 million for the higher priority areas, \$1.9 million for the lower priority areas and \$5.0 million for both higher and lower priority areas.

Location	Complete Survey and Removal Costs	Percent of Nets Removed	Partial Survey and Removal Costs
Higher Priority Area			
San Juan Islands	\$2,510,065	90%	\$2,259,059
North Puget Sound	\$1,017,132	90%	\$915,419
Subtotal	\$3,527,197	90%	\$3,174,477
Lower Priority Area			
Central Puget Sound	\$761,517	90%	\$685,365
South Puget Sound	\$927,352	90%	\$834,617
Hood Canal	\$393,000	90%	\$353,700
Subtotal	\$2,081,869	90%	\$1,873,682
Grand Total	\$5,609,067	90%	\$5,048,160

Cost of removals of newly lost fishing nets after legacy nets are removed

The highest priority derelict nets for removal are those that threaten human safety or present a hazard to navigation. These are typically nets lost during a recent fishing season and often are reported by the fishers who have lost the net. Since the inception of the Northwest Straits Initiative's (NWSI) derelict fishing gear program, an average of six to eight emergency net removal operations have occurred each year. Emergency net removals typically required two to three days of operations per removal. An estimated cost to conduct future emergency derelict net removal operations is approximately \$72,000 per year.

Six removals per year at three days per removal and \$4,000 per day = \$72,000

Derelict Pots/Traps

The technical committee determined that derelict crab pots were a lower removal priority than derelict nets, since the crab pots mainly impact Dungeness and red rock crab, both relatively healthy invertebrate populations in Puget Sound. However, the committee did recognize that localized depletion of crab populations and economic damage to the commercial and recreational crab fisheries could occur in some areas where derelict pot densities were high and removal operations might be warranted.

A number of side scan sonar surveys of popular crab fishing areas have been conducted in Puget Sound by the Northwest Straits Initiative and others. The density of derelict crab pots has ranged from a moderate 26 pots/km² in some areas to an extremely high 135 pots/km² that approaches or

exceeds active commercial and recreational pot densities. Several areas, such as Port Susan and Dungeness Bay, that are important fishing areas and had very high derelict pot densities were identified as higher priority removal areas and essentially all derelict pots were removed by the NWSI or other sponsored removal projects. In Port Susan, a declining Dungeness crab population was a concern to salmon fishery managers since juvenile salmon utilize crab larvae as an important food component during their early life in the Stillaguamish estuary. Although the commercial and recreational crab fishery had been significantly reduced in Port Susan, the high concentration of derelict pots fishing year around was believed to potentially limit the recovery of Dungeness crab stocks.

Based on known Dungeness crab fishing areas and derelict crab pot densities observed during side scan sonar surveys, the NWSI estimates there are approximately 14,000 to 20,000 derelict crab pots in Puget Sound that have accumulated over the past three to five years. Not all of these pots are still actively fishing but based on data collected during removal operations, approximately 37% or 5,000 to 7,000 of these pots may be actively fishing for a period of several months to several years. Each derelict crab pot has the potential to kill from 10 to 75 crab each per year or a total of 50,000 to 555,000 crab per year for actively fishing derelict pots. At an average ex-vessel commercial value of \$3.35 per Dungeness crab, total annual economic losses could range from \$167,000 to as high as \$1.86 million per year in Puget Sound compared with the average annual commercial harvest value of about \$2.3 million. The NWSI program has incurred an average cost of \$193 per pot for survey (\$25/pot) and removal (\$168/pot) operations.

Although it is difficult with existing limited information to determine which areas have derelict crab pot densities high enough to warrant higher priority removal, probably 40% of the existing 14,000 projected derelict pots are located in important fishing area in high enough densities to warrant removal operations. Areas such as Boundary Bay, Lopez Island, Lummi Island, Bellingham Bay, Port Gardner and Port Madison are likely candidates for removal operations. Removal of 40% of the 14,000 projected derelict pots or 5,600 pots at an average survey and removal cost of \$193/pot is projected to cost \$1.1 million and require 60 survey and 260 removal days over a five-year period. Once the buildup of derelict pots is removed, maintenance survey and removal operations could be conducted every several years and at a significantly lower cost. Combined with increased fisher education on the use of escape cord and best fishing practices, the negative impacts of derelict crab pot loss should be significantly reduced.

Recommendations for Institutionalizing Ongoing Surveys and Removals Beyond 2012

Introduction

The Northwest Straits Initiative has established a goal of removing 80-90% of derelict fishing gear from high priority areas of Puget Sound by 2012. After 2012, an ongoing ‘maintenance’ program, aimed at removing newly lost derelict fishing gear, must be established. This report introduces recommendations for institutionalizing ongoing derelict fishing gear surveys and removals beyond 2012.

The original purpose of the Northwest Straits Initiative’s (NWSI) Derelict Fishing Gear Removal Program was to develop an ongoing, comprehensive program to identify and remove derelict fishing gear in the Northwest Straits and Puget Sound. Safety and Priority Protocols were developed in partnership with many state and federal agencies. A database and reporting systems were developed. Funding sources were identified and applications prepared and submitted. An outreach program was developed for interest groups and the general public that emphasized a “no-fault” approach to the program. Finally, training and on-the-water testing of the protocols took place. This was a very successful approach and recommendations for institutionalizing surveys and removals beyond 2012 should build on that established foundation. A complete background report of the Northwest Straits Initiative’s program was prepared by Natural Resources Consultants (NRC) and is included in this report as Appendix A: Northwest Straits Initiative Derelict Gear Program Overview.

The recommendations in this report are based on the assumption that 80-90 percent of derelict fishing gear in high priority areas will be removed by 2012. The focus of efforts beyond 2012 will be on maintenance, where the highest priority will be removing newly lost gear as soon as possible before it does its worst damage.

Recommendations

Establish a program of Derelict Fishing Gear within a state agency

A state agency should be the most appropriate place to institutionalize a long-term survey and removal program. The Department of Natural Resources (DNR) has statutory responsibility for all state aquatic bed lands and has a Marine Debris Program that currently emphasizes creosote and derelict vessels. It is therefore, well-positioned to establish an ongoing derelict fishing gear survey and removal program. The Marine Debris Program receives budgetary support from the Legislature and the Governor. DNR also has a well-organized dive team that removes derelict fishing gear on its own as well as partnering with the NWSI. Most removals have been in the vicinity of geoduck beds in order to maintain a safe area for harvest. As an alternative to conducting its own surveys and removals, DNR could contract with the NWSI, a tribe, a non-governmental organization or private companies in much the same way the Department of Ecology contracts with oil spill response companies for emergency cleanups.

The Washington Department of Fish and Wildlife (WDFW) has statutory responsibilities for the health of fish and it also regulates fishing gear. It houses the phone and web-based derelict fishing gear reporting system and has maintained the derelict fishing gear database, although that

has been dropped recently due to a lack of budget. WDFW has a dive team, but under existing law, the team may only dive for research purposes and is not allowed to conduct derelict fishing gear removals. Like DNR, it could contract out surveys and removal operations.

The federal National Oceanic and Atmospheric Administration (NOAA) has an on-going derelict net program in Hawaii, but it is based on a situation where many harmful drift nets, from countries around the world, are expected to continue to accumulate due to ocean conditions. It is unlikely that the agency would be willing to establish an ongoing program in Puget Sound, especially since the gear is primarily lost by local, Washington State licensed fishermen.

The United States Army Corps of Engineers has participated in derelict fishing gear diver training exercises, but like NOAA, would unlikely be interested in an ongoing Puget Sound maintenance program.

Secure dedicated funding

An important key to institutionalizing an ongoing derelict fishing gear program is to have consistent funding. The Washington State Legislature has appropriated funds for derelict fishing gear operations and should commit itself to be a source for the future, much like it supports DNR's derelict vessel program and Ecology's oil spill program.

State and federal grants have been an excellent source of funds in the past and a state agency would be eligible to apply for most grants. Good funding sources include NOAA's Marine Debris Prevention and Removal Program, the Washington State Salmon Recovery Funding Board and the Puget Sound Partnership. Private foundations have also been important funders of derelict fishing gear operations. However, government agencies are usually not eligible to receive many foundation grants.

New funding sources should be explored. There have been suggestions including a tax on recreational and commercial fishing licenses, a tax on new fishing gear sales (crab and shrimp pots, fishing nets, etc.), and fines on fishermen that don't report lost gear. Each of these concepts has drawbacks and it is important not to undermine the no-fault approach of the program, which has fostered support from the fishing industry and has contributed to the program's success. However, the merits of these and other ideas for establishing a new, dedicated funding source needs to be examined.

Adopt a system for identifying priority removals

The primary task of the Derelict Fishing Gear Priority Ranking Project is to develop maps and lists of priority areas and rank them so efforts can be concentrated on removing the most harmful and important derelict fishing gear in the next five years. It is important for the agency responsible for ongoing efforts after 2012 to have a similar methodology to use as its guiding process. There should be a clear and simple way to rank newly lost gear and to remove it quickly.

Maintain strong partnerships

A hallmark of the success of the Northwest Straits Initiative's derelict fishing gear program has been the development of important cooperative relationships with agencies and organizations.

The negative consequences of derelict fishing gear are far reaching. Fish, shellfish, sea birds, marine mammals, recreational and commercial divers, boaters and others all benefit by the timely removal of derelict fishing gear.

In order to sustain an ongoing program, it is necessary for those organizations whose mission is helped by removing derelict fishing gear to remain involved and be active in advocating for funding for timely removal operations. The lead organization or agency for derelict fishing gear should reach out to those organizations and maintain strong partnerships.

Reporting and data maintenance

Any ongoing program for derelict fishing gear removals must include the ability to have a convenient method of reporting lost gear. This is especially true when the emphasis is on newly lost gear. The toll-free phone and web-based reporting systems work satisfactorily, but only if the information is regularly (daily is best) accessed and logged-in by staff with that has responsibility for this ongoing task. There also needs to be in place an efficient system for conveying reports to the dive teams for timely removals.

Personnel must also be assigned for maintaining the database. The database designed by the Northwest Straits Initiative works well, but, like any database, is only good if it is up to date. New reports have to include enough information to be useful. An ongoing review of the database is necessary for setting priorities and developing an efficient removal schedule. Additionally, gear removed needs to be recorded so the database remains accurate.

Prevention plan

A prevention plan should be developed and implemented. While it is acknowledged that lost gear is an inevitable by-product of recreational and commercial fishing, it is also important to make every attempt to reduce the losses.

Prohibiting the sale of illegal gear, promoting the use of escape cord, gear design improvements, better mapping and education about barge and shipping lanes, and other ideas have been recommended for reducing the proliferation of derelict fishing gear. The agency responsible for long-term removals should also be lead for implementing these and other ways to help prevent future losses.

Education and outreach

Regular education and outreach to the media, interest groups and the general public is also critical in order to maintain an ongoing budget and leadership for continuing this work. Until the NWSI began its program in 2002, few organizations and people were aware of the significant harm to Puget Sound caused by derelict fishing gear. Diligent reporting of the damages caused and the successes of removing derelict fishing gear must be part of institutionalizing the program for the long term.

Appendix A: Northwest Straits Initiative Derelict Gear Program Overview

Background

Derelict fishing gear is present throughout Puget Sound, Hood Canal, the Strait of Juan de Fuca and in many of the state's rivers where fishing occurs. This gear has accumulated over years of commercial and recreational fishing. Common types of derelict fishing gear include gillnets, purse seine nets, aquaculture nets, crab and shrimp pots, lines, ropes, and a variety of other gear components. Due to the introduction of synthetic materials in fishing gear manufactured since the 1950s, much of this gear persists for years in the marine environment. Depending upon the condition of the gear and its location, some gear may continue to actively fish for many years. Recent derelict gillnets removed from Puget Sound have been identified by mesh size and construction as nets not used since the early 1970s and yet this gear was found still actively fishing off Lummi Island.

Estimating the magnitude of the derelict fishing gear problem in Washington State is difficult because so little of the fishing grounds have actually been adequately surveyed. However, derelict fishing gear appears to be prolific. Wayne Palsson, a fishery biologist with the Washington Department of Fish and Wildlife (WDFW), conducts an annual bottom trawl survey for bottom fish in marine waters south of Port Townsend including Hood Canal, the main basin of Puget Sound (Central Sound), the Whidbey basin, and South Puget Sound. The bottom trawl also collects derelict fishing gear including pots, traps and nets. Based on the area swept by the bottom trawl, the 2002 survey produced an estimate of 117,000 derelict fishing gear items weighing nearly 1,200 metric tons in the area surveyed. However, the survey did not cover the Strait of Juan de Fuca, the San Juan Islands or Puget Sound north of Port Townsend where extensive commercial and recreational fishing and crabbing occurs. In 2005, WDFW carried out a full Puget Sound trawl survey (not including the outer Strait of Juan de Fuca west of Sequim). This survey projected a total of 2.5 million derelict gear items from Olympia north to the Canadian border and west to Sequim. These derelict gear items include for sport and commercial gear. Another measure of the derelict gear in Puget Sound is from reported commercial gear loss. Gillnet fishermen report in the past they lost 10 to 20% of their fishing gear in an average year. In the hay-day of the gillnet fishery during the 1970s, 1980s, and early 1990s, there were over 1,500 active gillnet permits fished in Puget Sound with seasons lengths of up to 40 days each year. This would indicate that fishermen lost on average the equivalent of from 150 to 300 gillnets (1,800 ft long by 100 ft deep) per year over the 30-year period. There are likely several thousand derelict gillnets remaining in Puget Sound.

The NWSC has identified over 178 derelict gillnet sites (many with multiple derelict nets) in 44.5 days of surveys covering about 50 nm² of fishing grounds in Puget Sound and the San Juan Islands. We estimate we have covered less than 5% of the known gillnet fishing grounds in Puget Sound. Commercial urchin divers reported two derelict gillnets off the south end of Lopez Island in January 2004. However, when removal operations were initiated, divers found a total of 41 nets in a one nautical mile area covering approximately nine acres of seabed.

Most gillnets are fished in traditional migratory corridors with high concentrations of returning adult salmon and steelhead. These are the same areas where commercial fishermen lose their gear. The derelict gear can continue to harvest salmon, steelhead and other species in these areas for years resulting in unreported fishing mortality. There are a number of these high intensity fishing effort areas in Washington's waters. Derelict fishing gear (gillnets) also occurs in freshwater rivers where Tribal net fisheries occur such as the Skagit, Snohomish, Lake Washington system and the Green/Duwamish system. Derelict gillnets have been identified by NMFS as a threat to sturgeon in the lower Columbia River.

Derelict crab pots are also prolific. Over 900 derelict crab pots were observed with side-scan sonar during five days of surveying in northern Puget Sound. Two divers recovered 292 crab pots in five days in Hale's Passage alone. Many of these pots were still actively fishing; even those equipped with rot cord. Derelict crab pots identified with side scan sonar in Port Angeles Harbor, Dungeness Bay and Sequim Bay in July 2003 were found to be still actively fishing when removed seven months later in February 2004.

There are indications that the impacts of this gear are persistent over a significant period of time (20 yrs + for gillnets). There is evidence that derelict fishing gear negatively impacts a variety of species and habitats for which state and federal agencies have responsibility. Recently lost gillnets probably have the greatest impact on salmonids and seabirds. We recovered sections of two gillnets in 2003 after that year's chum salmon gillnet season. One net found in shallow water on the east side of Lummi Island contained 159 salmon carcasses and at least 12 of these were identified as Chinook salmon. This net also had a number of dead Dungeness crabs and an unidentified seabird. The second net recovered in 2003 was in Bellingham Bay. It was approximately 1,000 ft in length and extended from tidal water out to subtidal depths of about 160 ft. It contained 68 salmon and one steelhead. Nearly all of the salmon were chum salmon with the exception of three large Chinook salmon. We removed 20 of the 26 nets found along the west side of Lummi Island and, although they did not contain any salmon, they did contain numerous dead rockfish and lingcod. A 120 ft length of gillnet recovered from off of Double Bluff in Central Puget Sound had numerous dead rockfish and lingcod and also contained three adult steelhead. Recently 46 derelict gillnets were removed from Lopez Island. The nets contained 43 dead seabirds, two salmonids, rockfish, lingcod, crab and one marine mammal, probably a harbor seal. However, beneath the nets divers found literally piles of dead seabird and fish bones.

To date, the NWSC's derelict gear project has resulted in the removal of over 600 derelict nets and 1,248 derelict crab pots weighing over 121,000 lbs. The removal of the derelict nets has restored over 140 acres of critical habitat in the San Juan Islands, Puget Sound and the Strait of Juan de Fuca. The derelict nets contained over 18,000 live and dead animals including 17 dead marine mammals, 208 dead seabirds and 904 live and dead fish and 16,875 live and dead invertebrates. Of the 1,248 derelict pots removed contained 385 dead and 1,806 live crab and 357 pots or 37% were still actively fishing.

The observed dead fish in recovered gillnets probably significantly underestimates the impact of the gear for several reasons. First, most recovery operations have been conducted during winter and early spring when water visibility is best but when few adult salmon are in the area.

Secondly, nets that have been lost for some time tend to be inhabited by a population of large starfish that rapidly eat any entangled and dead animals. Lingcod have been found in nets that are half eaten by starfish while the other half of the fish on the underside of the net is nearly fresh enough for human consumption, indicating the lingcod has only been dead a day or less. Once entangled and killed, a typical carcass will probably be consumed or otherwise decomposed within seven to ten days. Based on some recent tagging of dead animals in gillnets, the dead animals observed in nets probably represent about one-week to ten days of entanglement impacts.

As yet it is impossible to estimate the overall impact of the derelict gillnets in Puget Sound on salmon and trout populations. However, even if only 1% of the estimated thousands of derelict nets out there capture one ESA listed adult Chinook salmon or bull trout per year, that represents a significant "take" compared with other allowed impacts such as recreational and commercial fishing.

In addition to direct entanglement and mortality of fish, birds, crustaceans, and marine mammals, it has been shown that derelict gear also negatively impacts the habitat service functions where it is found (denial of access to habitat, sedimentation, scouring, blocking eelgrass growth, etc.). Gillnet meshes trap fine sediments out of the water column creating a layer of soft sediment over hard rocky habitat that suffocates most sessile organisms. Nets draped over high-relief rocky habitat prevent access to caves and depressions frequented by juvenile and adult rockfish. Tidal movement of lead lines and ropes scours attached animals and vegetation off the seabed. Derelict crab pots can block up to 50% of the eelgrass growth in their footprint and currents can cause erosion of eelgrass downstream of pots equal to an area three or four times the footprint of the pot.

Recently, the NWSC convened an expert advisory panel to develop a strategy to prioritize the removal of derelict fishing gear. The result of process is a set of criteria that defines high priority areas for derelict fishing gear removal in Puget Sound, the San Juan Islands and the Strait of Juan de Fuca and when applied to known derelict gear items, provides a priority ranking for removal.

Derelict fishing gear removal as a mitigation action provides an immediate positive return (reduction in mortality or take) plus a long-term return as the habitat recovers and its service functions are again made available. The benefits are measurable based on the area and quality of habitat that returns to full service function and based on the projected number of animals that are no longer killed as derived from impact assessments conducted during removal operations. This direct measurement of benefits is very unusual in mitigation measures. It is very difficult to actually measure the habitat service benefits from removing a creosote piling or from a few square meters of replanted eelgrass, i.e., calculating the mitigation benefit in terms of increased Chinook salmon or bull trout production. The other positive aspect of derelict gear removal is that the restored habitat is existing, natural habitat with all its related service functions as opposed to creating some man-made equivalent habitat.

Derelict fishing gear is present in a variety of habitat types and geographic locations allowing like-kind and close proximity mitigation for most actions. Derelict fishing gear removal projects

are scalable by adding additional removal effort and the costs of the removal operations and predictable and quantifiable.

Derelict gear survey and removal is expensive work. At the present time state and federal agencies, Tribal governments and private foundations are paying the costs. It may be preferable to have marine project proponents pay for a portion of this type of work as mitigation. This would provide an ongoing derelict gear removal fund that could really make progress in the removal of historical derelict fishing gear and provide money for immediate derelict gear removal when gear is reported lost in the future.

The National Oceanic and Atmospheric Administration (NOAA), the Environmental Protection Agency (EPA), the Army Corps of Engineers (ACOE), the U.S. Fish and Wildlife Service (USFWS), the Washington Departments of Natural Resources (WDNR), WDFW and the Washington Department of Ecology (WDOE) have all recently accepted derelict fishing gear removal as a valid marine mitigation measure for a King County project, the Vashon Island sewage outfall replacement project. The Northwest Straits Commission (NWSC) established the Northwest Straits Foundation (NWSF), a non-profit foundation, to manage funding for derelict fishing gear survey and removal operations. This program provides safe and environmentally effective removal of derelict fishing gear using an industry/community cooperative approach.

Funding has been obtained for derelict gear survey and removal operations from grants provided by NOAA's Community Restoration Program (NOAA CRP) and the Salmon Recovery Funding Board (SRFB). Additionally, funding has been provided by the NWSC, Tribal governments and other non-profit foundations. King County has funded the NWSF for derelict fishing gear removal as mitigation for marine construction activities.

A public law (Senate Bill 6313) passed by the Washington State Legislature and signed by Governor Locke in 2002 set up a no-fault derelict gear reporting system and required the Washington Dept. of Fish and Wildlife to develop guidelines for the safe and environmentally effective means of finding, removing and disposing of derelict fishing gear. The NWSC assisted in the development of these guidelines. If the guidelines are followed, no state or federal permits are required to conduct derelict fishing gear surveys or removals in Washington State. The WDFW is the state agency responsible for issuing permit waivers for derelict fishing gear removals under the guidelines. A typical derelict fishing gear operation may include surveying for derelict gear, preparing a derelict fishing gear removal plan for approval by WDFW, contracting for dive services, managing the derelict gear removal operation, recording impact data, arranging for storage, return or disposal of recovered fishing gear and preparing a final report for submission to WDFW and the project proponent. The details of the different aspects of the derelict fishing gear program and outlined in the following sections.

Locating Derelict Gear

Derelict fishing gear is located and reported by a variety of sources. Fishermen report lost gear to the WDFW under the no-fault reporting process. WDFW enforcement agents and scientists report derelict fishing gear found during their normal operations. Boaters, sport fishermen, divers and beach goers also find and report derelict fishing gear to the WDFW. WDFW maintains a

database of reported derelict fishing gear. The database contains a variety of information useful in prioritizing gear removal. A chart showing existing known derelict fishing gear locations is attached to this document.

In addition to accidentally encountered derelict fishing gear, directed surveys for gear are conducted. These surveys are typically directed to areas of high commercial or sport fishing effort. In some cases, surveys are directed to areas where fishermen report snags or interactions with tug and barge operations that have resulted in the loss of fishing gear in recent years. Side-scan sonar has proven effective for locating derelict crab and shrimp pots. Side scan sonar also locates other debris such as shipwrecks, tires, refrigerators, etc. Side scan sonar offers the advantage of a cost effective coverage of a large area with precise location of the gear. Approximately 2/3 of a square kilometer of seabed can be surveyed each eight-hour day for derelict pots or traps using side scan sonar. For each eight hours of on water survey work, there is another two hours of post-survey data processing effort required. Depending upon the location and depth of the area surveyed, side-scan sonar surveys cost \$2,500 to \$2,800 per day (eight hours of survey and two hours of post processing). The final product from a side scan sonar survey is a list of probable derelict gear targets indicating precise latitude and longitude and water depth, a GIS plot overlain on a chart of the area surveyed, a plot showing the location of probable derelict gear targets and a calculation of the area surveyed and the derelict gear density encountered.

ROV removals of derelict pots and traps from deep water require a different survey technique to accurately locate the derelict gear. Deepwater sidescan sonar with the acoustic tracking device of the relative location of the towfish to the vessel would cost about \$2,750 per day. The survey would cover about 2/3 of sq nm per day. One day of post-survey processing will be required at \$2,200/day for each five days of field work, i.e., a six day survey (five field days and one processing day) would cover about 3.3 sq nm of seabed would cost \$15,950. The products include the target list of latitudes, longitudes and depth, the trackline file that shows transects surveyed and a calculation of the amount area surveyed.

So far, diver drift and camera drop surveys have been most effective at locating derelict gillnets and purse seine nets. The monofilament mesh of the nets does not reflect the acoustic energy of the side scan sonar sufficiently to discriminate a useful image. Prior to diver surveys, WDFW over-flight fishing effort data are reviewed for high fishing effort years to determine areas of high concentration of net fishing effort. Fishermen are interviewed about locations of frequent fishing gear loss and specific underwater snags. Hydrographic charts of the seabed are reviewed for likely pinnacles, reefs or other obstructions. These three data sets are overlain on one another and areas of high fishing effort with likely underwater obstructions are chosen for the diver surveys.

Periods with high visibility water conditions and days with good tidal flows to conduct drift dive surveys. Typically, a team of two scuba divers is deployed from a boat with an operator. They drift at or near the surface along with the tide looking for derelict gear below. When derelict fishing gear is found, one diver will surface and call over the support boat that marks the location with a DGPS location and records a description of the gear and habitat supplied by the diver. Dive teams can cover one to two nautical miles of coastline per day. Diver surveys typically cost

between \$1,200 to \$2,200 per day depending upon the depth (more divers needed to survey deeper areas) and location of the area being surveyed.

Derelict Gear Removal Plan

In order to be exempt from acquiring state and federal permits for derelict fishing gear removal, it is necessary to submit and get approval for a derelict fishing gear removal plan. The WDFW reviews the derelict fishing gear removal plan and may consult with WDNR if the proposed removal operation impacts WDNR aquatic lands. The plan identifies the derelict fishing gear to be removed, the removal methods that will be employed, the type of habitat and any impacts that might occur, who will participate, the information that will be recorded and submitted to WDFW and what will be done with the derelict fishing gear once it is removed. The WDFW derelict fishing gear removal guidelines spell out what information is required in the derelict fishing gear removal plan. The typical derelict fishing gear removal plan costs about \$1,800 to prepare and run through the review process at WDFW and WDNR. The product is a written plan for the removal operators to follow and a letter from WDFW exempting the removal operation from permits. The derelict gear removal plan and approval process typically takes three weeks to a month to complete.

Pre-Removal Operations

Once the derelict fishing gear removal plan is approved, the WDFW guidelines require several events to occur prior to the start of actual removal operations. Three days notification must be provided to the U.S. Coast Guard's Notice to Mariners system. This assures that all mariners are aware of the location and schedule of operations. The local WDFW fisheries enforcement office must also be notified three days in advance of operations and provided an opportunity to observe the removal operations if desired. If the removal operation occurs in an area with frequent Tribal subsistence or commercial fishing, the appropriate Tribal fisheries departments must be provide prior notification of the operations. If the derelict fishing gear removal occurs in an area frequented by the U.S. Navy, the local Naval environmental officer is notified three days prior to the start of operations to assure there will be no conflict with U.S. Naval operations. If survey or removal operations are planned in the vicinity of U.S. Fish and Wildlife Service's San Juan Islands National Wildlife Refuge, the director's office is contacted and permission to work in the area is acquired. Due to homeland security concerns, city and county marine police and vessel transit control systems are notified three days prior to any survey or removal operations. If work is planned around security sensitive areas such oil or natural gas terminals, the security offices for such facilities are contacted a week to ten days prior to survey or removal operations. Finally, under the Washington State Abandoned Property Law, the local county sheriff's office must be contacted and informed that derelict fishing gear is going to be removed, stored in a secure location and the owners contacted if they can be identified and allowed an opportunity to recover their lost gear. The cost of the pre-operation notification process is included in the derelict fishing gear plan costs.

Removal Operations

Once the derelict fishing gear removal plan is approved by WDFW and all prior notifications are completed, the removal operation can be undertaken. Typically the removal operation involves a dive support vessel and a gear storage and transport vessel. If derelict nets are being removed, the dive operation usually entails three or more trained divers using surface supplied air, bailout bottles and a two-way voice communication system. In some cases this system is augmented by a real-time helmet mounted underwater video feed to the dive support vessel. One diver removes the gear (the work diver) while a second fully suited diver stands by as a safety backup (backup diver) and a dive supervisor monitors all aspects of the dive operation.

Prior to removal operations, the work diver surveys the length of the net and reports entangled animals, impacts of the net on the habitat and provides estimates of the size of the net and the amount and type of habitat impacted. In some cases, underwater video or still photographs are taken to document these observations. Nets are removed from the habitat by hand and, if necessary, cut loose where buried or encrusted. A strap and airlift bag is attached to the bundled net and it is floated to the surface where it is retrieved by the gear storage vessel. An onboard biologist further inspects the gear for entangled animals and records this information along with the information reported by the work diver. A deck hose is used to wash as much of the biological growth off the nets as possible. All dead and live animals are returned to the sea after identification and counting unless specimens are requested by federal or state agencies. The NWSF has obtained scientific collection permits from NMFS, USFWS, and WDFW. Gillnets are typically bundled into large plastic drawstring bags. Purse seine nets are rolled onto an on-deck drum or stacked and bundled on the deck.

If derelict crab pots are being removed, typically only a single vessel is required. A sophisticated WAAS DGPS charting system is deployed on the vessel with the known locations of all of the pre-determined derelict crab pots entered. A computer program analyzes the distribution of the derelict pots and suggests the most efficient removal pattern. The WAAS DGPS charting system guides the vessel to the exact location of the derelict pot and a clump weight, line and surface buoy is deployed at the location. A diver using surface supplied air or SCUBA, is deployed and follows the line from the surface float to the weight on the seabed and usually locates the pot within 10 to 15 ft of the clump weight location. The diver assesses the condition of the pot and follows the WDFW guidelines in deciding whether to remove the pot or disable it in place (pots more than 1/2 buried in the seabed are typically left in place but disabled). The diver also counts and identifies the number of animals entrapped in the pot and notes any impact on the habitat such as inhibiting eelgrass growth. The diver hooks a recovery line to the pot and either floats it to the surface with a lift bag or passes the line to the vessel crew that lifts the pot by hand off the seabed and then to the vessel by hand or hydraulic pot hauler.

Once onboard the vessel, the pot is inspected for the use of rot cord (a legal requirement), identified as to whether it is a sport or commercial pot and inspected for personal identification tags. All organisms in the pot are identified, counted, recorded as dead or alive, and for Dungeness crabs, the sex is determined. All of the information is recorded on data forms and notes about the condition of the pot are recorded in the electronic chart system, i.e., removed, disabled or remaining, etc. Pots are cleaned of as much vegetation and sessile animals as possible

and stored on deck. The onboard project manager/biologist typically manages the removal operation, assures the guidelines are being followed, records the data and is available to meet with the media or the project proponent and explain what has been accomplished.

Several tests of remote operated vehicle recovery of derelict crab and shrimp pot at depths greater than diver depth have been successfully conducted. Derelict pots have been located and removed from depths of up to 165 ft but the equipment and methodology should be feasible in depths up to 600 ft. Removal of derelict nets beyond the 105 ft maximum diver depth may be feasible with specialized dive equipment, such as rebreathers, mixed gas or hard suits. However, deepwater dive operations require additional safety equipment such as an on-site decompression chamber and require extensive diver training and experience. Deepwater dive operations would likely be very expensive and little is known about the number of derelict nets in deep water in Puget Sound. ROV removal of deepwater nets may be feasible with equipment modification; however, this has yet to be investigated.

Removal operations are the most expensive part of the derelict fishing gear removal operation. Surface supplied air divers and support vessel cost anywhere from \$2,200 per day to \$3,600 per day. SCUBA divers and a vessel for removal of pots typically cost \$2,200 to \$2,500 per day. The onboard manager/biologist costs an additional \$800 per day. Typically three to six derelict nets and up to 25 to 30 crab pots can be removed per dive day depending upon depth, water clarity and distance between the gear locations.

Deepwater ROV removal operations with the acoustic tracking device will cost about \$3,135 per day for the vessel and equipment. An additional \$800 per day would be required for the onboard biologist. It is estimated the ROV can recover 20 to 25 individual crab pots per day.

Disposal

Derelict fishing gear that can be identified as to the owner, such as gillnets with floats or crab pot tags showing the permit number, are set aside and stored in a secure area until the owners can be contacted. The project manager arranges for a secure storage area (typically an outside fenced area) and a truck to transport the identified gear to storage. WDFW and Tribal fishery offices are contacted for names and phone numbers of the owners of the gear. The project manager contacts the individuals, describes the condition of the gear held and provides the owner an opportunity to recover the fishing gear. Typically the gear is held for five days after notification. If the owner chooses not to recover their gear, the project manager will dispose of the gear. Unidentified or abandoned gear that is dilapidated and no longer useful is either sent to recyclers (if available) or disposed of in a county landfill. Typically, gillnets and purse seine nets are not reusable, cannot be recycled due to the vegetative material that remains on the meshes and they are typically disposed of in the landfill. Crab pots that cannot be identified to the owner or are unclaimed can be sold for salvage and the funds returned to the NWSF for additional gear removals. In some cases, useful pots are contributed to non-profit organizations such as the Ballard High School Marine Technology Program. Unusable pots can be sent to metal recyclers or the pots can be crushed and land filled.

Storage and disposal costs vary depending upon the amount of gear and the location. Typically disposal costs on a project run about \$500 to \$1,200.

Reporting

The WDFW guidelines require that a final report be submitted outlining what was accomplished during the removal operation, impacts observed, derelict fishing gear remaining on the fishing grounds and the disposition of the derelict fishing gear removed. The contents of the final report are provided in the removal guidelines. If a derelict fishing gear survey is conducted as part of the project, the location and description of derelict fishing gear found must be submitted to the WDFW in a format compatible with their derelict fishing gear database. This report may include formatted tabular output of the locations and types of derelict gear, a GIS chart of the area surveyed and charts showing the locations and types of derelict fishing gear removed and remaining. Additionally, the entity funding the project usually also desires a final report on the project and in some cases a media summary for press releases. If the project is being conducted as part of a state or federal mitigation measure, the permitting and consulting agencies may require a final report to assure that adequate mitigation action has occurred. Finally, often the county sheriff's department requires a report on the disposition of the derelict fishing gear removed with accounting for each gear item.

A final report for the WDFW and the proponent on a typical derelict fishing gear removal project costs about \$1,800 to \$2,500 depending upon the number of different removal locations and the level of detail required. The development of a GIS and tabular derelict fishing gear survey report cost approximately \$1,000. A derelict fishing gear disposition report for the county sheriff's office cost about \$200 to \$300.

Overall Costs

Due to the relatively fixed upfront minimum costs of the derelict fishing gear plan development and the post-project costs for disposal and reporting, the larger the budget, the greater the number of actual survey or removal days that can be performed. On average, a daily rate for a derelict survey operation is approximately \$2,750 (side scan sonar) to \$3,180 per day (ROV surveys). The average daily cost of a derelict gear removal operation ranges from about \$4,000 per day for diver removal to \$4,800 per day for deepwater ROV removal operations. These daily rate estimates include removal plan development, notification, data collect analyses and reporting and gear storage, return and disposal costs.

In most cases, individual projects are conducted for a particularly proponent, however, funds from several proponents can be combined into a larger single project, although if separate reporting is required, reporting costs can be higher than quoted above. Derelict gear surveys can be conducted for budgets as small as \$5,000, which produces two days of survey time and reporting. Derelict fishing gear removal operations typically cost a minimum of \$15,000, which results in plan preparation and approval, three to four days of removal operations, reporting and disposal of the gear. Project budgets of \$20,000 and larger are ideal since the added funding goes almost directly to additional removal days with five to seven days of removal possible.

Appendix B: Derelict Fishing Gear Removal Priority Development

INTRODUCTION

Background

Abandoned, lost and discarded fishing gear can present safety, liability, nuisance and environmental impact issues in marine waters. Identification and safe removal of derelict fishing gear can reduce these impacts. The Northwest Straits Commission (NWSC) teamed with the National Oceanic and Atmospheric Administration (NOAA), Washington Department of Fish and Wildlife (WDFW) and the Washington Department of Natural Resources (WDNR) to address the issue of derelict fishing gear in North Puget Sound and the Strait of Juan de Fuca.

The goal of the project was to develop and demonstrate a comprehensive program to safely and effectively locate and remove derelict fishing gear from the marine environment and inform the public about the program and the impacts of derelict fishing gear. An effective program protocol was developed, accepted and published by the WDFW. The NWSC's derelict fishing gear program has nearly four years of success in removing a variety of derelict fishing gear from a number of different habitats in Puget Sound and the Strait of Juan de Fuca. A substantial amount of information has been collected on derelict fishing gear including the frequency of occurrence in different geographic locations and habitat types, the frequency of entanglement and mortalities by species and impacts of derelict gear on marine habitats.

With limited removal funds available and a significant backlog of known derelict gear items to remove, it is important to prioritize removal efforts. This document provides a summary of the strategy for prioritizing derelict fishing gear removal from the first meeting of the prioritization advisory committee. The final outcome of the process will be a clear and concise methodology for prioritizing derelict fishing gear removal.

PRIORITY REMOVAL CRITERIA

Prioritizing derelict fishing gear removal provides the best removal and disposal results with the limited funds and resources likely to be available in the near future. Prioritizing derelict gear removal requires the development of criteria for derelict fishing gear removal. The technical committee, along with additional experts in marine biology and habitat, developed criteria for determining the priority of derelict fishing gear removal. Two classes of prioritization criteria were considered, criteria that could be ranked in terms of relative importance (Ranked Criteria) and operational criteria that may change the removal priority of a derelict gear item due to removal operational considerations. Ranked Criteria for prioritizing derelict fishing gear removal were evaluated and ranked in terms of their relative importance. The committee's different ranking for the criteria were averaged to obtain an overall weighting value for each Ranked Criteria.

The Committee recognized that most derelict fishing gear reports from private citizens would not contain sufficient information to evaluate each of the prioritization criteria. Many private citizen derelict gear reports only indicate the type of fishing gear and the location without providing information on species impacted, habitat type, distance to marine protected areas, the potential lethality of the gear or information necessary to evaluate priority criteria. Reports from scientists

and commercial fishers may provide most, if not all, of the information necessary to evaluate the priority criteria.

At the very least, credible derelict gear reports will provide reasonably accurate location information. The geographic location may provide some reasonable insight into evaluation of prioritization criteria.

Removal Criteria

Human Safety and Threats to Navigation

The Committee unanimously agreed that the two most important removal criteria are threats to human safety and vessel navigation. If derelict fishing gear presents either of these hazards, its removal should be the highest priority. In most cases, reports of derelict fishing gear that present a human safety and/or navigation hazard should elicit an immediate removal response. The Committee agreed that these criteria should “trump” any other criteria and therefore do not require a weighting factor.

Human Safety

Derelict fishing gear can entangle people beach walking, wading, swimming or diving. Entanglement can result in injury and even death from drowning. Typically the greatest threat of injury or death to humans is from nets, ropes or monofilament fishing line entangled at or below the surface of the water in an area frequented by humans. Derelict fishing gear above the high water line on the beach or below water depths frequented by divers (100 ft) and certain types of derelict gear such as crab or shrimp pots (without float lines) may offer little if any threat to human safety. The threat to human safety could be ranked with two levels of relative threat: absent or low threat or high threat.

These relative threats could be defined as:

Low—The derelict fishing gear is unlikely to present a threat to human injury or loss of life. Either the derelict gear is of a type unlikely to present a threat to a human (such as a crab or shrimp pot without a float line), or is in a location that poses little risk. These locations include areas where humans are unlikely to be present (water over 100 ft deep) or where humans are highly unlikely to become entangled and risk drowning (such as on a beach above the high tide line).

High—The derelict fishing gear presents a high level of threat of human injury or loss of life. The derelict fishing gear is of a type, size and configuration such that it definitely presents an entangling threat to humans. This includes gear such as a large free flowing gillnet, purse seine net, rope, line or monofilament fishing line in an area that is frequently occupied by humans. These areas include public beaches below the high tide line frequented swimmers or waders, popular sport diving locations, or areas such as bridge structures that may receive regular underwater inspections or maintenance.

Hazard to Navigation

Derelict fishing gear can present a significant threat to vessels through entanglement in propellers and steering devices. Derelict fishing gear that is free floating or entangled just below the surface can entangle passing vessels and cause loss of power or steering that can result in the

grounding or sinking of the vessel and danger to the crew. Typically the greatest threat to vessel navigation is from nets, ropes or monofilament fishing line located in or near normal traffic lanes. The threat to vessel navigation could be ranked with two levels of relative threat: low or high.

These relative threats could be defined as:

Low—The derelict fishing gear is unlikely to present a threat to vessel navigation. Either the derelict gear is of a type unlikely to present a threat to navigation (such as a crab or shrimp pot without a float line) or the derelict fishing gear is located where vessels are unlikely to be present (water over 50 ft deep or on a beach above the high tide line).

High—The derelict fishing gear presents a high level of threat to vessel navigation. The derelict fishing gear is of a type, size and configuration such that it definitely presents an entangling threat to vessels under navigation. This includes gear such as a large free flowing gillnet, purse seine net, rope, line or monofilament fishing line on or very near the surface. Additionally, the derelict gear is an area that is frequently occupied by vessels, such as designated navigation corridor or the entrance to a marina or popular anchorage.

The Committee identified seven criteria, “Ranked Criteria”, that could be ranked and weighted for a quantitative approach to prioritizing derelict fishing gear removal. The Committee members individually ranked the Ranked criteria in terms of relative importance as follows:

1. Species Impacts
2. Lethality
3. Habitat Impacts
4. Protected Areas
5. Legacy
6. Economics
7. Aesthetics

Table 1 provides the scores assigned to each Ranked priority criteria in terms of their relative importance, the average score across all Committee members, and a potential weighting value based on the average score of the highest priority criteria divided by the average score of the subsequent priority criteria. The weighting calculation incorporates, to some degree, the variability in ranking among the Committee members. Although the Committee did not undertake an analysis of the weighting of the priority criteria beyond a simple ranking, the above method would seem to provide a reasonable weighted rank among the criteria. Each criterion is evaluated based on reported information, post-report reconnaissance or inferred information from an overlay of information on the reported location of the derelict gear. Each criterion is scored either low (zero weight value) or high (the criterion’s weighted rank value). The weighted scores for the seven Ranked Criteria are summed to obtain an overall removal priority score.

Table 1. Ranked derelict fishing gear priority criteria, ranked by individual Committee members, average rank overall and priority weighting values.

Priority	Score by Committee Member								Average Score	Weighting Value
	#1	#2	#3	#4	#5	#6	#7	#8		
Species Impacts	1	1	1	3	1	2	1	2	1.50	1.00
Lethality	2	2	2	1	6	1	4	1	2.38	0.63
Habitat Impacts	3	4	3	4	2	4	3	3	3.25	0.46
Protected Areas	4	3	5	5	3	3	2	4	3.63	0.41
Legacy	6	5	6	2	4	6	6	5	5.00	0.30
Economics	5	6	4	6	5	5	5	6	5.25	0.29
Aesthetics	7	7	7	7	7	7	7	7	7.00	0.21

Note: Weighting values for each priority criteria were calculated by dividing the average score for the highest rated criteria by the average score for each subsequent criteria.

The Species Impact priority criterion was broken down into several categories: Endangered or Threatened under the Endangered Species Act (ESA), Protected under a Federal Act, Species of Concern (Federal, State and Canada), biodiversity of an area, and ecologically important species.

However, while it was noted that each of these categories have differing importance, it was agreed that it was not necessary to provide sub-ranking for Species Impact within the context of the Project goals.

Derelict gear reports may include observations of species impacts by the reporting party that will allow evaluation of this criterion. Where accurate geographic information on derelict fishing gear is available, species impacts may be inferred by overlaying maps of known distribution of important species. If a description of the habitat where the derelict gear is located is available along with an accurate geographic location, the potential for species impacts can be inferred from data collected on derelict fishing gear previously removed.

Fishing gear, by its nature, is designed to catch specific marine species. Derelict fishing gear can continue to perform this harvesting function and can take a shape and form that entangles and threatens many other species other than those originally intended to be harvested, such as birds and marine mammals. Derelict fishing gear can provide an obstruction to migration routes and/or become a source of unobserved chronic fishing mortality. These threats are particularly serious for Endangered, Threatened and Protected species and Species of Concern.

Low—The derelict fishing gear is unlikely to present a threat to Endangered, Threatened, or Protected species or Species of Concern. The derelict gear is not generally of a type (crab or shrimp pots, nets, rope, line, etc.) or configuration that presents an obstruction to migration and/or a source of unobserved mortality. The derelict fishing gear is unlikely to have an indirect impact on a species listed as Endangered, Threatened, Protected or a Species of Concern. The

derelict fishing gear is not located in an area frequented by Endangered, Threatened, Protected species or a Species of Concern (i.e. buried in the substrate in deep water).

High—The derelict fishing gear presents a high level of threat to a species listed as Endangered, Threatened, Protected or a Species of Concern. The derelict fishing gear is of a type, size and configuration such that definitely presents the possibility of obstruction of migration and/or unobserved mortality, such as a large free flowing or loosely bundled gillnet, purse seine net, tangle of ropes, lines or monofilament fishing gear. The derelict fishing gear is located in an area known to be frequented by Endangered, Threatened, or Protected species or Species of Concern, such as near a river mouth or in a spawning/breeding, feeding or migratory area.

The weighting value for the Species Impact priority criterion is 1.00, indicating that if a derelict gear report provides direct evidence of a potential threat to an Endangered, Threatened, Protected species or Species of Concern, or if such a threat can be inferred from the location of the gear then the value for this criterion would be 1.00.

The Lethality refers to the ability of the gear to kill animals and vegetation and the magnitude of the expected damage. Factors affecting the potential lethality of derelict fishing gear include age, size, exposure and the amount of time in the water. Exposure relates to the gear's position in the environment, such as the extent of any suspension of the net.

Lethality is a somewhat subjective criterion that can only be assessed for certain by documenting animals and plants actually killed by the gear. However, potential lethality can be inferred from some attributes of the gear likely to be reported, such as the size and exposure of the gear.

Low—The derelict fishing gear is unlikely to be lethal to most animals. The gear is either in such poor condition or its location in the environment is such that it is unlikely to entangle, entrap or kill animals (buried).

High—The derelict fishing gear is observed to have entangled or entrapped animals and/or dead animals are observed in and around the gear. The description of the location and the condition of the gear indicates a high likelihood of entanglement, entrapment or lethality (newer gear, suspended in the water column, etc.). The weighting value for the Lethality priority criterion is 0.63, indicating that if a derelict gear report provides either direct evidence of the potential lethality to any animal (including species of special concern under the Species Impact) or lethality can be inferred from the description and location of the gear, then the value for this criterion would be 0.63. The Habitat Impact priority criterion was divided for discussion purposes into Critical (ESA) and Sensitive (Essential Fish Habitat and Priority Habitat Species.) Impacts of derelict fishing gear on marine habitats vary by gear type and habitat type. In nearly all cases, derelict fishing gear significantly reduces the service functions of habitat to the species that rely on it, typically by blocking access and/or smothering habitats. Only in those cases where the derelict fishing gear has become completely integrated into the existing habitat and has actually become part of the habitat would removal be unlikely to benefit the habitat service function. Although the Committee incorporated biodiversity impacts into the species impact criteria, it was recognized that the presence of derelict fishing gear could reduce the biodiversity of a habitat.

Derelict fishing gear reports may or may not include descriptions of the habitat where the derelict gear is located. However, if detailed geographic location information is provided, the type of habitat can be inferred. GIS overlays are available for Critical and Sensitive Habitats from Federal and State agencies and the Nature Conservancy has mapped biodiversity information for some areas of Puget Sound and the Straits. These layers could be used to infer habitat impacts from reported geographic location. Derelict fishing gear may have an indirect impact on species in the marine environment by impacting a critical or sensitive habitat important to a particular species or group of species. The habitat impacts of derelict fishing gear may be in addition to or in lieu of direct impacts on species through mortality. Examples of impacts of derelict fishing gear on critical and sensitive habitats may include a gillnet or purse seine net draped over a high relief rocky pinnacle that covers and prevents the use of hiding areas for juvenile fish and invertebrates, nets or ropes that are constantly scouring across a substrate removing sessile organisms, or netting that blocks growth of eelgrass or other marine vegetation along a shoreline.

Low —The derelict fishing gear is unlikely to present an impact to a critical or sensitive habitat. The derelict gear is not generally of a type (disabled crab or shrimp pots, rope, line, etc.) or configuration that presents a negative impact on sensitive habitat. The derelict fishing gear is not located in area of critical or sensitive habitat (i.e. buried in the substrate in deep water).

High—The derelict fishing gear definitely presents a high level of impact to a sensitive habitat. The derelict fishing gear is of a type, size and/or configuration such that it definitely impacts sensitive habitat. This includes gear such as a large free flowing or loosely bundled gillnet, purse seine nets, and tangles of ropes, lines or monofilament fishing gear. The derelict fishing gear is located in an area designated critical habitat (ESA) or sensitive habitat (Essential Fish Habitat).

The weighting value for the Habitat Impact priority criterion is 0.46, indicating that if a derelict gear report provides either direct evidence of the potential impact to critical or sensitive habitat or impacts can be inferred from the description and location of the gear relative to known distributions of critical and sensitive habitats, then the value for this criteria would be 0.46.

The Protected Areas priority criterion includes No-Take Reserves, Aquatic Reserves (DNR), National Wildlife Refuges (USFWS), other Marine Protected Areas (MPAs) as designated by state or local governments, and others (Olympic Coast National Marine Sanctuary, State and Federal Parks, Padilla Bay National Estuarine Research Reserve, etc.)

The Committee believed that derelict fishing gear removal in or near protected areas should have a higher priority than derelict fishing gear having similar potential species and habitat impacts in otherwise unprotected areas. The Protected Areas criterion captures a variety of designated areas having a variety of different levels of protection ranging from no-take zones where fishing is prohibited to areas designated as “reserves” where fishing is allowed and minimal, if any, limits on access and use are imposed. The Committee assumed that Protected Areas designation is meant to enhance species and habitat regardless of the level of protection imposed. The presence of derelict fishing gear likely diminishes habitat benefits and may entangle and kill the species the Protected Areas are meant to enhance. Some protected areas such as No-Take Reserves (both voluntary and regulated) offer the potential for a greater reduction in derelict fishing gear

impacts through removal as the likelihood of future gear loss in these areas is reduced compared with areas with continued fishing effort.

Committee members reviewed a list of Protected Areas known to occur in Puget Sound and selected those that were relevant for derelict fishing gear removal prioritization (Table 2) and rejected others (Table 3).

Protected Areas occur in known, demarcated locations. Even if derelict fishing gear reports do not indicate whether the gear is located in a Protected Area, if accurate geographic location for the gear report is available, a GIS query system can determine if the gear is in or near a Protected Area and assign a priority rank for this criteria. The personnel assigning the score for the Protected Areas criterion may wish to consider the level of species and habitat protection imposed by the specific type of Protected Area the derelict gear is located in or near.

Derelict fishing gear can have many of the same effects on habitats in Protected Areas as those described above for impacts to critical and sensitive habitats. Derelict nets can prevent access to habitat through physical obstruction. Derelict nets have been observed to collect fine sediments out of the water column, suffocating sessile animals growing on hard rocky habitat, and “strumming” of nets and leadlines caused by currents continually wears encrusting animal and plant growth off hard habitat surfaces. Currents can cause the erosion of the seabed down current from derelict crab pots impeding aquatic vegetation growth.

Low —The derelict fishing gear is unlikely to present an impact to habitat in a Protected Area. The derelict gear is not generally of a type (disabled crab or shrimp pots, rope, line, etc.) or configuration that presents a negative impact on habitat or the derelict fishing gear is not located in the vicinity of a Protected Area.

High—The derelict fishing gear is reported to be located in or near a Protected Area and definitely presents a high level of impact to habitat. The Protected Area is a no-take zone were future fishing is prohibited. The derelict fishing gear is of a type, size and/or configuration such that it definitely impacts habitat. This includes gear such as large free flowing or loosely bundled gillnets, purse seine nets, and tangles of ropes, lines or monofilament fishing gear.

The weighting value for the Protected Areas priority criterion is 0.41, indicating that if a derelict gear report provides either direct evidence of the potential impact to a Protected Area or impacts can be inferred from the description and location of the gear relative to known distributions of Protected Areas, then the value for this criteria would be 0.41.

Table 2. Site type, manager, description of protection measures for those areas found to be relevant for derelict fishing gear removal prioritization for marine protected areas (MPA) in the Puget Sound region.

Site Type	Manager	Comments	MPA for derelict gear removal prioritization process
San Juan Marine Biological Preserve (San Juan County)	UW FHL	No harvest except for food fish and kelp in all of San Juan County and Cypress Island.	No
No-Anchor Zone (Jefferson County)	Jefferson MRC	No-anchor area established as a voluntary program to protect eelgrass.	No
Iceberg Point, Point Colville, Watmough Bay, Patos, Turn Island (San Juan County)	BLM	Upland areas and shoreline are managed for conservation purposes.	No
Special management fishery areas: Haro Strait, Upright and San Juan channel (San Juan County)	WDFW	Areas closed to commercial sea cucumber and sea urchin harvest	No
Underwater parks: Deception Pass and Fort Casey (Island County) and Fort Worden (Jefferson County)	WA Parks	Areas closed to harvest of seaweed and non-food fish species (this is a catch all for marine invertebrates such as sea stars, sand dollars, etc.). Intense public use of the area may have negative affects.	No
National Historic Park: American Camp and English Camp (San Juan County)	NPS	No harvest on park-owned tidelands (except shellfishing allowed at English Camp under WDFW regulations). Together these parks have 7 miles of shoreline that is managed for conservation and cultural preservation.	No

Site Type	Manager	Comments	MPA for derelict gear removal prioritization process
Aquatic Reserves: Cherry Point (Whatcom County), Fidalgo Bay and Cypress Island (Skagit County)	DNR	Commercial lease withdrawal only Indirect benefits occur through increased research and education	yes
San Juan marine preserves: Argyle Lagoon, False Bay, Friday Harbor, Shaw Island, Yellow and Low islands	WDFW/ FHL	Closed to shellfish and bottomfish harvest - WDFW Closed to collection of non-food species, except kelp - FHL Uplands and tidelands owned by UW FHL at some sites	yes
Admiralty Head marine preserve (Island County)	WDFW	Closed to all harvest except sea urchins and sea cucumbers	yes
Keystone Conservation Area (Island County)	WDFW	Closed to all harvest	yes
Edmonds Underwater Park/Brackett's Landing Shoreline Sanctuary (Snohomish County)	City of Edmonds, WDFW	The underwater park is a fully protected marine reserve with no take of any species allowed. The tidelands are withdrawn from leasing.	yes
Padilla Bay National Estuarine Research Reserve (Skagit County)	Ecology	No harvest restrictions associated with the NERR to protect marine life. Some access limitations. Focus is on research and education. Special status as NERR and shoreline of statewide significance.	yes
San Juan National Wildlife Refuge complex: 83 separate sites and 200 yd marine buffer	USFWS	USFWS has no jurisdiction below high water mark but does have an advisory marine buffer of 200 yards to keep boating activity away from the refuge site. Uplands are regulated to keep people away.	yes
Privately held sites: Chuckanut Island, Dabob Bay, Ebey's Landing, Foulweather Bluff, Port Susan Bay, Waldron Island	TNC	The Nature Conservancy has title to the tidelands at these sites as well as ownership of the adjacent uplands. The management goal is for conservation but the organization has no regulatory authority beyond their rights as property owners to prohibit public access.	yes
Privately held sites: Deadman Island, Goose Island, Jack Island, Sentinel Island and Yellow Island	TNC	TNC has either ownership or easements on these upland sites but no title to the adjacent tidelands. Indirect benefits occur from conservation status of the uplands.	yes
Voluntary Bottomfish Recovery Areas: 8 sites (San Juan County)	San Juan MRC	These sites are designated by the San Juan County Board of County Commissioners to discourage fishing for bottomfish. On-the-water education is the primary enforcement tool.	yes
Protection Island Seabird Sanctuary (Jefferson County)	USFWS, DNR, WDFW	Upland areas are managed as seabird sanctuary and protected from development. Bedlands are withdrawn indefinitely from incompatible activities (leasing).	yes
Tongue Point Marine Life Sanctuary (Clallam County)	Clallam County	Tidelands are withdrawn by DNR. Removing intertidal marine life is prohibited.	yes

Table 3. Site type, manager, description of protection measures for those areas found not to be relevant for derelict fishing gear removal prioritization for marine protected areas (MPA) in the Puget Sound region.

The Legacy priority criterion attempts to capture how an area, once the derelict fishing gear is removed, is expected to remain “clean” of future accumulations, as contrasted to an area that

would likely require ongoing maintenance as additional fishing gear is lost in the future. This is primarily a function of whether or not fishing occurs in the area. Point Roberts was cited as an area that may have a low Legacy value at this time because extensive net and pot fishing occurs and gear loss can be expected to continue. However, in some locations where historical fishing gear loss has been high, the accumulation of years of derelict fishing gear may have a significant impact on species and habitat and in some cases may result in additional derelict gear loss (such as crab pot loss from entanglement in derelict nets).

The Committee agreed that derelict fishing gear removal in areas of historically high fishing effort could be beneficial in restoring habitat and reducing species impacts even if future fishing and gear loss is likely to continue. The Committee recognized that in some fisheries (salmon purse seine and gillnet) the fishing effort is greatly reduced from historical levels.

Further, the use of modern navigation and charting equipment in all fisheries has likely reduced the occurrence of fishing gear loss.

Low —The derelict fishing gear is reported from an area where active fishing can be expected to continue in the future and additional gear items are likely to be lost.

High—The derelict fishing gear is reported from areas where fishing effort has diminished or stopped or from areas where future gear loss is unlikely.

The weighting value for the Legacy priority criterion is 0.30, indicating that if a derelict gear report provides either direct evidence of the gear being in an area with a high Legacy factor (little chance of future gear loss) or if, based on the description and location of the gear relative to known fishing areas, a high Legacy value can be assigned, then the value for this criteria would be 0.30.

The Economic priority criterion includes a gain or loss in commercial and recreational fishing and ecotourism.

The Committee agreed that the economic value of derelict fishing gear removal should be considered when prioritizing derelict fishing gear removal, but that until better information on the cost/benefit of derelict gear removal is available, this criterion should have a relatively low influence on removal priority. An analysis of the cost/benefit of derelict gear removal is planned for 2007. The analysis will compare the costs and benefits of habitat restoration from derelict fishing gear removal to other similar habitat restoration projects, such as those required as mitigation for marine construction projects. Additionally, research is being conducted to estimate the annual mortality of species in persistent derelict fishing gear so that estimates of economic loss to commercial and recreational fisheries can be assessed. The economic cost of derelict fishing gear on ecotourism is somewhat more difficult to assess. Recreational diving charter companies have substantiated that some previously popular dive areas have become either less desirable or outright dangerous due to derelict fishing gear (particularly derelict nets). Several of these popular dive sites have been completely cleaned of derelict nets by the NWSC project and are now being used by charter dive operators. However, assessing the economic benefit of this is difficult to estimate. The Committee believed that this criterion might be more useful for

justifying derelict fishing gear removal funding (positive cost/benefit) than for actually ranking individual derelict fishing gear items for removal.

Low —The removal of the derelict fishing gear is unlikely to result in an economic benefit to commercial or recreational fisheries or ecotourism. The derelict gear is not generally of a type (disabled crab or shrimp pots, rope, line, etc.) or configuration that presents a negative impact on species or habitat.

High—The derelict fishing gear removal is likely to result in a direct or indirect economic benefit to commercial or recreational fisheries or ecotourism. The derelict gear is of a type and/or configuration that presents a negative impact on species and/or habitat or there are sufficient amounts of derelict gear to potentially have a localized population level effect.

The weighting value for the Economic priority criterion is 0.29, indicating that if a derelict gear report provides either direct evidence of the potential impact on the economics of recreational or commercial fisheries or on ecotourism, or these impacts can be inferred from the description, location and quantity of the gear relative to known distributions in economically important areas, then the value for this criteria would be 0.29.

The Aesthetics priority criterion attempts to capture where derelict gear is in an area of public proximity and view. It is considered a subjective criterion, but is sometimes identified for removal because of its aesthetic impacts.

While the Committee recognized there is a public affairs issue involved in the removal of derelict fishing gear for a purely aesthetic reason, for the most part aesthetics should be considered the lowest highest priority for removal. However, from a practical standpoint the occurrence of a persistent derelict fishing gear item in a prominent public location may give the perception that public agencies are not taking the derelict fishing gear issue seriously. This may ultimately have a negative impact on the public's support for the derelict fishing gear removal program. The Committee agreed that, where possible, derelict fishing gear with a predominately aesthetic impact should be handled by existing agency resources such as Federal, State or Tribal agencies. If a derelict fishing gear removal project is being conducted in an area where a derelict fishing gear item with a purely aesthetic impact is located, it should be included in the removal efforts.

Low—The derelict fishing gear is unlikely to present an aesthetic impact. The derelict gear is not generally visible to the public or is located in an area not frequented by humans.

High—The derelict fishing gear presents a high level of aesthetic impact. The derelict fishing gear is of a type, size and/or configuration such that it definitely presents an aesthetic impact. This includes gear such as large free flowing or bundled gillnets or purse seine nets in plain view and in an area that is frequently occupied humans, such as a public park, dive park or commonly used area.

The weighting value for the Aesthetics priority criterion is 0.21, indicating that if a derelict gear report provides either direct evidence of the aesthetic impacts or these impacts can be inferred

from the description, location and quantity of the gear relative to known distributions publicly used areas, then the value for this criterion would be 0.21.

Operational Criteria

The Committee identified five Operational criteria. These criteria may be thought of as operational constraints. Rather than trying to rank these, the Committee suggested that each of the Ranked Criteria should be reviewed in light of the Operational criteria.

The Environmental Impact criterion attempts to capture how to balance the benefit of removing derelict fishing gear with any negative environmental impacts associated with the actual removal (crab pots mostly buried in eelgrass, gear in a hazardous waste area, etc.) The current Washington State Derelict Fishing Gear Removal Guidelines have sufficient guidance to determine if a removal operation is likely to result in a negative environmental impact.

The Tribal/Cultural Impacts criterion attempts to capture consideration of derelict fishing gear removals in culturally important areas. It was suggested that there could be situations where a removal operation may bring about positive or negative cultural results. The NWSC currently coordinates derelict fishing gear removal operations with Federal, State, local governments and Tribes. In every removal operation conducted where Tribal derelict fishing gear will be potentially removed or where work will occur in usual and accustomed fishing areas, Tribal agencies are invited to participate. In many cases, derelict fishing gear removal work in culturally sensitive areas is actually conducted by Tribal government personnel. Additionally, the NWSC has undertaken a Tribal diver training program to teach experienced Tribal divers to safely and effectively remove derelict fishing gear with the lowest risk of environmental impact. If Tribal cultural issues related to derelict fishing gear are of concern, the trained Tribal divers should be capable of conducting the removal operations in a manner acceptable to the Tribes.

The Geographic Concentration criterion attempts to capture where there are areas with a high quantity of gear that may magnify the environmental impact as well as increase the efficiency of removal operations. The Committee recognized that although the ranking process may rank derelict fishing gear items relatively low on an individual basis, there are instances of large concentrations of gear items concentrated in a particular location. This can create a cumulative effect of gear impacts that may warrant higher for removal than the priority warranted by individual items. Additionally, areas with high concentrations of derelict fishing gear may result in an improved cost/benefit for a removal operation over a moderately higher-ranked gear item present in low concentration in an area. The Committee agreed that the best approach in considering geographic abundance in derelict fishing gear removal prioritization is to plot known derelict fishing gear distribution by area and highlight those areas with high concentrations for potential elevated priority.

The Cost of Removal criterion is an important consideration, especially when prioritizing limited funds. The location, season, efficiency of removal contractors, removal and disposal methods, and the concentration of gear are all factors in determining costs. The Committee discussed how removal cost could be incorporated into a removal priority process, but agreed that until better

cost/benefit analyses are available, the effect of removal cost on gear removal priority should be a decision of the project removal team.

The Regional Location criterion is another factor to be considered when reviewing the Ranked Criteria. The regions relevant to this project includes the greater Puget Sound and can be divided into North Puget Sound, Straits, San Juan Islands, Central Puget Sound, Hood Canal and South Puget Sound. The Committee had a concern that emphasis on Species and Habitat Impacts for prioritizing derelict fishing gear removal may favor the removal of gear in potential high impact areas such as the San Juan Islands, where numerous species of concern and important habitats are found to the detriment of derelict fishing gear removal in other areas. Some funding for past derelict fishing gear removal operations had area specific requirements such as South and Central Puget Sound. The derelict fishing gear database of known remaining derelict gear items provides the ability to select for gear items in distinct geographic locations. The subset of known gear items in a geographic area can then be ranked for removal priority relative to other gear items in the area. The Committee agreed that some derelict fishing gear removal effort should be allocated regionally and temporally throughout Puget Sound, the Straits and Hood Canal in lieu of a strictly high to low priority removal program.

CRITERIA SCORE EVALUATION AND PRIORITY RANKING

The evaluation of criteria for the overall prioritization of removal and disposal of derelict fishing gear can be subjective depending upon the importance placed on the different impacts of the derelict fishing gear, the difficulty and cost of removal, and the capabilities of a particular removal operation. Ideally, the evaluation of information for assigning values to the Ranked Criteria and evaluating the Operational criteria would be done jointly by the derelict gear database manager (WDFW) and the removal project manager in consultation with Tribal representatives if Tribal aspects are involved. The prioritization criteria described above provide a range of impact factors that can be considered and evaluated against derelict fishing gear removal policies established for a long-term removal program.

Although no formal policies for derelict fishing gear removal have been adopted by the Northwest Straits Commission or the state agencies involved in the pilot derelict gear removal program, some policies are obvious. For example, derelict fishing gear that presents a significant threat to human safety and navigation and is feasible to remove should have the highest priority for removal. Likewise, derelict fishing gear that presents a significant threat to an Endangered, Protected, or Sensitive species should also have a relatively high removal priority. However, determining an overall relative priority for an individual derelict fishing gear item requires an analysis of more than one if not all of the different criteria. For example, an item of derelict fishing gear might threaten an endangered species but be located in an area where it may be impossible to effect a successful removal (for example a derelict gillnet in deep water beyond diver depth capabilities) and therefore, it may be assigned a low removal priority value.

The actual derelict fishing gear selected for removal in any particular removal operation will incorporate a variety of factors described in the prioritization criteria as well as other operational factors including the location of the removal operation, the capabilities of the removal and

disposal team, the region of interest, etc. A beach removal operation may target several low priority derelict fishing gears simply because of the limited operational capabilities of the removal team and the desire to confine the activity to a localized area. A full experienced, professional dive removal team with support vessels may select higher priority derelict fishing gear that is more difficult to remove. The following guidelines provide a suggested approach to evaluating the importance of the different removal and disposal criteria.

An approach to evaluating the relative importance of the derelict fishing gear removal criteria is to separate the criteria into two groups: those criteria describing impacts to humans, biota and habitat (the seven Ranked Criteria and those criteria describing logistics and policies of removal and disposal (the five Operational Criteria). The evaluation of the first group of criteria involves assessing the degree of threat presented by the derelict fishing gear and the evaluation of the second group of criteria involves assessing the difficulty, impact and cost of removing the derelict fishing gear. The greater the degree that the threat to humans, biota and habitat from the derelict fishing gear exceeds the difficulty, impact and/or cost of removal, the higher the priority of removal and disposal.

Reviewing the existing 4,000+ reports of derelict fishing gear in the NWSC/WDFW derelict gear database shows that less than 10% of the reports provide sufficient detailed information to evaluate the Ranked or Operational criteria. Reports from agency scientists and reports from targeted survey efforts provide most of the information necessary to directly evaluate a majority of the Ranked and Operational criteria. However, reports from individual citizens rarely provide more than the location and type of the derelict fishing gear. Additionally, not all of the seven Ranked and five Operational priority evaluation criteria developed by the Committee are directly referenced in the WDFW reporting system but must instead be inferred from reports of habitat type, species entangled and descriptions of how the derelict fishing gear is ensnared. It may be advisable to consider reformatting the WDFW derelict fishing gear reporting form to include evaluations of each of the seven Ranked Criteria.

It may be possible to use a geographic information system (GIS) approach to infer values for the some of the Ranked priority criteria, as described above under the description of individual criteria. If accurate information on the location (latitude and longitude) and type of derelict fishing gear is available from the reporting system, the location of the gear can be identified via GIS data. The presence or absence of a threat from the gear based upon these criteria can then be inferred using GIS layers of information on important species distribution, critical and sensitive habitats, protected areas and fishing areas. Where actual information is reported that can be used to evaluate the Ranked Criteria the GIS system would defer to the reported information.

Using this technique, values for the more important Ranked Criteria can be generated and an overall rank priority score for the gear item assigned by summing the weighted scores over all the Ranked Criteria. For example, a derelict gear report might include accurate information on the location of the gear that places it in subtidal waters on the south side of Lopez Island, identifies the gear as a gillnet and reports the sighting of a dead marine mammal near the surface. The ranking system would generate a positive score, 1.0, for the Species Impacts criteria and for Lethality, 0.63, from the report of the dead marine mammal entanglement. The location of the derelict gear would be evaluated by the GIS system might then determine the gear is located

within an area of critical and/or sensitive habitat, generating a weighted score of 0.46 for Habitat Impacts criteria, and is in or near an MPA, generating a weighted score of 0.41 for the Protected Areas criteria.

Although there might not be enough information to generate scores for the Legacy, Economics or Aesthetics criteria, the overall rank score of 2.5 would be generated from a combination of the reported and GIS-inferred criteria values. The ranking system could also indicate which priority ranking criteria were directly evaluated from the gear report information and which were inferred from the GIS system. Under the proposed weighted value system for the Ranked Criteria, the maximum rank (highest priority) value for an individual item of gear would be 3.31.

Using the above hypothetical gear report, the evaluators might assess the Environmental Impact as low based on the experience of previous removal operations in the area, the Tribal/Cultural impacts as low since the gear is in a common use area, the Geographic Concentration as high since many other derelict nets are reported in the area, and the Cost of removal as moderate based on previous removal work. The overall assessment of the Operational criteria would not indicate any significant limitations to removal of the gear item. However, if one of the Operational criteria presented a potential impediment to removal, such as a potential environmental impact or Tribal/cultural impact, the derelict gear item would be flagged under those criteria for further evaluation prior to removal. Figure 1 provides a hypothetical flow chart of evaluation and priority ranking process.

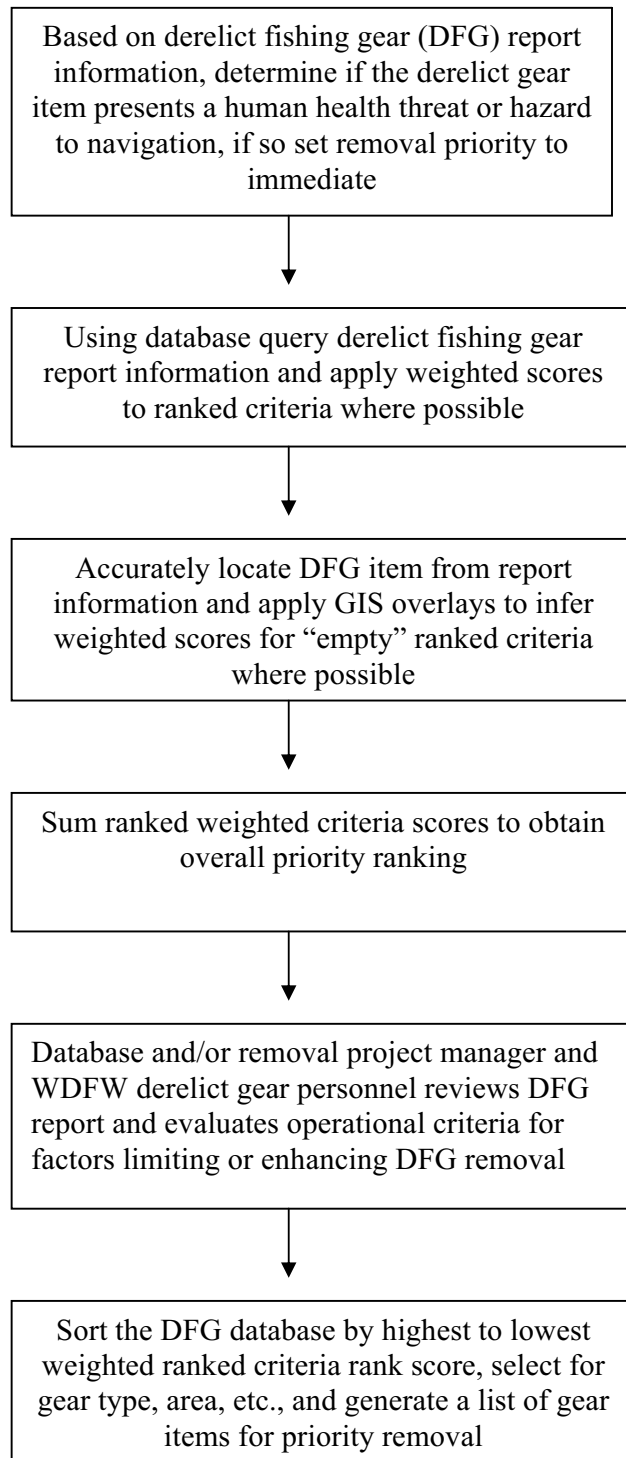


Figure 1: Flow chart of Ranked and Operational priority criteria evaluation and priority ranking of derelict fishing gear.

Based on the Ranked and Operational priority criteria recommended by the Committee, and the proposed weighted rank scoring and GIS inference process, the following is a description of how individual derelict gear items are likely to be prioritized.

Highest Removal Priority

In most cases, a combination of analyses of several criteria will be necessary to establish an overall removal priority. The severity of the threats to humans, biota and habitat from the derelict fishing gear will be compared to the difficulty, cost and environmental impacts of removal. The highest removal priority should be applied to those derelict fishing gears that offer a high level of threat to human safety, navigation, species listed as Endangered, Protected or Species of Concern, and on critical or sensitive habitats that do not have impossible removal logistics or overwhelming environmental impacts of removal.

The following criteria and rankings within criteria would constitute the highest removal priority.

Impacts to Humans, Biota and Habitat

- Threat to human safety—High, and/or
- Hazard to navigation—High, and/or
- Threat to endangered, protected or species of concern—High, and/or
- Threat of lethality —High, and/or
- Impact on sensitive habitat—High; and

Removal Logistics

- Environmental impact of removal—Low, and
- Feasibility of removal—Possible, and
- Tribal/Cultural Impacts—Low, and
- Cost of removal—Average.

Low Removal Priority

Derelict fishing gear that presents a low removal priority would include gear with low ranks for impacts to humans, biota and habitat criteria, where the derelict fishing gear may be difficult and/or expensive, and/or where environmental impacts or Tribal/cultural impacts may preclude removal.

Logistics of removal may be the determining factor in assigning a low removal priority to a specific item of derelict fishing gear. If a determination is made that the reported and verified derelict fishing gear is impossible to remove given current technology, the gear would maintain its removal priority based on the Ranked Criteria but the infeasibility of removal would be noted. Likewise, if it is determined while assessing the Environmental Impact of Removal criteria that the derelict fishing gear is located in an area where removal would disturb hazardous substances in the sediment requiring state and/or federal permits or other agency permission beyond that covered by the derelict fishing gear removal program policies, then the derelict fishing gear would be assigned a hazardous rating under the Environmental Impact criteria.

The following criteria and rankings within criteria would constitute a low removal priority.

Impacts to Humans, Biota and Habitat

- Threat to human safety—Low, and
- Hazard to navigation—Low, and
- Threat to endangered, protected or species of concern—Low, and
- Lethality—Low, and
- Threat to critical or sensitive habitat—Low, and
- Legacy—Low; and

Removal Logistics

- Tribal/Cultural Impacts—High, or
- Environmental impact of removal—High, or
- Feasibility or Cost of removal—Impossible.

FURTHER WORK

With the Committee's concurrence, the NWSC and NRC will develop the database query and GIS inference systems and apply them to the existing derelict gear database to test the accuracy of the priority ranking process.

Several analyses of the priority ranking process can be conducted. A blind test of the priority ranking process can be conducted on derelict gear items that have already been removed and where original lost gear reports are available. Since the derelict gear items have already been removed, the gear and impact databases provide actual observed information about the impacts of this gear on species and habitats. The priority ranks from the priority ranking process can be compared to the known impacts from these gear items to determine if the gear items with the highest priority ranks had the greatest impacts on the Ranked Criteria.

Additionally, all the gear items in the derelict gear database can be ranked by the Ranked and Operational criteria process and the distribution of ranks assessed. Ideally, the priority scores should range throughout nearly the entire high and low scoring range possible and gears with limiting factors for removal should be generated.