NRC
NATURAL RESOURCES CONSULTANTS, INC.

1900 W. NICKERSON, SUITE 207
SEATTLE, WASHINGTON 98119-1650, U.S.A.
TELEPHONE: (206) 285-3480
TELEFAX: (206) 283-8263
E-Mail : jjune@nrccorp.com
Web: http://www.nrccorp.com

NORTHWEST STRAITS INITIATIVE DERELICT FISHING GEAR REMOVAL PROJECT

FINAL REPORT

DERELICT FISHING GEAR REMOVAL PRIORITY DEVELOPMENT

Prepared by:

Natural Resources Consultants, Inc.

June 5, 2007

ACKNOWLEDGEMENTS

This report was prepared for the Northwest Straits Marine Conservation Foundation. Project funding was provided by the Russell Family Foundation, the Puget Sound Action Team, and the United States Fish and Wildlife Service Coastal Program.

The following persons contributed their time and expertise as members of the project advisory committee:

Greg Bargmann, Washington Department of Fish and Wildlife
Wayne Palsson, Washington Department of Fish and Wildlife
Rich Doenges, Washington Department of Natural Resources
Tom Good, National Oceanic and Atmospheric Administration
Kevin Ryan, United States Fish and Wildlife Service
Nick Jones, Puget Sound Gillnetters Association
Ginny Broadhurst, Northwest Straits Commission
Kit Rawson, The Tulalip Tribes and Northwest Indian Fisheries Commission

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 Criteria	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
									Maximum Weighted Score	3.31

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 were 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
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 activites (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.

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

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 were 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 eco-tourism, 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.

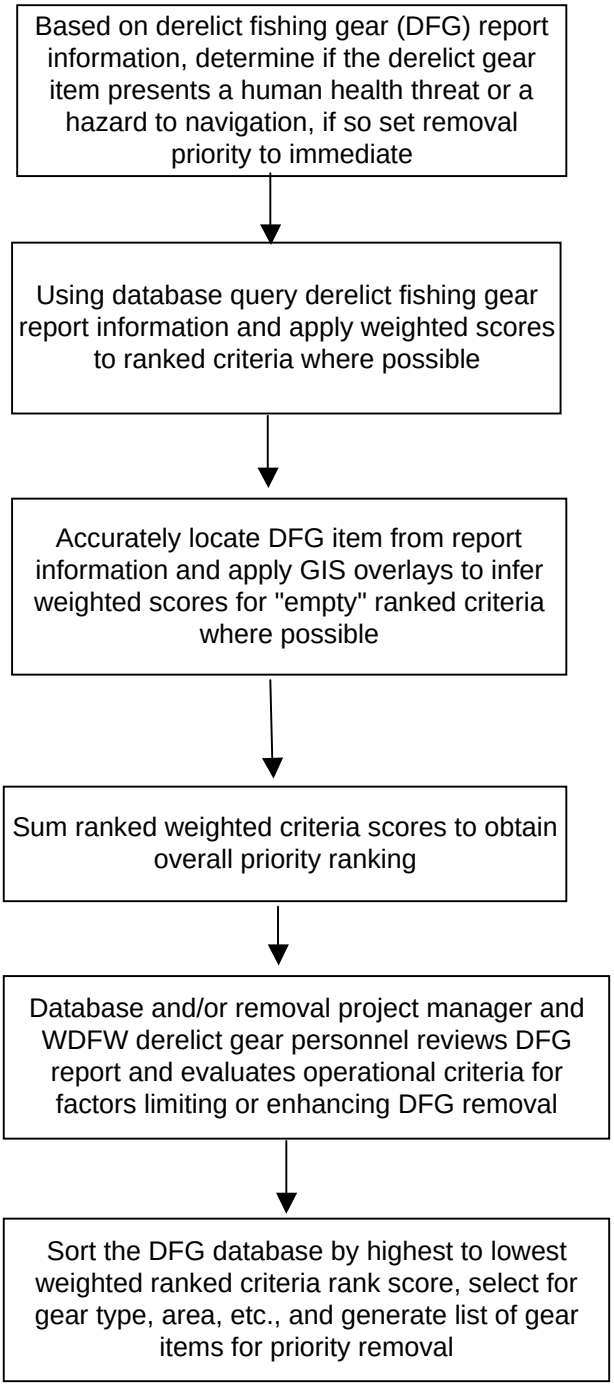

Figure 1: Flow chart of Ranked and Operational priority criteria evaluation and priority ranking of derelict fishing gear.

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.