Derelict Fishing Gear Removal in Puget Sound
Expanded Narrative to final progress report
Award #NA09NMF4630322
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Executive Summary

The project employed about 50 people full and part time for an average of 15 new and retained full-time equivalent positions. Jobs included boat captains, divers, biologist, information technology specialists, and consultants. A total of 2,493 derelict fishing nets were removed from Puget Sound. This number represents about 80% of the known and estimated number of derelict fishing nets in high priority shallow sub-tidal habitats in Puget Sound. Observed species impacts included entanglement and death of 139,365 animals representing 185 unique species, including mammals, birds, fish and invertebrates. Estimated annual mortality from these nets reached 1.5 million animals, including 316 mammals and thousands of birds and fish. Two hundred thirty two acres of marine habitat were restored by removing these derelict nets. A new survey technique using 300 kHz sidescan sonar technology was developed during the project, enabling more accurate surveys for derelict nets. Reaccumulation of derelict nets was estimated at 13-26 nets per year. The statewide derelict fishing gear database and reporting system were updated and refined during this project. The database was migrated to a web-based platform, allowing greater access. The reporting system allows reporting by phone and internet and seamlessly transfers all reports to the field project manager for verification and input into the database. Outreach focused on increasing reporting of lost gear, as well as improving management decisions and building support for continued removal of derelict fishing gear.

Background

The Northwest Straits Initiative has a comprehensive derelict fishing gear program that addresses the problem of derelict fishing gear in Puget Sound, Washington with a three-pronged approach: removals, research, and prevention. The problem of derelict fishing gear was identified by the Initiative in 1999. Since then, the Initiative worked cooperatively with a number of partners to develop state-approved removal protocols, a no-fault reporting system for lost or found gear, data collection procedures, a database management system, and education and outreach aimed at raising awareness about the problem as well as prevention. The Initiative completed a strategic prioritization process to focus limited resources and conducted several research projects aimed at quantifying impacts of derelict gear on the marine ecosystem. Much of this effort was carried out by the Northwest Straits Foundation, the non-profit arm of the Northwest Straits Initiative. These research and priority setting efforts were carried out concurrently with aggressive removal operations.

American Recovery and Reinvestment Act (ARRA) funding for this project was awarded to the Foundation in July, 2009. At that time, the Initiative had already removed more than 1,300

derelict fishing nets from Puget Sound and published research had documented the devastating impacts this derelict gear was having on important marine species and habitats. ARRA funding enabled the Initiative's removal program to grow from one vessel operating part time to four removal vessels operating full time as weather permitted.

Jobs

Natural Resources Consultants, Inc. (NRC) was chosen as field project manager at the start of the project. NRC was responsible for sub-contracting and coordinating removal and survey operations for the duration of the project, as well as assisting with the refinement of the statewide derelict fishing gear database and reporting. NRC hired onboard biologists and a database technician to support the project.

NRC sub-contracted four removal vessels to complete the field work: F/V Betsea, captained by Doug Monk; the R/V Surveyor II captained by Crayton Fenn; the F/V Twila Dawn, directed by Nisqually Aquatic Technologies; and the F/V Tenacious, captained by Brian Santman. The Bet-Sea and the Surveyor conducted diver or drop camera surveys as well as removal operations. The Surveyor conducted the sidescan sonar surveys. The removal vessels employed captains, divers, deckhands, crane operators, waste haulers, mechanics, and administrative support.

Willamette Consulting, Inc. was selected to complete the database and reporting system updates and refinements. Tom Cowan, of Tom Cowan Consulting, was hired as project manager. Joan Drinkwin, was retained to manage the grant and contracts, coordinate with NOAA, and complete all reporting. The Foundation hired a program assistant to support the project. The Foundation also used the services of a graphic designer, computer maintenance specialist, and an accountant during the course of the project.

In all, about fifty people were employed full and part time on this project during its duration. Workers included divers, boat captains, deck hands, biologists, crane operators, waste haulers, mechanics, graphic designers, bookkeepers, administrative assistants, accountants, information technology contractors, environmental consultants, and an employee of the Northwest Straits Foundation.

Significant non-matching in-kind services were provided by staff of the Northwest Straits Commission. The Commission provided all bookkeeping services to the Foundation and the Director of the Commission, Ginny Broadhurst, provided overall project oversight.

In our project proposal, we estimated the total number of hours that would be worked for the duration of the project. We estimated that 123,717 hours would be expended during 18 months of the project, assuming a July 1, 2009 start date. Estimated hours equaled 40 full time equivalent (FTE) jobs. Project costs were estimated at $4,795,369, including $200,000 of non-

federal matching funds. Costs estimates were based on a daily removal rate that would not change regardless of the number of individuals working on the removal vessels.

These estimates proved significantly higher than actual hours expended. We documented 42,500 hours expended over the life of the project. Project costs were very close to estimates. Hours were significantly less because we over-estimated the number of divers that would be employed during the project. By over-estimating the number of divers needed, but not adjusting the costs for daily removal rates, we under-estimated the hourly rates for divers and captains in our original cost projections. Initial estimated rates were about $32/hour, much less than actual prevailing wages, which ranged from $50-$62.50/hour. We also only worked for about 17 months, with a July 28, 2009 start date instead of the initially expected 18 month project duration. Daily vessel survey and removal rates remained constant and as predicted throughout the project.

Removal results

We removed 2,493 derelict fishing nets: 1,899 from the San Juan Islands and North Puget Sound; 557 from Central and South Puget Sound and Hood Canal; and 37 from the Strait of Juan de Fuca. Budget savings in some areas allowed us to increase the number of removal and survey days we accomplished during the project. We completed 783.5 removal days: 33.5 more than planned. See Maps 1, 2, and 3 for locations of nets removed during the ARRA project and since removals began in 2002.

Our original removal goals of 3,000 nets and the companion goals of removing approximately four nets per removal day and restoring 645 acres of habitat, were based on five years of removal experience that was focused in areas with a high density of derelict nets, such as around the west side of San Juan Island. During that time, we averaged removal rates of 4.0 nets per day and restored about 0.22 acres of habitat per net removed, or 0.86 acres restored per removal day.

Because this project focused on some high priority areas that were not as densely covered with derelict nets as pre-2007 removal areas, we found fewer nets/acre in these areas. In addition, because we focused on completely cleaning all removal areas of derelict nets, we spent much more time in areas picking up smaller nets that were more widely dispersed. This resulted in a lower average net per day removal rate and a lower acre of habitat per net recovery average. For this project, we averaged 3.18 nets/removal day, restoring 0.09 acres of habitat/net removed for an average of 0.30 acres restored/removal day (see Table 1).

Table 1. Projected and actual numbers of nets removed and acres restored

	Pre-ARRA	ARRA estimate	ARRA actual
Nets removed /removal day	4.0	4.0	3.18
Acres restored/net removed	0.22	0.22	0.09
Acres restored/removal day	0.86	0.86	0.30

Estimated tonnage of debris removed was also based on earlier averages, with the project total coming in a bit lower than expected for the reasons stated above. A total 161.8 metric tons of derelict fishing gear was removed during the project, 12.94 tons of which was lead line that was recycled, instead of disposed of in landfills. Recycling of this lead waste was initiated part way through the project after our removal divers developed a method to remove lead lines from the recovered gillnets.

Defining 90% of High Priority Areas

Our project performance measures, or goals, included removing 90% of legacy derelict fishing nets from high priority areas in Puget Sound. The definition of high priority areas at the time of our proposal was based on a 2007 priority ranking project we completed to prioritize our removal efforts and estimate the number of nets left in Puget Sound.[1] During the first six months of this ARRA project, we spent time in consultations with our NOAA technical monitors and program managers to refine our definition of high priority areas and to determine the best way to document percent removal of legacy nets in Puget Sound.

As a result of those consultations, we refined our definition of high priority areas to include coastal reaches throughout Puget Sound where high relief bottom substrate likely to snag nets coincides with areas of present and historic high gillnet fishing effort. These high priority areas make up about 628 miles of Puget Sound's 2,500 miles of shoreline, or 25% of Puget Sound. Most of our survey and removal efforts prior to July 28, 2009 also focused in these high priority areas. Map 4 shows these high priority areas as defined.

During this project, our intent was to complete surveys of 100% of these high priority areas for derelict nets and remove as many of the nets we found, as funding allowed. While we did not manage to survey 100% of the high priority areas by December 31, 2010, we have since completed those surveys with other funding. So, currently, 100% of the high priority shallow

[1] Northwest Straits Marine Conservation Initiative. 2007. Derelict Fishing Gear Priority Ranking Project. http://www.nwstraits.org/uploadBibliography/PriorityRankingReport-041808.pdf

sub-tidal areas have been surveyed for derelict fishing nets. Remaining known and estimated derelict nets are discussed below.

In 2007 we set a goal to remove 90% of derelict fishing nets from Puget Sound by 2012. Articulating this goal was an important step for our program and allowed us to plan for an end point to the problem of derelict fishing gear in Puget Sound. Initially, the removal percent chosen was an educated assumption that not all nets could be removed because of costs, depth, or logistics. We included this goal in the ARRA project proposal. When we were awarded ARRA funding, we worked to provide a clearer basis for this goal.

After consultation with NOAA partners, we decided to revise our estimate of total nets lost in high priority areas and develop a more realistic removal goal based on that estimate. We have removed 3,860 nets from these areas, including the 2,493 nets removed during this project. By completing all surveys of high priority areas, we have a firm estimate of how many legacy nets remain derelict in those areas, as well as known numbers of nets already removed. The removed and remaining nets equal a reasonable estimate of total lost nets, or total historical accumulation in shallow sub-tidal waters to 105 feet in depth. This total number is 4,813 nets (3,860 removed plus 953 remaining nets). Total removed nets account for 80.0% of all known and estimated nets lost. To reach our 90% removal goal, we must remove 4,331 nets, or an additional 471 derelict nets.

Survey Developments and results

During this project reporting period, we refined our survey technique. Our previous surveying method was to use a drop camera towed by the survey vessel or have divers conduct seabed sweeps looking for derelict nets. Coordinates of nets were noted and divers verified their locations. These survey techniques have limitations and cannot cover more than about 30 (drop camera) to 300 (diver) feet of area all around the survey vessel.

During this project, sub-contractor Fenn Enterprises perfected an improved surveying technique using both 300 kHz and 600 kHz sidescan sonar. The new technique provides a range of 'visibility' from the water surface to a depth of about 105' with a width of about 50 to 100 meters on each side of a survey vessel. This new technique detects geologic obstacles on the seabed likely to snag lost fishing nets and other objects or line likely to be nets. These geologic obstacles and objects that may be nets or lines are marked as 'targets,' and their depth and coordinates are noted. Diver verification confirmed that 25% of the geologic obstacles and 68% of the net or line objects in high priority areas do indeed represent derelict nets. For the targets where derelict nets were found, we often found more than one net. Identified net or line targets resulted in 1.3 derelict nets found per target location and overall geologic targets resulted in 0.3

derelict nets per found target investigated. Figure 1 shows an example of the images produced using this method.

This new survey technique was used to survey almost all of the project's high priority areas, with two notable exceptions. The first exception was vertical rock faces, such as those found in some of the high priority project areas, where sonar energy is so strongly reflected that derelict nets cannot be detected using sonar. Geologic features such as fissures and cracks on these rock faces that resemble nets or lines add difficulty in identifying targets. In these areas, previous survey methods using drop cameras and divers were used to locate derelict nets. The second exception was flat, featureless sand, mud or gravel habitat where information from previous diver or camera surveys and removals showed extremely low concentrations of derelict gear. Estimating the extent of derelict nets in these areas relied on previous surveys and gear removal operations.

Project survey days totaled 81.5 or 6.5 more days than initially planned. Surveys covered 819 miles. Some sidescan sonar surveys re-surveyed areas previously surveyed using drop camera methods to assure all nets had been detected. Weather impaired surveys during the final project month, so there remained about 35 shoreline miles left to survey in identified high priority areas after December 31, 2010. Non-ARRA funding was used to complete those surveys in March, 2011. Maps 5 and 6 show locations of surveyed areas and remaining areas left to survey after project completion.

We now estimate that 953 derelict nets remain in high priority shallow sub-tidal waters of Puget Sound. At the conclusion of this project (December 31, 2010), our estimate was 934 nets remaining.

Species impacts

One hundred eighty-five unique marine species were found entangled in the removed nets. A total of 139,365 animals were found. See attached photos of multi-species impacts of derelict gear. Table 6 lists the species and numbers of animals found dead and alive.

Researchers at UC Davis developed a catch rate model using our data to estimate annual impacts of derelict fishing nets. This model factors in rates of carcasses, bones, and shells dropping out of the net upon removal (17%) as well as the rate at which animals decompose, are scavenged, or are swept away (7-14 days).[2] Using this model, we can estimate that the 2,493 nets removed during this project were entangling more than 1.5 million animals every year, including more than 300 mammals, 4,000 birds, and 21,000 fish. This unseen mortality has occurred every year

[2] Gilardi, K.V.K., D. Carlson-Bremer, J.A. June, K. Antonelis, G. Broadhurst, and T. Cowan. 2009. Marine species mortality in derelict fishing nets in Puget Sound, WA and the cost/benefits of derelict net removal. *Marine Pollution Bulletin*. doi: 10.1016/j.marpolbul.2009.10.016.

since the nets were lost, in some cases over 30 years, but has now been eliminated forever. Table 2 shows the estimated impacts of these 2,493 derelict nets over time.

Table 2. Animals entangled in 2,493 nets per unit of time

Animal Group	Catch/day	Catch/year	Example of animals found
Marine Mammals	0.87	316	Harbor porpoise, river otter, harbor seal
Birds	11.03	4,025	Cormorants, murre, bufflehead, grebe
Fish	59.06	21,558	Canary rockfish, salmon, lingcod, skate
Invertebrates	4,078.26	1,488,565	Dungeness crab, octopus, abalone
Total	**4,149.22**	**1,514,464**	

These estimates are alarming, especially because so many species of seabirds in Puget Sound are in serious decline. Thirteen of 18 marine diving bird populations have shown significant losses in the past 20 years.[3] Many of the bird species, as well as other species found in derelict gear are species of concern in the United States, Washington State, Canada, or British Columbia. Species of concern found dead during this project include: harbor porpoise; pelagic, and Brandt's cormorant; white sturgeon and canary, black, copper, China, yellowtail, and quillback rockfish, and northern abalone.[4] Table 5 shows the observed impacts.

Table 5 also shows that all mammals and birds found in the removed nets were dead, while some fish and invertebrates were still alive. Fish found alive are usually so entangled that it is unlikely they would be able to free themselves from the net. Therefore, even live fish are included when predicting long-term impacts of the nets. Some invertebrates, however, such as sunflower stars, do scavenge other animals killed in the nets and are unlikely to be killed by the nets themselves. These animals are not included when predicting long-term impacts of the nets.

Twelve mammals were found dead in nets during the project period. With the exception of one net in the San Juan Islands which had two mammals found in it, all nets with mammal impacts contained just one mammal. In South Puget Sound, 0.9% of the 557 nets removed impacted mammals (five mammals found in five nets removed). In North Puget Sound and the San Juan Islands, 0.3% of the 1,899 nets removed were found to be impacting mammals (seven mammals found in 6 nets). Juvenile harbor seals seem particularly vulnerable. Map 7 shows the distribution of removed nets found with mammal impacts.

[3] Puget Sound Action Team. 2002. *Puget Sound's Health Report*.
[4] Brown, Nicolas A., and Joe K. Gaydos. 2007. Species of Concern within the Georgia Basin Puget Sound Marine Ecosystem: changes from 2002 to 2006. *Proceedings of the 2007 Georgia Basin Puget Sound Research Conference*. pp. 6-10.

Bird impacts were concentrated in northern Puget Sound and the San Juan Islands during this project. Most nets with bird impacts had from one to ten birds in them, with an average of 1.5 birds per net with bird impacts. Of the 1,899 nets removed from North Puget Sound and the San Juan Islands, 6.1% had dead birds in them (123 birds in 116 nets). In Central and South Puget Sound, 4.7% had birds in them (26 birds in 26 nets). Map 8 shows the distribution of removed nets found with bird impacts.

Fish impacts were also higher in North Puget Sound and the San Juan Islands. Of the nets removed in the north, 21.8% had fish in them upon removal (628 fish in 414 nets). In the south, 17% had fish in them (126 fish found in 95 nets). One canary rockfish, a species listed as threatened under the federal Endangered Species Act, was found dead in a net off San Juan Island. Map 9 shows the distribution of removed nets found with fish impacts.

Rockfish impacts observed are of particular interest due to the declining populations of a number of rockfish species in Puget Sound. Derelict fishing gear is identified as a high likely stressor to rockfish populations by the Washington Department of Fish and Wildlife, both in shallow and deepwater habitats.[5][6] Eight species of rockfish were observed in removed nets during this project. Rockfish made up 6.5% of all fish observed in nets. Table 3 shows rockfish impacts.

Table 3. Rockfish impacts observed in 2,493 removed derelict nets

Common Name	Scientific name	Sum Number of Dead	Sum Number of Alive	Total
black rockfish	*Sebastes melanops*	5	3	8
canary rockfish	*Sebastes pinniger*	1	0	1
China rockfish	*Sebastes nebulosus*	0	1	1
copper rockfish	*Sebastes caurinus*	4	2	6
kelp rockfish	*Sebastes atrovirens*	1	0	1
Puget Sound rockfish	*Sebastes emphaeus*	0	2	2
quillback rockfish	*Sebastes maliger*	18	8	26
rockfish unid.	*Scorpaenidae sp.*	1	0	1
rockfish unid.	*Sebastes sp.*	2	0	2
yellowtail rockfish	*Sebastes flavidus*	1	0	1
	Total	**33**	**16**	**49**

[5] Palsson, W.A., Tsou, T-S., Bargmann, G.G.,Buckley, R.M., West, J.E., Mills, M., Cheng, Y., and Pacunski, R.E. 2009. The biology and assessment of rockfishes in Puget Sound. Washington. Washington Department of Fish and Wildlife publication.

[6] Washington Department of Fish and Wildlife. 2009. Draft EIS for the Puget Sound Rockfish Conservation Plan.

Habitat impacts

The 2,493 nets removed during this project were removed from a variety of habitat types, including high and low relief rocky substrate. Nets were covering and degrading a total of 232.2 acres of marine habitat. Many of the nets removed were located in known distribution areas for canary, yelloweye, and bocaccio rockfish, all recently listed under the federal Endangered Species Act. Many were removed from known salmon migration corridors as well as federally designated Essential Fish Habitat. In the San Juan Islands, derelict nets were removed from waters around the islands that comprise the U.S. Fish and Wildlife Service Washington Maritime National Wildlife Refuge. Table 4 shows acres of marine habitat restored by type.

Table 4. Acreage of habitat restored by type

Habitat Type	Total Habitat Area (sq ft) Recovered	Total Habitat Area (acres) Recovered
boulders on sand/mud/gravel	3,392,294	77.88
high-relief rocky substrate	1,522,973	34.96
low-relief rocky substrate	3,277,067	75.23
mud/sand/gravel/vegetation	1,693,178	38.87
underwater obstructions	224,365	5.15
aquatic vegetation	6,000	0.14
Total	**10,115,877**	**232.23**

Removal of derelict fishing nets allows for natural regeneration and species recruitment and restores the full service benefits of marine habitat. A post-removal monitoring project to assess the rate of recovery of marine habitats after derelict net removals showed that marine habitat dominated by kelp achieved 90% recovery over one growing season through natural processes.[7]

Reaccumulation

Early on in the project, the question of reaccumulation of newly lost nets was raised. How many nets are lost each year and reaccumulating as derelict nets? This is an important question as we anticipate a point in time when all legacy nets will be removed and as we develop a maintenance program to remove newly lost nets. We define reaccumulation as loss without removal. In other words, a lost net that is reported and removed will not reaccumulate.

[7] Northwest Straits Marine Conservation Initiative. 2009. *Marine Habitat Recovery of Five Derelict Gear Removal Sites in Puget Sound*. http://www.nwstraits.org/uploadBibliography/Marine%20Habitat%20Recovery%20Monitoring%20report.pdf.

We approached the question of reaccumulation rates in two ways. First, we looked at whether we could document reaccumulation in the field by resurveying areas that had been cleaned of nets. Second, we looked at determining reaccumulation rates by analyzing the rate of loss of nets by active fishermen using fishing effort data and reports of lost nets.

We employed our sidescan sonar methodology to resurvey a number of areas that had been surveyed before using our former method of drop camera followed by diver verification. Nets found during previous surveys had been removed, so we were investigating whether we could document accumulations of newly lost nets in those areas. We concentrated these follow-up surveys at Hein Bank, Lawson Reef, Alden Bank, areas west of San Juan Island and in Hood Canal. In all, a total of 179 miles of shoreline that had already been surveyed and cleaned of nets were resurveyed using sidescan sonar. See Maps 5 and 6 to see areas resurveyed.

Sidescan sonar surveys did indeed find derelict nets at sites where removals had been completed. For example, many nets were found on Hein Bank and a few nets or leadlines with scraps of nets were found on the west side of Lawson Reef. After overlaying coordinates of new targets onto known locations of previously surveyed areas, it became apparent that the nets detected by the sidescan sonar were not newly lost nets, but were legacy nets that had not been detected using the previous diver or drop camera survey methods. In fact, none of the newly identified nets or targets could be identified as newly lost nets with any degree of confidence.

This is not surprising for a number of reasons. First, we already knew that our previous survey methods may have missed nets and that our new sidescan sonar method was more comprehensive and accurate. Second, barely one fishing season had passed since many of these areas had been cleaned of derelict nets, so reaccumulation of nets would be difficult to document in that short time period.

That is not to say that we cannot be certain that nets are being lost during active fishing. Crews did have occasion to document a newly lost net at Lawson Reef. During a removal operation, they witnessed a fishermen struggle with a net, finally cut it loose, and leave the area without reporting the loss. The crew immediately went over to the area and removed that newly lost net. In addition, during this project our program received reports of 12 newly lost nets. Of those 12, four were found and removed, six were investigated but not found, one was reported to and removed by tribal enforcement, and one was not investigated due to logistics and low priority based on description. In addition, our crews removed two additional nets that they determined had been newly lost, based on their location and condition. Nevertheless, field observations were not adequate to estimate the rate of net loss or reaccumulation.

Attempting to estimate reaccumulation using fishing effort data and other variables was more effective but not wholly satisfying in terms of accuracy. When our program began in 2002, we interviewed net fishermen about net loss and developed an educated estimate that 3% - 5% of non-treaty gillnet fishermen lose a whole or partial net each year. Our data shows that of the derelict nets removed, 95.2% were gillnets, 3.3% were purse seine, 1.3% aquaculture nets and 0.2% trawl nets. For the purse seine fishery in Puget Sound, we used an arbitrary number of 1% - 3%, based our knowledge that fewer nets are lost and fishermen make greater effort to retrieve their own lost nets because of their cost. Our estimates assume the same loss rate for treaty fishermen as non-treaty fishermen.

Starting in 1968, we have fishing pressure data from the Washington Department of Fish and Wildlife, documenting how many non-treaty fishing vessels were active during a season. We doubled that number to account for treaty fishing vessels. With that data we can estimate how many nets were lost each season thereafter by applying the 3%-5% nets lost per year estimate to the number of vessels active during each year. Applying this method back to 1968 yields a low estimate of 2,633 and a high estimate of 4,559 lost nets (gillnets and purse seine) since 1968. Table 6 shows fishing fleet data and percent loss rates used to develop these estimates.

Given the amount of gillnet fishing effort in recent years (2010 was unusually high effort due to the large Fraser River sockeye run), we estimate that 20 to 33 gillnets will be lost each year. We have information from 2003-2009 on how many nets were reported. Since 2003, 35 nets reported by the public have been newly lost nets for an average of seven newly lost nets reported each year. Assuming that all newly lost nets reported can be removed yields an estimate of 13 to 26 newly lost nets reaccumulating each year in Puget Sound. This reaccumulation of derelict nets will persist until fishermen report all lost gear and funding is available for immediate removal. Since 2005, only one commercial gillnet fisherman has reported a lost net on the Initiative's reporting system.

Database and Reporting

The upgrade and refinement of the statewide derelict fishing gear database and reporting system was completed. The database was transferred to a Structured Query Language platform with an Access database front end design. The reporting system was updated to allow for efficient and prompt reporting of lost gear by fishermen as well as reporting of gear encountered in the field by others, such as recreational divers. Launch date for the updated systems was February 8, 2010. We coordinated with Washington Department of Fish and Wildlife (WDFW) for this work. We also coordinated with Puget Sound tribes to ensure that treaty fishermen have the choice of reporting gear through the Northwest Straits Initiative as well as through WDFW.

The update and refinement of the statewide derelict fishing gear reporting system and database now allows researchers and resource managers easy access to real-time data on gear removed and impacts. It is accessible online to those with permission, including researchers and resource managers. It allows easy querying of the data for information related to number of gear reports, location of removed gear, species impacts, etc. It also allows for data downloads to Excel spreadsheets for data manipulation and to Geographic Information System databases. This has expanded the ability of a variety of users to extract information from the database for both resource management and research purposes.

The reporting system was updated so reports can be made by phone or the Internet. Web-based reporting is available via the WDFW and Initiative websites. Reports made through the WDFW site are now seamlessly transferred to the Initiative site. A link to our web-based reporting site was also installed on the website of the Northwest Indian Fisheries Commission. Phone reports can be made to WDFW or the Initiative and are entered into the online system by staff taking the reports. All web-based reports are forwarded to our Field Project Manager for verification before being added to the database.

Outreach

Project outreach had three key goals: to increase reporting of lost and found fishing gear by fishermen and the public; to improve management of marine resources by informing decision makers and resource managers about the impacts of derelict fishing gear; and to inform user groups and the general public about the impacts of derelict fishing gear and the benefits of removing it.

First, to increase reporting by fishermen and the general public, we developed a suite of outreach materials for distribution at events and through mailings. Rack cards, wallet-sized cards, and small stickers were developed to advertise the reporting system. Materials were mailed out to licensed non-treaty gillnetters and licensed harvest divers. Project staff met with representatives of several Puget Sound tribes to promote reporting among treaty fishermen. Advertisements and articles were also placed in NW Dive News recreational dive magazine. Project staff and volunteers hosted booths at a number public venues, including the Coastal America Conference held in Blaine, WA, the Pacific Marine Expo in Seattle, and a meeting of the Salmon Fishery Advisory Committee (a committee of salmon fishermen who advise Washington Department of Fish and Wildlife). The project was highlighted in an article in Pacific Fishing Magazine, a publication read widely by fishermen. Reports of derelict fishing gear by harvest and recreational divers have increased substantially since outreach began. More work needs to be done to increase reporting by fishermen. Figure 2 shows the rack card that was developed during the project.

Second, removal observations with resource managers, the press, and elected officials were organized throughout the project. Notable individuals who joined our crews on removal vessels included Congressman Jay Inslee, state representative Christine Rolfus, and National Fisheries Service Director Eric Schwab. Presentations to other resource managers and decision makers, such as the Puget Sound Partnership Leadership Council and the Fish and Wildlife Commission, were given at various times. The project was featured at the Oceans 2010 conference in Seattle and at the Restore America's Estuaries conference in Galveston, TX.

Press interest was extremely high, especially at the start of the project, with CNN TV News joining us on our first operation day, July 28, 2009. Other national coverage included stories on NBC Nightly News, and in the New York Times, and USA Today. Local coverage was also extensive, with more than 30 stories on local television, radio and in local newspapers. Press releases were sent out at the beginning of the project, mid-way through the project, and at the conclusion of the project.

Third, a number of talks about the project were given to local user groups, such as chapters of the Puget Sound Anglers and the Coastal Conservation Association. More than 1,000 people were reached during more than thirty presentations. A Facebook page was developed to keep supporters abreast of our project's progress. Weekly updates on the Northwest Straits Initiative website communicated where our removal vessels were working each week. Tables 7, 8 and 9 list project outreach events, removal observations, and media coverage.

What's left

At the conclusion of this project, we estimated there remained 934 derelict nets in Puget Sound, based on final project surveys and reported gear. Since completing surveys of all high priority areas in March, 2010, we now estimate 953 derelict nets remain in Puget Sound. Adding that estimate to the number of nets we have already removed since 2002 (3,860 nets) yields a total net loss estimate of 4,813, which is comparable to the high estimate of 4,559 developed from fishing fleet data. It makes sense that the known number is higher, since there is reason to believe that net loss during the heyday of salmon fishing in the 1970s and 1980s was higher than the 3%-5% documented in 2002. Recent technological advances, such as global positioning systems units, radar and depth sounders have improved vessel safety and reduced net loss in recent years, but were not widely used in the 1970s and 1980s.

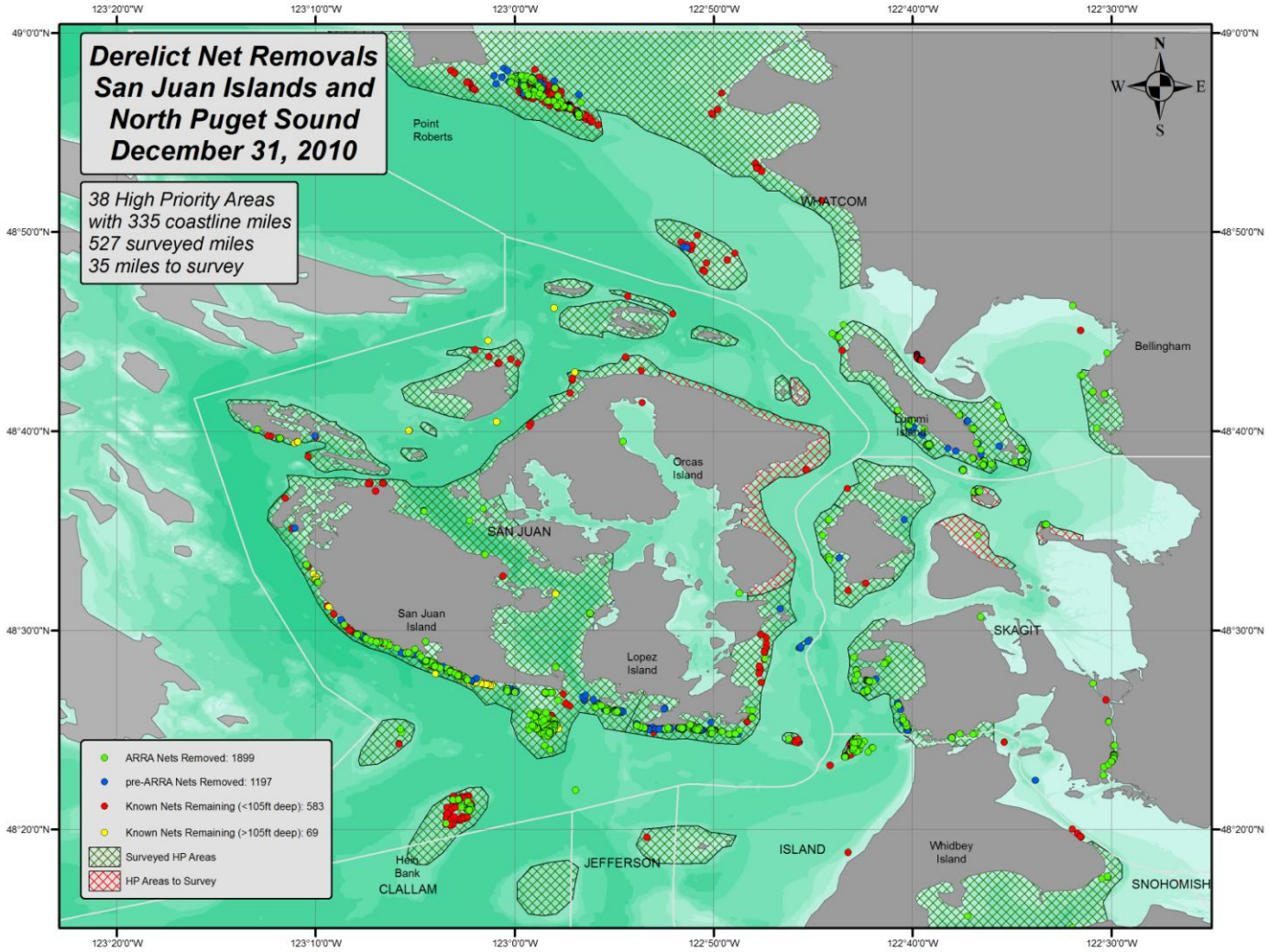
Removal costs average $6,000/day and include project management, boat costs, removal personnel, onboard biologists, gear disposal, database management, fiscal management, and reporting. This cost is based on more than 1,000 removal and survey operation days. Our crews can remove about 3.2 nets/removal day. About 300 removal days are needed to remove the

estimated 953 remaining nets. This work will cost about $1.8 million and can be accomplished in one year using the same removal crews trained and employed during this project.

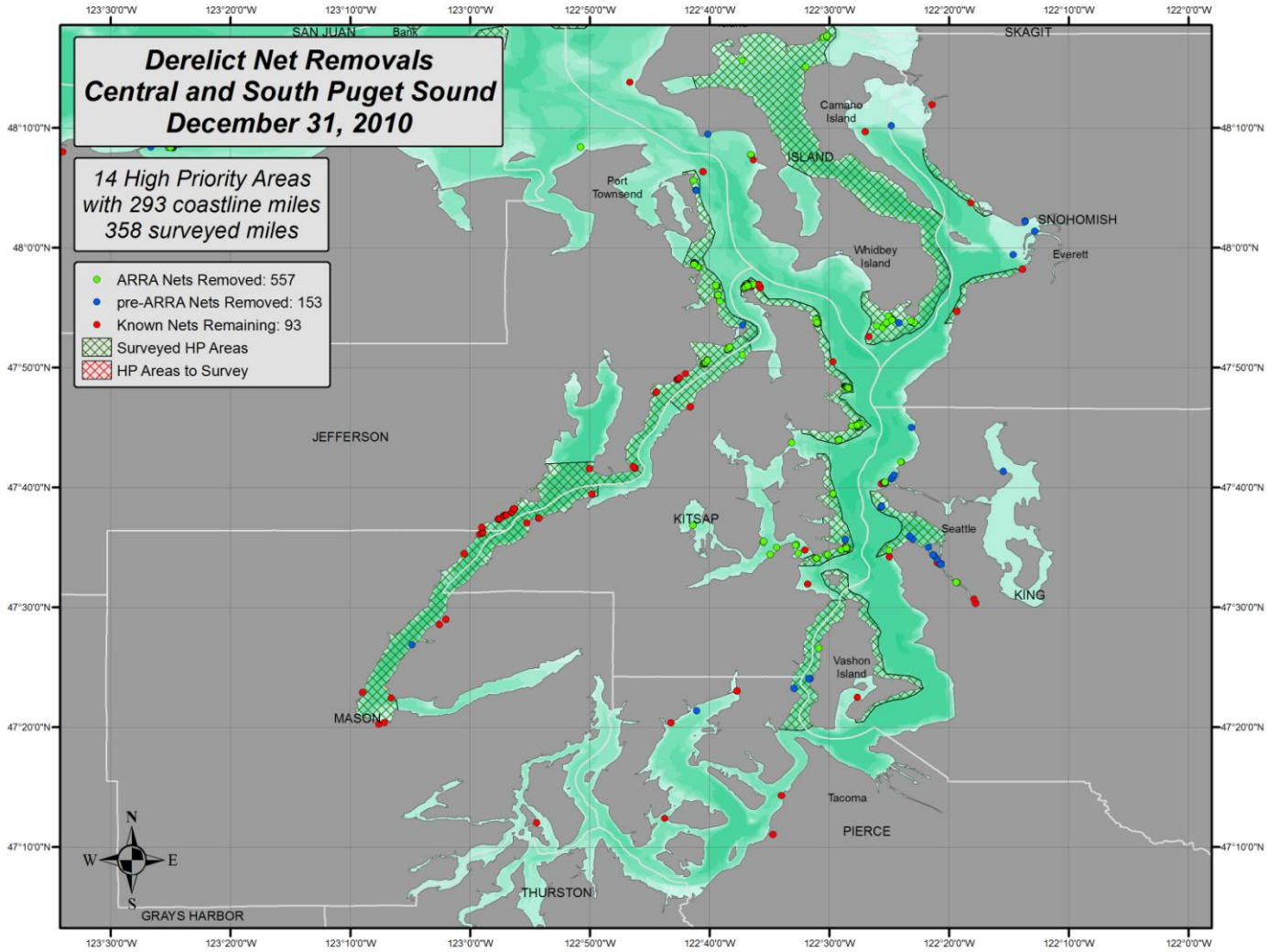
After all estimated legacy nets are removed, a maintenance program focused on responding to reports of newly lost nets should be developed and funded. Assuming 20-33 nets are lost each year at different times and in different locations, probably only one newly lost net would be removed per removal day. Removing these newly lost nets could cost anywhere from $96,000-$180,000 per year, although cost would decrease if more than one net could be removed in one day.

Maps

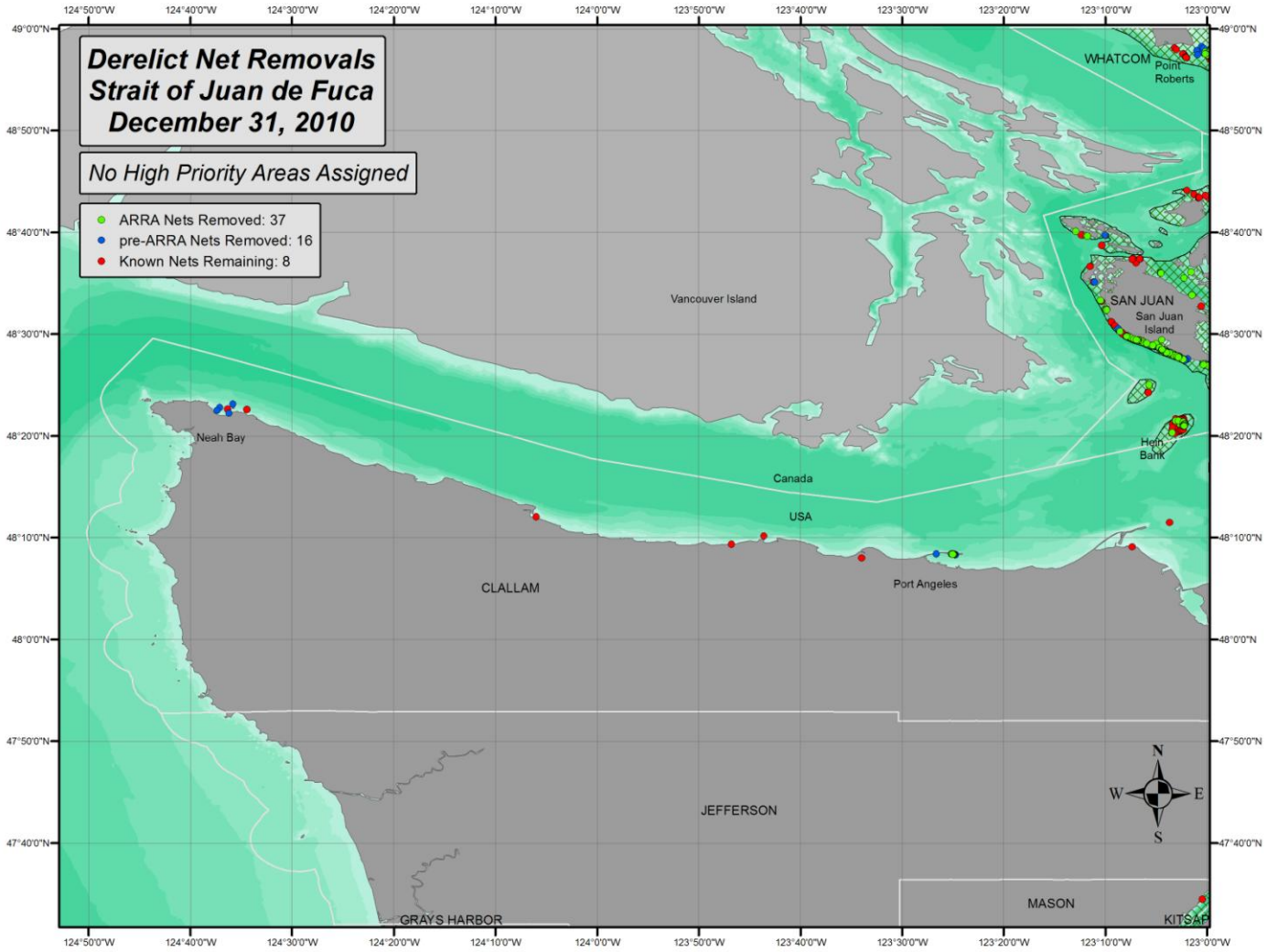
Map 1. Derelict nets removed pre-ARRA project and during the ARRA project and known to be remaining in northern Puget Sound and the San Juan Islands.



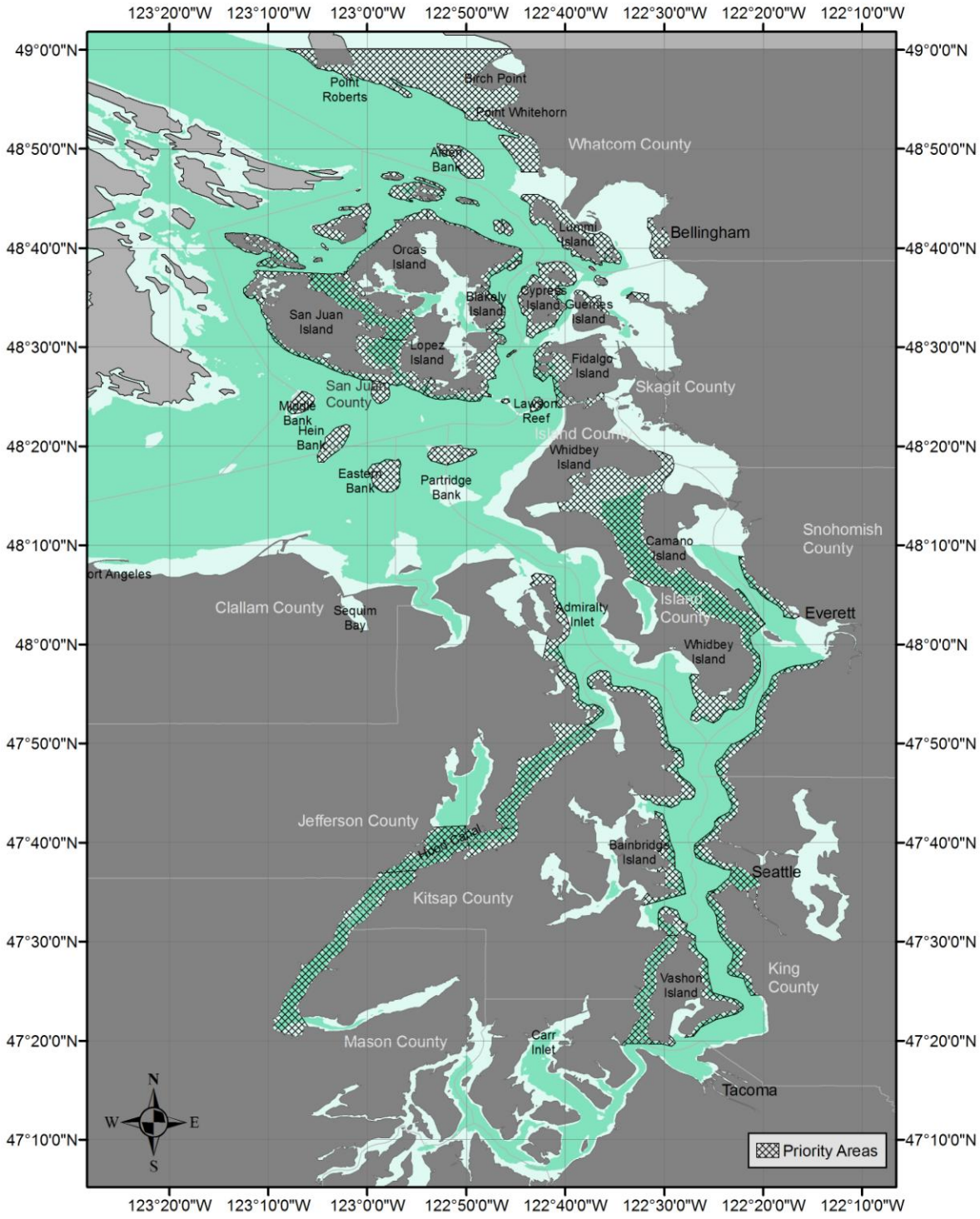
Map 2. Derelict nets removed pre-ARRA project and during the ARRA project and known to be remaining in Central and South Puget Sound and Hood Canal.



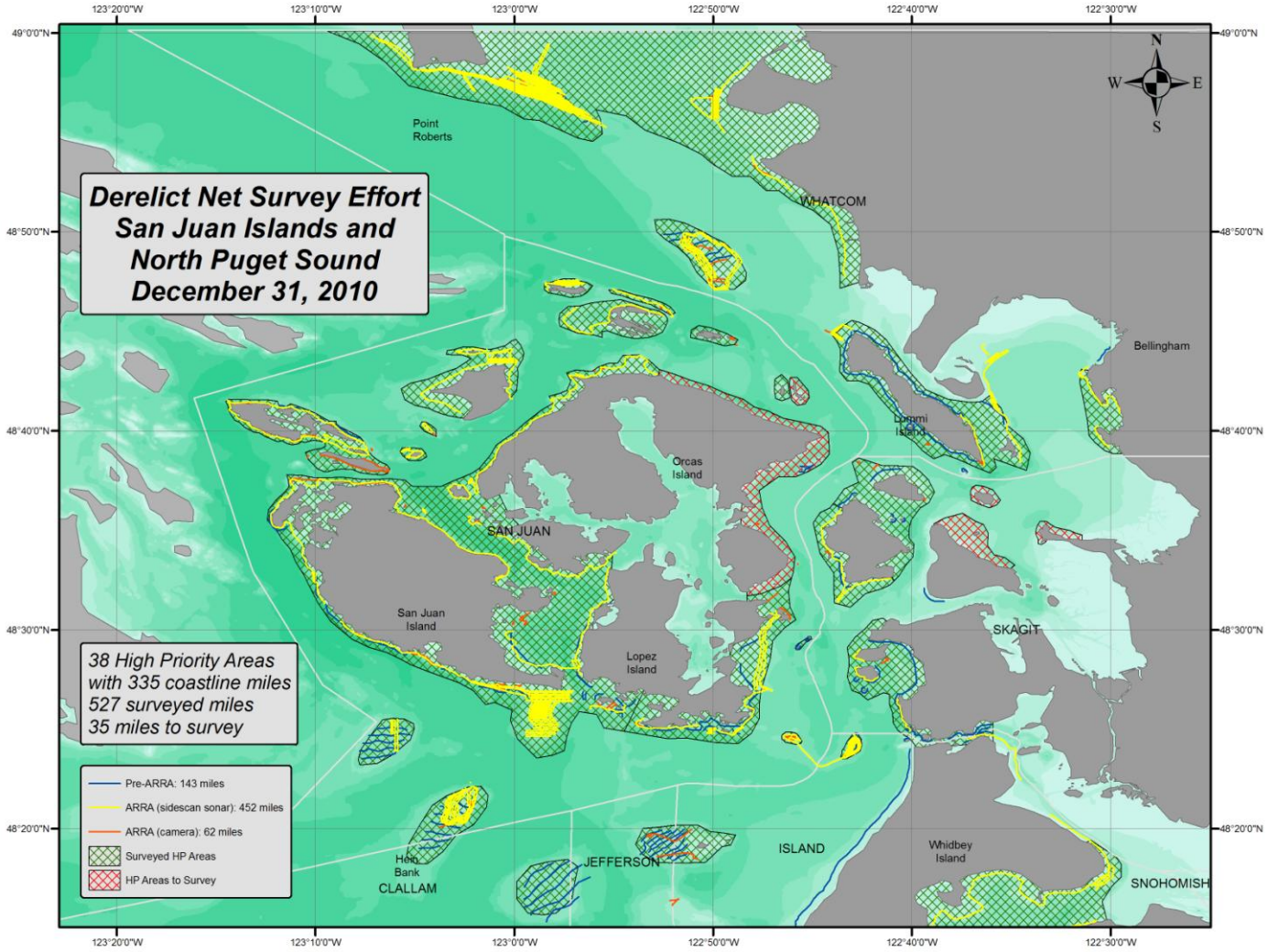
Map 3. Derelict nets removed pre-ARRA project and during the ARRA project and known to be remaining in the Strait of Juan de Fuca.



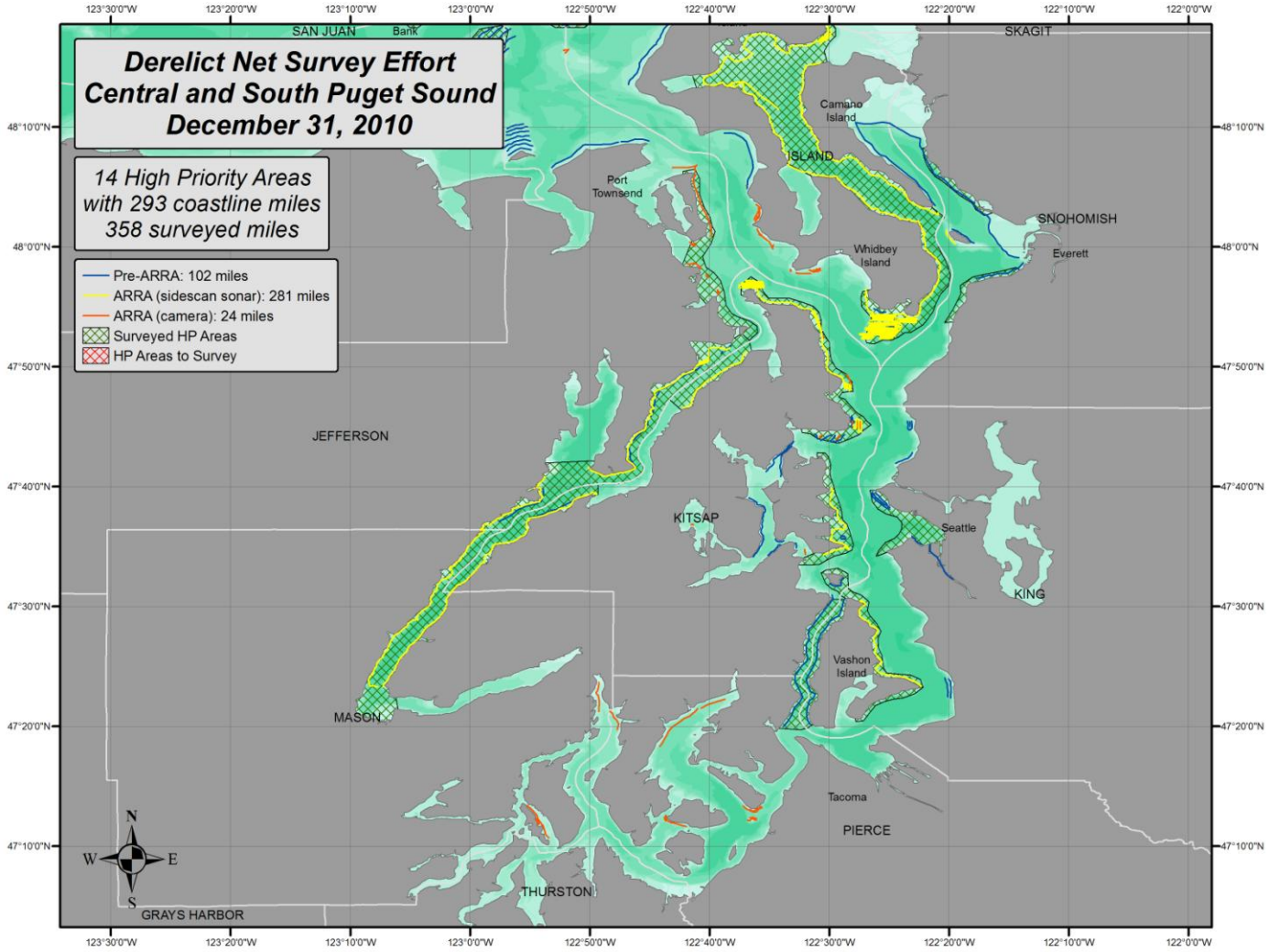
Map 4. High priority areas defined for the ARRA project



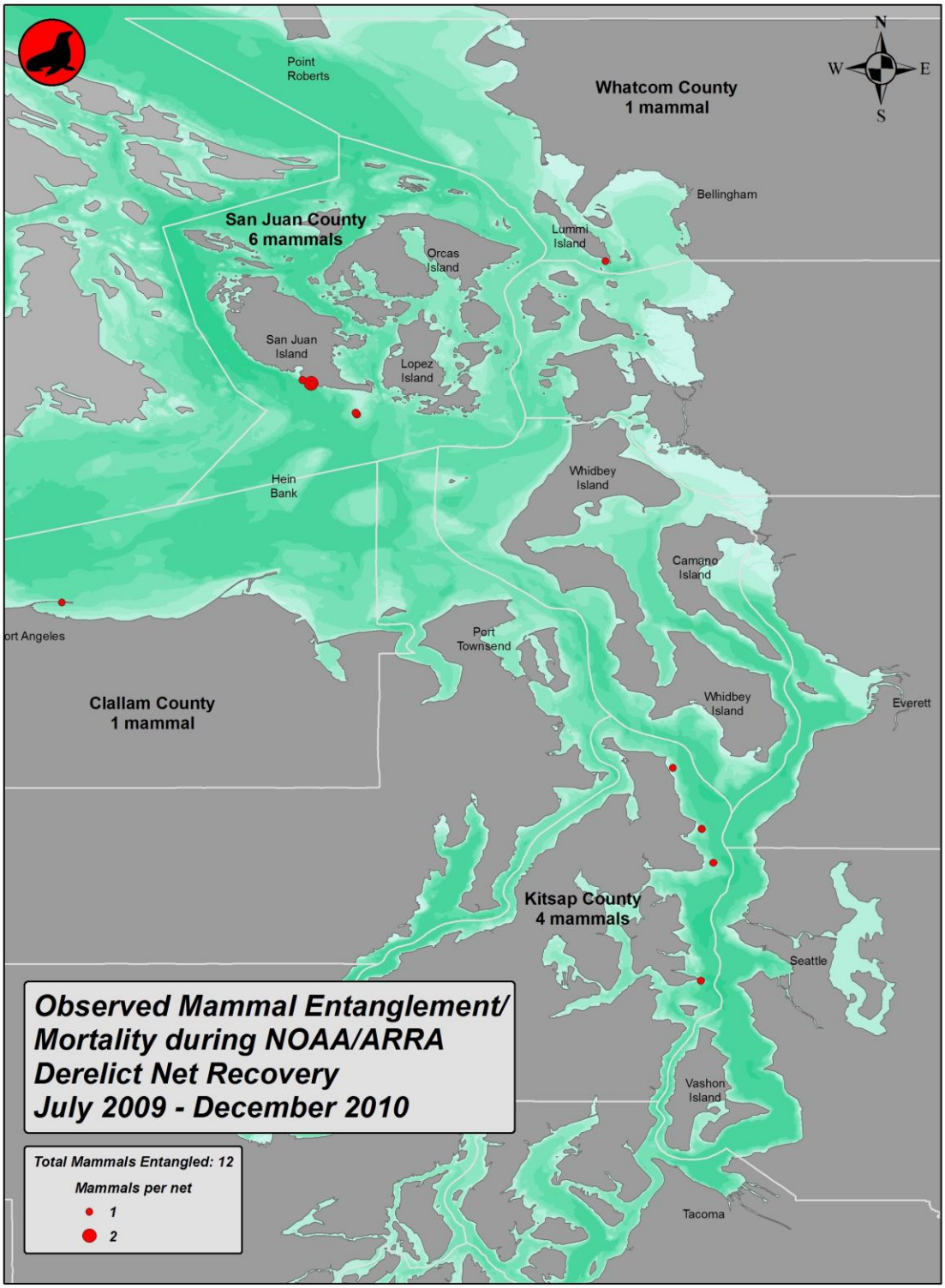
Map 5. High priority areas surveyed and remaining to be surveyed pre-ARRA project and during the ARRA project in northern Puget Sound and the San Juan Islands.



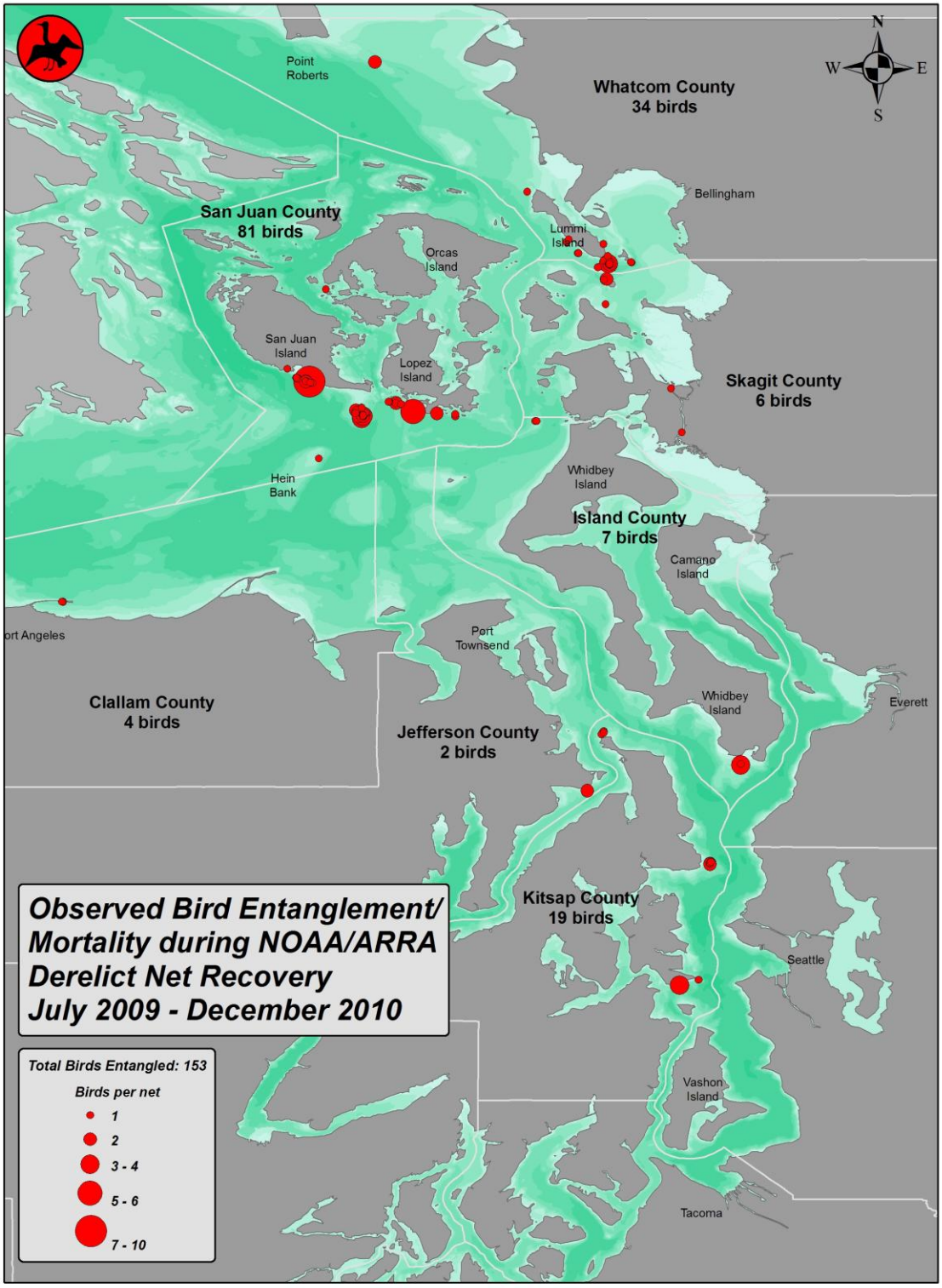
Map 6. High priority areas surveyed and remaining to be surveyed pre-ARRA project and during the ARRA project in Central and South Puget Sound and Hood Canal.



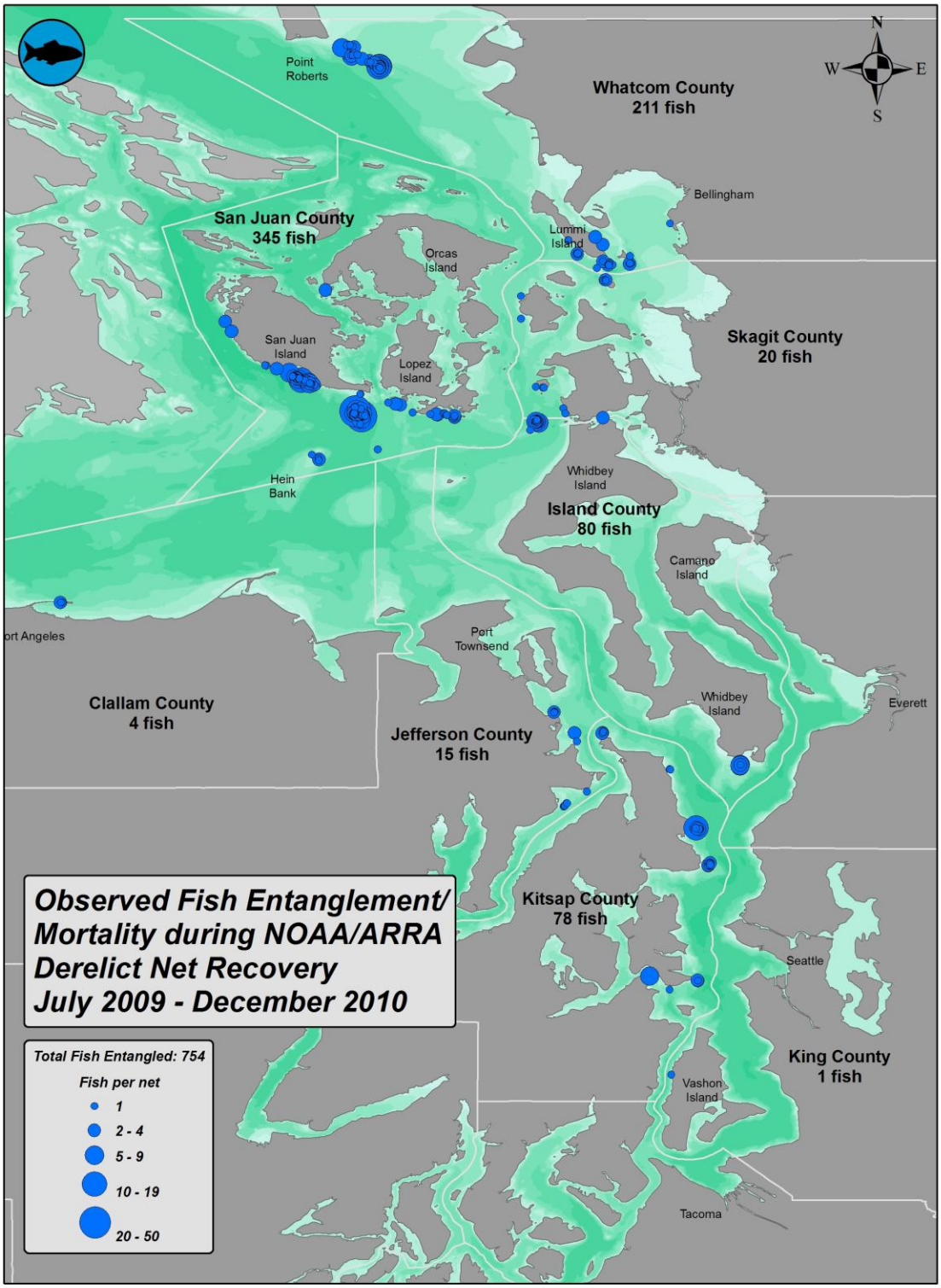
Map 7. Nets found with mammals entangled in them



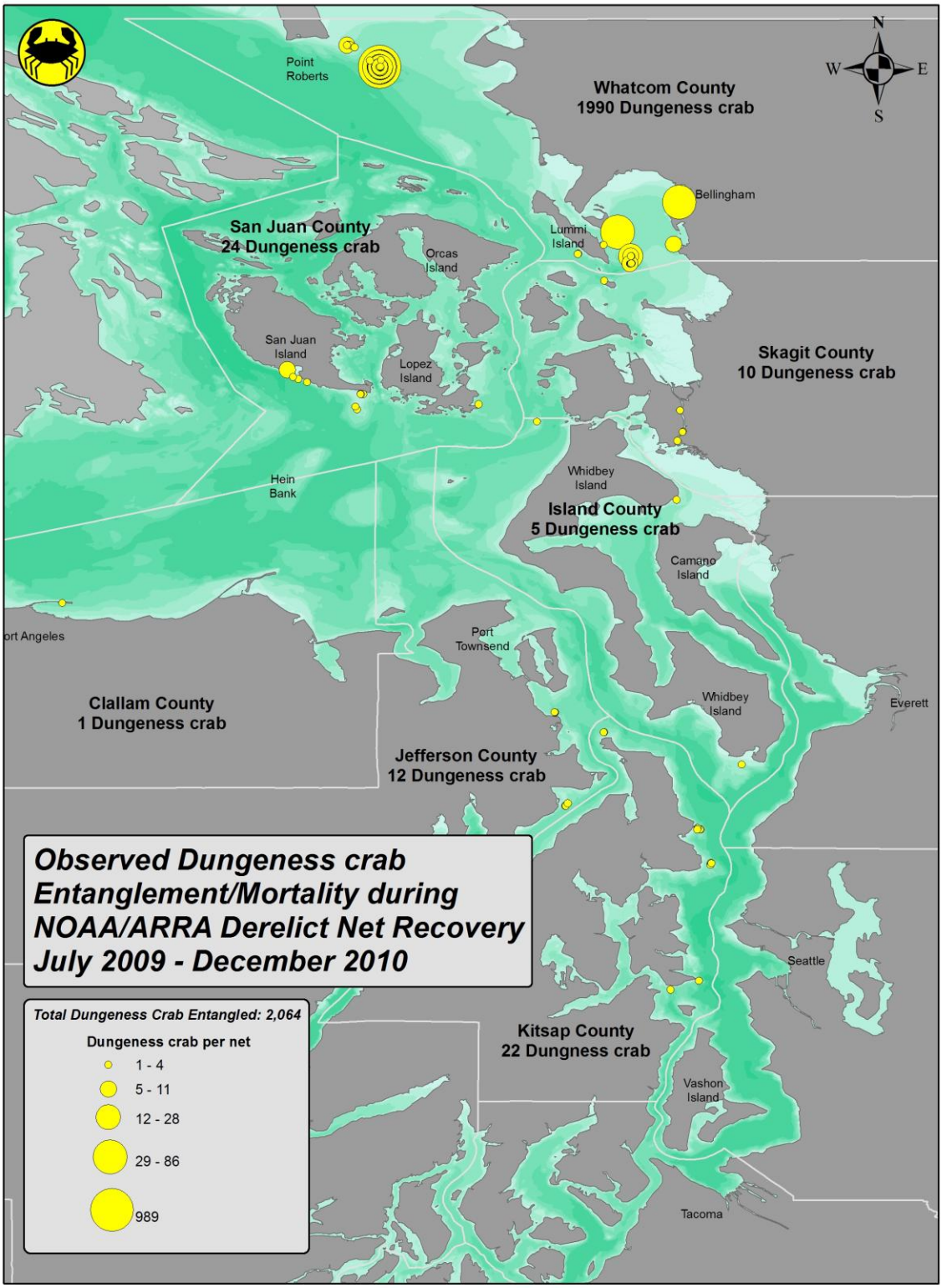
Map 8. Nets found with birds entangled in them Project images



Map 9. Nets found with fish entangled in them Project images



Map 10. Nets found with Dungeness crab entangled in them



Figures

Figure 1. Sidescan sonar image showing possible derelict nets

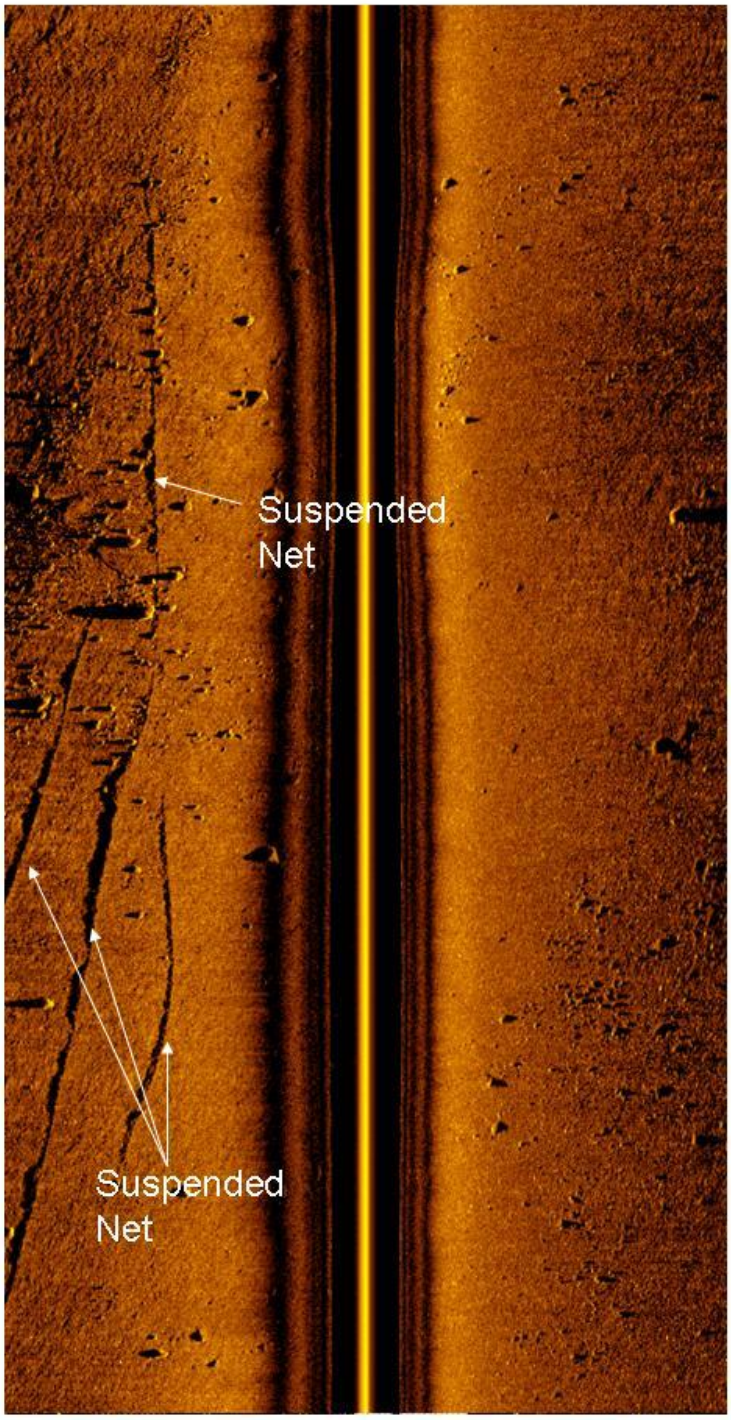


Figure 2. Rack card developed to build awareness and increase reporting

(front)

Still Fishing After All These Years

Lost and abandoned fishing gear continues to fish, killing marine animals and destroying habitat. The Northwest Straits Initiative removes derelict fishing nets from Puget Sound.

NORTHWEST STRAITS
marine conservation initiative

Report lost or abandoned nets or pots at

www.derelictgear.org or call

360-428-1084 (Northwest Straits Initiative)

800-477-6224 (WA Dept. of Fish and Wildlife)

Please collect the following information for reporting:

- Type of gear
- Approximate water depth
- General location
- Latitude (ex. 4834.333) Longitude (ex. 12300.333)

There are no penalties associated with reporting lost fishing gear.

Nets are dangerous! Do not attempt to remove nets. Divers, stay a safe distance away.

(back)

The **Northwest Straits Initiative** is currently removing lost and abandoned fishing nets from Puget Sound. Since 2001, the Initiative has worked cooperatively with fishermen, tribes, and agencies to document the impacts of derelict gear, remove damaging gear, and raise awareness about the harm caused by derelict gear in Puget Sound.

The Initiative has removed more than 2,500 derelict fishing nets and 1,500 crab pots from Puget Sound. Over 100,000 animals, representing more than 135 species, were found entangled in this gear; including marine mammals, birds and commercially valuable fish and shellfish. And this is only a snapshot of the long-term impacts of these nets, some of which have been derelict for over twenty years, yet still effectively capture and kill animals. Hundreds of derelict nets still remain in Puget Sound.

In 2009, the Initiative was awarded funding from NOAA to complete the removal of legacy derelict nets in Puget Sound. Funding will allow the Initiative to remove remaining legacy derelict nets and newly reported lost nets through the end of 2010.

Please report lost nets or abandoned nets or crab pots using the reporting information on the front of this card. This is a no-fault program and there are no penalties associated with fishermen reporting lost nets. The Initiative employs highly trained divers and removal vessels to conduct this work. All removals follow state-approved protocols and safety is the first concern. Do not approach derelict nets found in the water and do not attempt to remove nets.

Learn more about the Northwest Straits Initiative's Derelict Gear Program by visiting

www.derelictgear.org

NORTHWEST STRAITS
marine conservation initiative

Tables

Table 5. Animals found in recovered derelict gear from project start through December 31, 2010

Species Group	Species Local Common	Species Scientific	Sum Number of Dead	Sum Number of Alive	Total
Mammal	Harbor Porpoise	Phocoena phocoena	1	0	1
Mammal	Harbor Seal	Phoca vitulina	10	0	10
Mammal	river otter	Lontra canadensis	1	0	1
Mammals Total (3 species)			**12**	**0**	**12**
Bird	Brandt's Cormorant	Phalacrocorax penicillatus	38	0	38
Bird	Bufflehead	Bucephala albeola	1	0	1
Bird	Cormorant unid.	Phalacrocorax sp.	14	0	14
Bird	Cormorant unid.	Phalacrocoracidae sp.	3	0	3
Bird	Murre unid.	Uria sp.	3	0	3
Bird	Pelagic Cormorant	Phalacrocorax pelagicus	75	0	75
Bird	Pigeon Guillemot	Cepphus columba	1	0	1
Bird	Red-necked grebe	Podiceps grisegena	1	0	1
Bird	seabird unid.		16	0	16
Bird	Swans	Cygnus	1	0	1
Birds Total (7 species)			**153**	**0**	**153**
Fish	Arrowtooth flounder	Reinhardtius stomias	1	0	1
Fish	big skate	Raja binoculata	2	8	10
Fish	black rockfish	Sebastes melanops	5	3	8
Fish	buffalo sculpin	Enophrys bison	52	4	56
Fish	cabezon	Scorpaenichthys marmoratus	31	10	41
Fish	canary rockfish	Sebastes pinniger	1	0	1
Fish	cartilaginous fish unid.	Chondrichthyes sp.	8	0	8
Fish	China rockfish	Sebastes nebulosus	0	1	1
Fish	Chum salmon	Oncorhynchus keta	1	0	1
Fish	copper rockfish	Sebastes caurinus	4	2	6
Fish	decorated warbonnet	Chirolophis decoratus	0	15	15
Fish	English sole	Parophrys vetulus	0	2	2
Fish	fish unid.		26	0	26
Fish	flatfish unid.	Pleuronectidae sp.	1	1	2
Fish	great sculpin	Myoxocephalus polyacanthocephalus	31	6	37
Fish	greenling unid.	Hexagrammos sp.	7	1	8
Fish	Irish lord unid.	Hemilepidotus sp.	4	2	6
Fish	kelp greenling	Hexagrammos decagrammus	32	15	47

Species Group	Species Local Common	Species Scientific	Sum Number of Dead	Sum Number of Alive	Total
Fish	Kelp rockfish	Sebastes atrovirens	1	0	1
Fish	lingcod	Ophiodon elongatus	111	10	121
Fish	northern ronquil	Ronquilus jordani	1	2	3
Fish	Pacific sanddab	Citharichthys sordidus	2	0	2
Fish	plainfin midshipman	Porichthys notatus	1	0	1
Fish	Puget Sound rockfish	Sebastes emphaeus	0	2	2
Fish	quillback rockfish	Sebastes maliger	18	8	26
Fish	red Irish lord	Hemilepidotus hemilepidotus	18	15	33
Fish	righteyed flounder	Pleuronectidae	2	0	2
Fish	rock sole	Lepidopsetta bilineata	3	0	3
Fish	rockfish unid.	Scorpaenidae sp.	1	0	1
Fish	rockfish unid.	Sebastes sp.	2	0	2
Fish	sailfin sculpin	Nautichthys oculofasciatus	1	3	4
Fish	salmonid unid.	Oncorhynchus sp.	5	0	5
Fish	sculpin unid.	Cottidae sp.	1	1	2
Fish	skates	Rajiformes	3	0	3
Fish	spiny dogfish shark	Squalus acanthias	94	15	109
Fish	spotted ratfish	Hydrolagus colliei	23	6	29
Fish	staghorn sculpin	Leptocottus armatus	0	10	10
Fish	starry flounder	Platichthys stellatus	85	32	117
Fish	Sturgeons (white)	Acipenser sp.	1	0	1
Fish	tidepool sculpin	Oligocottus maculosus	1	0	1
Fish	wolf eel	Anarrhichthys felis	1	0	1
Fish	Yellowtail rockfish	Sebastes flavidus	1	0	1
Fishes Total (31 species)			**582**	**174**	**756**
Invertebrate	basket star	Gorgonocephalus eucnemis	0	4	4
Invertebrate	bat star	Asterina miniata	0	1	1
Invertebrate	bent nose macoma	Macoma nasuta	12	2	14
Invertebrate	black clawed shore crab	Lophopanopeus bellus bellus	1	4	5
Invertebrate	black katy chiton	Katharina tunicata	0	5	5
Invertebrate	black-eyed hermit	Pagurus armatus	0	45	45
Invertebrate	blood star	Henricia leviuscula	73	2537	2610
Invertebrate	blood worm	Glycera americana	0	58	58
Invertebrate	blue mussel	Mytilus trossulus	30	32	62
Invertebrate	blue topsnail	Calliostoma ligatum	40	1089	1129

Species Group	Species Local Common	Species Scientific	Sum Number of Dead	Sum Number of Alive	Total
Invertebrate	blunt gaper	Mya truncata	2	0	2
Invertebrate	bread crumb sponge	Halichondria sp.	0	15	15
Invertebrate	brittle star unid.	Ophiuroidea sp.	2	90	92
Invertebrate	butter clam	Saxidomus gigantea	17882	217	18,099
Invertebrate	Butterfly crab	Cryptolithodes typicus	0	2	2
Invertebrate	California sea cucumber	Parastichopus californicus	35	4,671	4,706
Invertebrate	California sunset clam	Gari californica	12	0	12
Invertebrate	channelled dogwinkle	Nucella canaliculata	0	4	4
Invertebrate	checkered periwinkle	Littorina scutulata	0	1	1
Invertebrate	clam worm	Nereis vexillosa	0	104	104
Invertebrate	clown dorid	Triopha catalinae	10	169	179
Invertebrate	common Pacific octopus	Enteroctopus dofleini	0	3	3
Invertebrate	coonstriped shrimp	Pandalus danae	30	159	189
Invertebrate	cryptic kelp crab	Pugettia richii	51	7940	7991
Invertebrate	cushion star	Pteraster tesselatus	0	26	26
Invertebrate	daisy brittle star	Ophiopholis aculeata	0	1480	1480
Invertebrate	dark mahogany clam	Nuttallia obscurata	2	0	2
Invertebrate	dire whelk	Lirabuccinum dirum	22	184	206
Invertebrate	Dungeness crab	Cancer magister	1496	590	2086
Invertebrate	fat henricia	Henricia sanguinolenta	0	1	1
Invertebrate	frilled dogwinkle	Nucella lamellosa	11	42	53
Invertebrate	geoduck clam	Panopea abrupta	282	79	361
Invertebrate	giant barnacle	Balanus nubilus	15440	10452	25892
Invertebrate	giant dendronotid	Dendronotus iris	0	1	1
Invertebrate	giant Pacific chiton	Cryptochiton stelleri	6	69	75
Invertebrate	giant Pacific octopus	Octopus dofleini	0	1	0
Invertebrate	giant white dorid	Archidoris odhneri	0	3	3
Invertebrate	glassy sea squirt	Ascidia paratropa	0	239	239
Invertebrate	glove sponge	Neoesperiopsis digitata	59	81	140
Invertebrate	golfball crab	Rhinolithodes wosnessenski	6	53	59
Invertebrate	graceful crab	Cancer gracilis	3	0	3
Invertebrate	granular claw crab	Oedignathus inermis	0	4	4
Invertebrate	green false-jingle	Pododesmus macroschisma	4244	351	4595
Invertebrate	green sea urchin	Strongylocentrotus droebachiensis	171	3355	3526
Invertebrate	hairy cancer crab	Cancer oregonensis	35	935	970
Invertebrate	hairy hermit crab	Pagurus hirsutiusculus	0	1	1

Species Group	Species Local Common	Species Scientific	Sum Number of Dead	Sum Number of Alive	Total
Invertebrate	hairy lithodid	Hapalogaster mertensii	0	2	2
Invertebrate	heart crab	Phyllolithodes papillosus	5	19	24
Invertebrate	helmet crab	Telmessus cheiragonus	9	18	27
Invertebrate	hermit crab sponge	Suberities suberea	0	2	2
Invertebrate	hermit crab unid.	Paguridae sp.	0	5	5
Invertebrate	horse clam	Tresus sp.	901	134	1035
Invertebrate	horsehair crab	Erimacrus isenbeckii	0	2	2
Invertebrate	horseshoe ascadian	Chelyosoma productum	0	3606	3606
Invertebrate	hudson's dorid	Acanthodoris hudsoni	0	6	6
Invertebrate	humpback shrimp	Pandalus hypsinotus	6	63	69
Invertebrate	kelp isopods	isopoda	0	7	7
Invertebrate	Kennerley venus	Humilaria kennerleyi	305	7	312
Invertebrate	lampshell	Terebratalia transversa	404	925	1329
Invertebrate	leafy hornmouth	Ceratostoma foliatum	200	630	830
Invertebrate	leopard dorid	Diaulula sandiegensis	10	15	25
Invertebrate	lined chiton	Tonicella lineata	0	9	9
Invertebrate	lined ribbon worm	Tubulanus sexlineatus	0	2	2
Invertebrate	long ray star	Stylasterias forreri	0	1	1
Invertebrate	longarm brittle star	Amphiodia urtica	0	9	9
Invertebrate	longhorn decorator crab	Chorilia longipes	148	2776	2924
Invertebrate	lyre crab	Hyas lyratus	0	1	1
Invertebrate	lyre whelk	Neptunea lyrata	0	25	25
Invertebrate	manila clam	Venerupis philippinarum	6	0	6
Invertebrate	mask limpet	Tectura persona	0	3	3
Invertebrate	metridium anemone	Metridium giganteum	0	52	52
Invertebrate	moon snail	Euspira lewisii	4	3	7
Invertebrate	morning sunstar	Solaster dawsoni	2	44	46
Invertebrate	mossy chiton	Mopalia muscosa	1	15	16
Invertebrate	mottled star	Evasterias troschelii	0	66	66
Invertebrate	mudstar	Ctenodiscus crispatus	0	5	5
Invertebrate	northern abalone	Haliotis kamtschatkana	2	0	2
Invertebrate	northern kelp crab	Pugettia producta	25	289	314
Invertebrate	Nuttall's cockle	Clinocardium nuttalli	363	3	366
Invertebrate	ochre star	Pisaster ochraceus	1	119	120
Invertebrate	orange sea cucumber	Cucumaria miniata	0	26	26
Invertebrate	orange sunstar	Solaster paxillatus	0	1	1
Invertebrate	Oregon triton	Fusitriton oregonensis	546	1251	1797
Invertebrate	Pacific blue mussel	Mytilus edulis	204	1427	1631

Species Group	Species Local Common	Species Scientific	Sum Number of Dead	Sum Number of Alive	Total
Invertebrate	Pacific gaper	Tresus nuttallii	20	3	23
Invertebrate	Pacific littleneck clam	Protothaca staminea	150	0	150
Invertebrate	Pacific oyster	Crassostrea gigas	3	5	8
Invertebrate	Pacific razor clam	Siliqua patula	60	1	61
Invertebrate	painted anemone	Urticina felina	0	75	75
Invertebrate	painted star	Orthasterias koehleri	19	87	106
Invertebrate	pointed macoma	Macoma inquinata	2	0	2
Invertebrate	porcelain crab	Petrolisthes sp.	11	529	540
Invertebrate	prawn	Pandalus platyceros	0	14	14
Invertebrate	primitive ribbon worm	Tubulanus polymorphus	3	527	530
Invertebrate	Puget Sound king crab	Lopholithodes mandtii	48	58	106
Invertebrate	purple ring topsnail	Calliostoma annulatum	7	239	246
Invertebrate	purple shore crab	Hemigrapsus nudus	0	1	1
Invertebrate	red fur crab	Acantholithodes hispidus	3	11	14
Invertebrate	red octopus	Octopus rubescens	0	6	6
Invertebrate	red rock crab	Cancer productus	936	763	1699
Invertebrate	red sea urchin	Strongylocentrotus franciscanus	131	359	490
Invertebrate	red sponge nudibranch	Rostanga pulchra	0	2	2
Invertebrate	ridged blood star	Henricia aspera	4	153	157
Invertebrate	rock scallop	Crassadoma gigantea	147	37	184
Invertebrate	rose star	Crossaster papposus	0	55	55
Invertebrate	scale worm	Halosydna brevisetosa	0	31	31
Invertebrate	scaly lithodid	Placetron wosnessenskii	12	12	24
Invertebrate	sea lemon	Anisodoris nobilis	0	14	14
Invertebrate	sharp-nosed crab	Scyra acutifrons	0	821	821
Invertebrate	shiny orange sea squirt	Cnemidocarpa finmarkiensis	0	39	39
Invertebrate	short plumose anemones	Metridium senile	0	1	1
Invertebrate	slender cancer crab	Cancer gracilis	9	66	75
Invertebrate	slender decorator crab	Oregonia gracilis	0	1517	1517
Invertebrate	slender kelp crab	Pugettia gracilis	2	2009	2011
Invertebrate	smooth pink scallop	Chlamys rubida	14,023	5,493	19,516
Invertebrate	softshell clam	Mya arenaria	10	2	12
Invertebrate	spiny mudstar	Luidia foliolata	0	2	2
Invertebrate	spiny pink shrimp	Pandalus eous	0	4	4

Species Group	Species Local Common	Species Scientific	Sum Number of Dead	Sum Number of Alive	Total
Invertebrate	spiny pink star	Pisaster brevispinus	0	5	5
Invertebrate	spiny sea squirt	Halocynthia hilgendorfi igaboja	0	285	285
Invertebrate	spiny top snail	Cidarina cidaris	9	10	19
Invertebrate	spot shrimp	Pandalus platyceros	1	67	68
Invertebrate	squat lobster	Munida quadrispina	0	1	1
Invertebrate	stalked hairy sea squirt	Boltenia villosa	150	17,738	17,888
Invertebrate	striped dogwinkle	Nucella emarginata	0	18	18
Invertebrate	striped sun star	Solaster stimpsoni	2	51	53
Invertebrate	sunflower star	Pycnopodia helianthoides	9	325	334
Invertebrate	tabled whelk	Neptunea tabulata	2	3	5
Invertebrate	tanner crab	Chionoecetes bairdi	2	5	7
Invertebrate	tennis ball sponge	Craniella villosa	0	46	46
Invertebrate	thick-claw porcelain crab	Pachycheles rudis	0	49	49
Invertebrate	transparent sea squirt	Corella willmeriana	0	189	189
Invertebrate	tube worm	Phoronid	0	355	355
Invertebrate	umbrella crab	Cryptolithodes sitchensis	0	10	10
Invertebrate	vermillion sea star	Mediaster aequalis	0	13	13
Invertebrate	weathervane scallop	Patinopecten caurinus	0	2	2
Invertebrate	white dendronotid	Dendronotus albus	0	1	1
Invertebrate	white sea cucumber	Eupentacta quinquesemita	4	202	206
Invertebrate	widehand hermit	Elassochirus tenuimanus	0	6	6
Invertebrate	yellow encrusting sponge	Myxilla lacunosa	1	571	572
Invertebrate	yellow margin dorid	Cadlina luteomarginata	0	2	2
Invertebrate	yellow sponge	Spongia barbara	0	8	8
Invertebrates Total (142 species)			**58,879**	**79,565**	**138,444**
Coral	hydroid coral	Abietinaria greenei	-	-	-
Coral	orange cup coral	Tubastraea coccinea	-	-	-
Total Entangled			**59,626**	**79,739**	**139,365**

Table 6. Estimates of derelict fishing net accumulation from 1968-present

YEAR	Total Gillnet Vessels	loss at 3%	loss at 5%	accum-ulation at 3%	accum-ulation at 5%	Total Purse Seine Vessels	loss at 1%	loss at 3%	accum-ulation at 1%	accum-ulation at 3%	Total accumulation all Vessels-low estimate	Total accumulation all Vessels-high estimate
1968	1,818	55	91	55	91	341	3	10	3	10	58	101
1969	2,014	60	101	115	192	424	4	13	8	23	123	215
1970	2,078	62	104	177	296	352	4	11	11	34	188	329
1971	2,838	85	142	262	437	329	3	10	14	43	277	481
1972	2,838	85	142	348	579	304	3	9	18	53	365	632
1973	2,606	78	130	426	710	353	4	11	21	63	447	773
1974	3,980	119	199	545	909	151	2	5	23	68	568	976
1975	3,318	100	166	645	1,075	425	4	13	27	80	672	1,155
1976	3,072	92	154	737	1,228	415	4	12	31	93	768	1,321
1977	2,954	89	148	825	1,376	430	4	13	35	106	861	1,482
1978	3,355	101	168	926	1,544	459	5	14	40	120	966	1,663
1979	3,165	95	158	1,021	1,702	468	5	14	45	134	1,066	1,835
1980	3,153	95	158	1,116	1,859	454	5	14	49	147	1,165	2,007
1981	2,991	90	150	1,205	2,009	472	5	14	54	161	1,259	2,170
1982	2,906	87	145	1,293	2,154	463	5	14	58	175	1,351	2,330
1983	2,652	80	133	1,372	2,287	442	4	13	63	189	1,435	2,475
1984	2,454	74	123	1,446	2,410	423	4	13	67	201	1,513	2,611
1985	2,629	79	131	1,525	2,541	470	5	14	72	215	1,596	2,756
1986	2,569	77	128	1,602	2,670	424	4	13	76	228	1,678	2,898
1987	2,660	80	133	1,682	2,803	446	4	13	80	241	1,762	3,044
1988	2,855	86	143	1,767	2,945	437	4	13	85	255	1,852	3,200
1989	2,676	80	134	1,847	3,079	419	4	13	89	267	1,936	3,346
1990	2,486	75	124	1,922	3,203	413	4	12	93	279	2,015	3,483
1991	2,237	67	112	1,989	3,315	368	4	11	97	291	2,086	3,606
1992	2,050	62	103	2,051	3,418	343	3	10	100	301	2,151	3,718
1993	1,973	59	99	2,110	3,516	328	3	10	104	311	2,213	3,827
1994	1,727	52	86	2,162	3,603	275	3	8	106	319	2,268	3,922
1995	1,352	41	68	2,202	3,670	265	3	8	109	327	2,311	3,997
1996	970	29	49	2,231	3,719	170	2	5	111	332	2,342	4,051
1997	1,076	32	54	2,264	3,773	259	3	8	113	340	2,377	4,112
1998	795	24	40	2,287	3,812	196	2	6	115	346	2,403	4,158
1999	602	18	30	2,305	3,842	106	1	3	116	349	2,422	4,191
2000	771	23	39	2,329	3,881	159	2	5	118	354	2,446	4,235
2001	663	20	33	2,348	3,914	132	1	4	119	357	2,468	4,272
2002	653	20	33	2,368	3,947	115	1	3	120	361	2,488	4,308

YEAR	Total Gillnet Vessels	loss at 3%	loss at 5%	accum-ulation at 3%	accum-ulation at 5%	Total Purse Seine Vessels	loss at 1%	loss at 3%	accum-ulation at 1%	accum-ulation at 3%	Total accumulation all Vessels-low estimate	Total accumulation all Vessels-high estimate
2003	565	17	28	2,385	3,975	121	1	4	122	365	2,507	4,340
2004	621	19	31	2,404	4,006	112	1	3	123	368	2,526	4,374
2005	534	16	27	2,420	4,033	100	1	3	124	371	2,543	4,404
2006	676	20	34	2,440	4,067	123	1	4	125	375	2,565	4,441
2007	669	20	33	2,460	4,100	101	1	3	126	378	2,586	4,478
2008	831	25	42	2,485	4,142	103	1	3	127	381	2,612	4,522
2009	675	20	34	2,505	4,175	106	1	3	128	384	2,633	4,559
2010	unk	unk										

Table 7. Summary of outreach events for the reporting period July 1, 2009 through December 31, 2010

Date	Outreach Events Description	Location	Number attending
8/2009	Presentation: P.S. Harbor Safety Committee	Seattle	35 industry representatives
10/2009	Presentation: Annual NW Harbor Masters Conference	Bremerton	Approximately 50 port and harbor managers from Pacific Coast from Oregon to B.C.
10/2009	Poster: Annual Coastal America Conference	Blaine	Approximately 75 federal and state coastal resource managers from across the U.S.
10/2009	Presentation: Highline Big Picture Hign School	Seattle	High School Senior Class
11/2009	Staffed booth: Pacific Marine Expo.	Seattle, Qwest Field	Approximately 35-40 people interested in the program, including fishermen interested in the reporting system.
12/2009	Presentation: PS Commercial Salmon Advisory Group post season meeting	WDFW, Olympia	Approximately 25 gillnetters, purse seiners, and fish buyers. Our objective was to encourage more and better derelict net reporting.
2/16/10	Presentation: NW Indian Fisheries Commission, Environmental Policy Committee	Shelton	30 tribal leaders engaged in fisheries issues
2/22/10	Testimony: Senate Natural Resources Committee on HB 2593	Olympia	25 state senators and representatives
2/24/10	Presentation: Trout Unlimited, Edmonds Chapter, Crab Mortality Study	Edmonds	35 recreational fishers
3/25/10	Presentation: Nisqually Tribal Council Welcome Ceremony	Lacey	25 tribal leaders
4/07/10	Presentation: Depth Chargers Dive Club	Puyallup	60 recreational and commercial divers
4/05/10	Presentation: Corinthian Yacht Club	Seattle	26 recreational boaters
4/07/10	Presentation: San Juan MRC	Friday Harbor	20 MRC members and general public
4/14/10	Presentation: Bellingham Coastal Conservation Association, North Sound Chapter	Bellingham	20 citizens active in coastal conservation
4/21/10	Presentation: Puget Sound Anglers	Whidbey Island	14 recreational fishers
5/11/10	Presentation: National meeting of chairs of NOAA Sanctuary Advisory Councils and headquarters staff	Port Angeles	50 staff and advisory council members from NOAA sanctuaries around the country
5/12/10	Presentation: Poggie Club	Bremerton	60 community members
5/21/10	Presentation: Northwest Straits Commission	Port Townsend	15 commissioners and general public
5/21-5/23/10	Staffed Booth: Dive Expo	Tacoma	300 recreational and professional divers and dive gear retailers
5/21/10	Presentation: USFWS Endangered Species Day	Lacey	40 general public
6/8/10	Presentation: Snohomish Coastal Conservation Association	Everett	110 citizens active in coastal conservation
6/9/10	Presentation: Puget Sound Anglers	Hansville	86 recreational fishers
6/12/10	Presentation: CCA/Trout Unlimited, joint meeting of Board of Directors		20 recreational fisher group leaders

Date	Outreach Events Description	Location	Number attending
6/5-6/6/10	Staffed Booth: Pt. Defiance Aquarium World Ocean Days	Tacoma	Over 500 general public
6/24/10	Snohomish/King County Chapter of CCA	Woodinville	16 citizens active in coastal conservation
7/08/10	Puget Sound Anglers, Lake Washington Chapter	Mercer Island	16 recreational fishers
7/13/10	Puget Sound Anglers, Kitsap Peninsula Chapter	Port Townsend	36 recreational fishers
8/12/10	Puget Sound Anglers, North Sound Chapter	Edmonds	63 recreational fishers
8/26/10	San Juan County Action Agenda Oversight Committee	Friday Harbor	18 policy-makers and citizens
9/08/10	Puget Sound Anglers, North Kitsap Chapter	Hansville	73 recreational fishers
9/14/10	Coastal Conservation Association, Seatac Chapter	Kent	43 citizens active in coastal conservation
9/15/10	Puget Sound Anglers, Bellingham Chapter	Bellingham	30 recreational fishers
9/21/10	Puget Sound Anglers, Anacortes Chapter	Anacortes	60 recreational fishers
9/21-23/10	Oceans 2010 Conference	Seattle	1,500+ attendees
10/06/10	Puget Sound Harbor Safety Commission	Seattle	63 industry representatives
10/11/10	Beach Watchers Volunteer Training	Coupeville	20 citizen volunteers
10/21/10	Puget Sound Anglers, Sequim Chapter	Sequim	61 recreational fishers
10/21/10	Puget Sound Anglers	Everett	60 recreational fishers
10/05/10	Northwest Straits Initiative Conference	Orcas Island	100 citizens, agency representatives, and elected officials
11/13/10	Restore America's Estuaries Conference	Galveston, TX	100 restoration advocates and professionals

Table 8. Summary of removal observations for the reporting period July 1, 2009 through December 31, 2010

Date	Observer (name and affiliation)	Boat
7/28/09	Patrick Oppmann, CNN reporter; Polly Hicks, NOAA	Bet Sea
8/10/09	NBC Nightly News. Lee Cowan, reporter; Karen Lucht, producer; photographer; sound staff; Jen Steger, NOAA	Bet-Sea
8/13/09	New York Times, Bill Yardley, reporter; photographer; Nir Barnia, NOAA	Twila Dawn
9/3/09	Ross Anderson, freelance writer	Tenacious
9/3/09	Brian Irwin, CCA executive director	Twila Dawn
9/7/09	Jeff Chew, reporter, Peninsula Daily News	Tenacious
9/25/09	36 participants including press, representatives from state agencies and the Governor's office, DFG funders, and NWSC members	Bet-Sea
11/12/09	WA State Rep. Christine Rolfes, Kitsap County Commissioner Steve Bauer, Mendy Droke (Congressman Jay Inslee aide), Lisa Veneroso (WDFW), Tara Mathewson (Kitsap Sun reporter), Meegan Reid (Kitsap Sun photographer)	Bet-Sea
1/08/10	Arn Thoreen, commercial fishermen	Bet Sea
1/29/10	Nir Barnea, NOAA Technical Monitor	Surveyor II
2/19/10	Rob Rau, Lisa Macchio, EPA divers	Surveyor II
4/01/10	Congressman Jay Inslee, staffer Peter Mills and NOAA Laurel Jennings	Surveyor II
4/21/10	Eric Schwaab, administrator for NOAA Fisheries, Jen Steger, NOAA, Sheila Babb, staff for Senator Murray, Chris Townsend, PSP	Surveyor II
6/8/10	Nir Barnea, NOAA Technical Monitor	Bet Sea
6/7/10	Don Velasquez,WDFW	Tenacious
7/31/10	Jackie DeHaven, REEF	Surveyor II
9/03/10	Kevin Adams, NOAA	Twila Dawn

Table 9. Summary of media coverage for the reporting period July 1, 2009 through December 31, 2010

Date	Publication	Title/Link
7/31/09	CNN	Removing Dangerous Nets - http://www.nwstraits.org/default.aspx?pageID=243 aired several times that day and was posted on the CNN website
8/8/09	The Outdoor Line, 710 AM ESPN	Ginny Broadhurst interview
8/15/09	Northwest Wild Country, 950 AM ESPN	Jeff June interview
8/12/09	Salt Water Sportsman	Latest Recession Victim: Puget Sound Ghost Nets - http://www.saltwatersportsman.com/article/News/Latest-recession-victim-Puget-sound-ghost-nets
8/24/09	New York Times	Cleaning of Puget Sound Brings Tribes Full Circle - http://www.nytimes.com/2009/08/25/us/25fishnets.htm
9/7/09	Peninsula Daily News, also The Seattle Times, The Olympian, Spokesman-Review	Crews save ocean life by cleaning up lost, abandoned fishing gear from Jefferson, Clallam water - http://www.peninsuladailynews.com/article/20090908/NEWS/309089991
9/25/09	NBC Nightly News with Brian Williams	What Lies Beneath - http://www.msnbc.msn.com/id/3032619/#33079803
10/7/09	San Juan Journal	Derelict fishing nets' toll: 30,000 marine birds, 110,000 fish and 2 million invertebrates a year - http://www.pnwlocalnews.com/sanjuans/jsj/news/63615992.html
9/23/09	Indian Country Today	Crews Save Ocean Life by Cleaning up Lost Gear - http://www.indiancountrytoday.com/national/northwest/59991982.html
Nov/Dec edition	Tide (CCA publication	Exorcising the Ghosts of Puget Sound
11/13/09	Kitsap Sun, article, video and photos	Under Water, Old Nets are Silent Killers - http://www.kitsapsun.com/news/2009/nov/13/under-water-old-nets-are-silent-killers/
11/14/09	Seattle Times	Stimulus money funding sea floor gill nets cleanup - http://seattletimes.nwsource.com/html/localnews/2010276345_apwakillernets1stldwritethru.html
11/14/09	The Olympian	Stimulus money funding sea floor gill nets cleanup - http://www.theolympian.com/northwest/story/1036532.html
11/14/09	Puget Sound Maritime	Stimulus money funding sea floor gill nets cleanup - http://www.pugetsoundmaritime.com/
11/14/09	Scripps News	Stimulus money funding sea floor gill nets cleanup - http://www.scrippsnews.com/node/49092
11/13/09	Kingston Community News	Conservation Program Nets Lost Fishing Gear - http://www.pnwlocalnews.com/kitsap/kin/news/70007812.html
11/14/09	KIRO TV	
Oct. 2009	American Institute of Fishery Research Biologists	Member June Leads Conservation Effort
12/14/09	Heraldnet	Stimulus Money Pays to Pluck Abandoned Fishing Gear off Puget Sound's Floor - http://heraldnet.com/article/20091114/NEWS03/711149847/1031/LIVING08
1/27/10	Seattle PostGlobe	Thousands of lost crab pots in Puget Sound harm marine wildlife http://www.seattlepostglobe.org/2010/01/27/thousands-of-lost-crab-pots-in-puget-sound-harm-marine-wildlife
3/05/10	NW Dive News	Derelict Gear Removal http://www.divenewsnetwork.com/pdf/nwdn/NWDN_0310.pdf

Date	Publication	Title/Link
3/12/10	Bellingham Herald, also The News Tribune	100,000 pounds of abandoned fishing gear taken from Whatcom County http://www.bellinghamherald.com/2010/03/12/1336083/100000-pounds-of-abandoned-fishing.html
3/13/10	The Seattle Times	Divers lift 50 tons of fishing gear from Whatcom County waters http://www.heraldnet.com/article/20100314/NEWS03/703149854/1008/SPORTS02
3/06/10	Kitsap Sun	Fewer "ghost nets" in Kitsap waters http://www.kitsapsun.com/news/2010/mar/06/kitsap-waters-cleared-of-derelict-nets/
3/09/10	Port Townsend Leader	Lost fishing nets removed from 13 Puget Sound locations http://ptleader.com/main.asp?Search=1&ArticleID=26468&SectionID=36&SubSectionID=55&S=1
3/07/10	Island Guardian	13 PS areas free of derelict fishing nets - SJC not one of them http://www.islandguardian.com/archives/00003144.html
3/11/10	KUOW Radio	Litter cleanup in Puget Sound http://www.kuow.org/program.php?id=19675
4/25/10	KOMO TV	Abandoned "killer nets" destroying Puget Sound sea life http://www.komonews.com/news/local/92062169.html
5/18/10	USA Today	Crews Fish Out Lost Nets to Save Trapped Wildlife http://www.usatoday.com/news/nation/environment/2010-05-17-ghost-fishing-rescue-conservation_N.htm?loc=interstitialskip
5/23/10	Delmarvanow.com	Ghost Pots Haunt Chesapeake http://www.delmarvanow.com/article/20100523/NEWS01/5230303
5/28/10	Indian Country Today	Nisqually, Puyallup, Squaxin Island Remove Derelict Gear http://www.indiancountrytoday.com/national/northwest/95120234.html
5/29/10	Seattle Times	Gill Nets in Rivers Could Pose Major Damage to Resources http://seattletimes.nwsource.com/html/othersports/2011987819_outn30.html
6/10/10	Bellingham Herald	Efforts Under Way to Remove Derelict Fishing Gear in the Nooksack River http://www.bellinghamherald.com/2010/06/10/1473462/efforts-under-way-to-remove-derelict.html?story_link=email_msg
6/12/10	The Outdoor Line	Radio Interview with Ginny Broadhurst
9/2010	Pacific Fishing Magazine	Cleaning Up Puget Sound
9/01/10	Sea Technology	Application of Sidescan Sonor for the Detection of Derelict Gear
9/15/10	The Ripple Effect: Pacific NW CCA regional newsletter	New Technology Helps Uncover Derelict Nets
11/10	Watertalks, EPA Newsletter	EPA Divers Help in Recovery of Abandoned Gear in Puget Sound
11/10	Nor'westing Magazine	Ghosts of the Sea

Project Photos

The Twila Dawn worked as one of four removal vessels removing a total of 434 derelict nets.

Divers were deployed to remove nets

A diver works to free a net for removal.

A net being loaded onto the deck of a removal vessel.

A live copper rockfish found in a net off of Possession bar, March 2010

Invertebrate impacts included this young red octopus found dead in a net.

This adult skate was entangled in a derelict net.

Lead line removed for recycling