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FINAL REPORT

PORT GARDNER 2014 DERELICT FISHING GEAR REMOVAL PROJECT AND STUDY AREA ANALYSIS

PREPARED FOR:

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Introduction

Abandoned, lost and discarded crab pots can present economic and environmental impact issues in marine waters. Every year pot gear is lost due to entanglement with debris, vessel hits and vandalism. Identification, location and safe removal of derelict crab pots can reduce these destructive impacts of derelict fishing gear, as has been demonstrated in derelict gear removal projects previously conducted in Washington waters of the Salish Sea.

The goals of the Northwest Straits Foundation (NWSF) 2014 Port Gardner derelict gear project were to locate and remove derelict fishing gear from a specific study area in the commonly fished commercial, Tribal and recreational Dungeness crab (*Cancer magister*) fishing area of Port Gardner. In addition to the standard gear characteristics and impact (species entrapped) information collected and summarized; investigations consisting of in-water and out-of-water analysis of each derelict crab pot and their components were conducted to determine the most likely cause for pot loss. Additionally, derelict crab pot removal data summarizing number of pots lost and escape cord compliance in the Port Gardner Study Area during 2014 has been added to the analysis provided in NRC reports for Snohomish MRC, completed December 31, 2012 and December 31, 2013, and summarized here. Combined, these report components will increase the ability to identify trends and/or anomalies in the characteristics of the lost gear in the area, and the practices of the recreational and commercial fishers utilizing these fishing grounds. They can further be used to assist in evaluating the effectiveness of recreational crabber educational programs that have been in place through the work of Snohomish County MRC and Washington State University (WSU) Extension Beach Watchers.

The Northwest Straits Foundation secured funding from Washington State Department of Natural Resources for derelict crab pot survey and removal operations. The Foundation then contracted with Natural Resources Consultants, Inc. (NRC) to manage the project. The removal operations were coordinated with the WDFW, Snohomish County, Tribal governments, NOAA, the U.S. Fish and Wildlife Service (USFWS) and the U.S. Coast Guard (USGC).

Scope of Work

The project consisted of 1 day of sidescan sonar survey fieldwork in the Port Gardner Study Area, with an associated 0.25 days of post-survey processing. This was followed by 2 days of dive removal operations for derelict crab pot targets. Dive removal operations were conducted in the commonly fished area immediately west of Jetty Island in Port Gardner. During derelict gear removal operations, project personnel performed data collection methods to include a visual analysis of the derelict gear removed to estimate the reason for pot loss for each target. Additionally, pot loss rate and escape cord compliance was compared to summaries of data collected from previous years in the Study Area.

Methodology

Sidescan Sonar Survey

Fenn Enterprises performed the sidescan sonar surveys on January 10, 2015, in Port Gardner followed by 0.25 days of post-survey processing. A Marine Sonic sidescan sonar system operating at 600 kHz with a differential global positioning system (DGPS) was used during the survey to locate derelict fishing gear. The sonar system employed a heavy towfish, towed off the bow of an 8 m (26 ft) survey vessel. A hydraulic winch and cable controlled the depth of the towfish. The sidescan sonar image was projected on a monitor onboard the vessel and recorded onto a computer hard drive for later processing.

The sidescan sonar survey was conducted at an average speed of 4.63 km/hr (2.5 knots) with a sonar signal range of 40 m on both sides of the vessel for an approximate path width of 80 m (262 ft). Survey depths in Port Gardner generally ranged from about 3 m (10 ft) to 32 m (105 ft) in order to identify derelict fishing gear within the dive depth capabilities of the recovery team.

The intent of the 2015 sidescan sonar survey was to locate derelict crab pots lost in the 2014 fishing season to be removed from the previously cleaned Port Gardner Study Area. Counts and precise locations of derelict fishing gear were recorded during post-survey processing of the data. The products from the sidescan sonar survey included a trackline file of the area surveyed, calculation of the area covered and the positions (latitude and longitude) of likely derelict fishing gear targets found (Figure 1).

Derelict Fishing Gear Removal

Fenn Enterprises was contracted to conduct the dive recovery operations of crab pots in the Port Gardner area. Two divers equipped with SCUBA operated off a 12 m (40 ft) dive support and gear recovery vessel, the R/V *Surveyor II*. A list of the precise locations of derelict crab pots detected during the sidescan sonar survey was used by the onboard biologist and dive team to locate derelict pots using a wide area augmentation (WAAS) GPS and electronic navigation software (Nobeltec®). Derelict gear target locations derived from the sidescan sonar survey were transferred into the Nobeltec software as waypoints and plotted over navigation charts of the Port Gardner area.

Using the WAASGPS system, the dive support vessel was directed to the exact location of the potential derelict gear targets. When the vessel arrived at the target location, a clump weight with a line and float was deployed at the target location. The dive support vessel drifted nearby as a single diver was deployed, while a safety backup diver stood by on deck. A 30 m (100 ft) length of rope was passed through a loop on the rope near the clump weight and the diver held the other end. Typically the clump weight landed within

two meters of the derelict gear target and the diver visually located the derelict pot. However, in poor water visibility conditions, the diver would drag the 30 m rope around the clump weight in a circle until it tangled with the derelict fishing gear and then the diver worked back along the rope to the gear. The derelict gear was freed by hand by the diver and a recovery line from the vessel was attached and it was hauled aboard the recovery vessel with a hydraulic winch.

A variety of information about the derelict crab pot was reported by the diver to the biologist or observed directly onboard the support vessel. Information collected included whether the derelict pot was from the commercial or sport (recreational) fishery, whether it was equipped with escape cord, whether the gear was actively fishing or not and the number of live and dead Dungeness crab and other crab and fish entrapped. Also reported was information about the overall condition of the gear, the depth and type of seabed where the gear was located, and if there was any evidence that would elucidate the reason the pot was lost. The biologist also searched for owner identification, and if present, recorded contact information that was later used to coordinate returning gear items to their owners.

During removal operations at Port Gardner, the derelict fishing gear was stored by Fenn Enterprises at a secure location offsite. If the owner of the pot could be determined, the owner was contacted and allowed the opportunity to recover their fishing gear at no cost. Pots that remained in good condition and were not claimed by owners were stored in a secure location for potential future use. Pots in poor condition were taken to the Snohomish County solid waste facility for disposal.

Investigating Reasons for Pot Loss

In order to successfully address the derelict crab pot issue in the Puget Sound region, it is important to understand why pots are being lost. The reasons for pot loss are many, and may vary depending on the area. While the full story behind each lost pot cannot be found through inspecting a derelict crab pot, much information about the probable reasons for pot loss can be found by investigating the gear both underwater and out-of-water. Therefore, since the Snohomish County MRC Port Gardner 2013 derelict gear removal project, careful attention has been given to investigating the reason for pot loss. The anticipated reasons for pot loss were divided into twelve categories: (1) line length to water depth mismatch, (2) vessel strike, (3) barge strike, (4) vessel or barge strike (5) tampering / sabotage, (6) gear malfunction (7) user error, (8) entanglement with other gear, (9) entanglement with something else, (10) other, (11) unknown and (12) abandoned. Divers were instructed to report to the biologist any visual evidence they witnessed underwater that would explain why the pot was lost. At the surface, the onboard biologist further inspected the pot and its components (i.e., harness, clips, buoy lines, etc.), looking for signs that could determine how each pot was lost; such as broken gear components, cut or tangled buoy lines, evidence of tampering or sabotage,

significant structural damage and more. Photographs of each removed crab pot were taken for future reference and further investigations, if needed.

Comparing Results from Derelict Pot Removals in Port Gardner

In 2008, the derelict fishing gear survey and removal project in Port Gardner successfully surveyed and cleaned a specific area of heavily concentrated Dungeness crab pot fishing effort just west of Jetty Island outside the Port of Everett. The 2008 operations overlapped an area where derelict crab pot surveys were conducted in 2004 with subsequent removals in 2004 and 2005. This area has been identified as the Port Gardner Study Area and repeated surveys and removal in the Study Area have been completed in 2009, 2011, 2012, 2013, and now in 2015. Along with the goals of removing derelict crab pots that impact the local resource and marine ecosystem, multiple years of completed surveys and removals within the same area provide an opportunity to analyze gear loss over time. This also allows for observing changes in the rate of compliance by fishers regarding use of legally mandated escape cord in both the commercial and recreational crab fisheries. These are important factors with respect to the impacts of derelict gear on the valuable Dungeness crab resource.

To calculate pot loss rates over time we identified how many seasons occurred between derelict gear operations, which part of the year those seasons occurred (summer or winter) and how many days of fishing were available for sport fishers during those seasons. Sport fishing effort expended during winter seasons is significantly less than summer seasons and WDFW biologists estimate winter effort at 12% to 13% that of summer effort (D. Velasquez, personal communication). Therefore, a correction factor of 0.125 was applied to winter season days available to account for the difference in effort, standardizing the unit of effort measurement to summer day equivalent (SDE). To remain within the scope of the project, this analysis was only performed on sport pot data and excludes commercial pot data.

Spatial analysis of the sidescan sonar survey areas and derelict gear targets investigated per project was conducted using ArcGIS®. A detailed description of the differences in pot loss and escape cord compliance in the Study Area between projects from 2004 through 2012 were provided to Snohomish County in a report from NRC dated December 31, 2012, and reports of findings after the 2013 fishing season were provided to Snohomish County in a report from NRC dated December 31, 2013. This document reports on how the data collected in 2015, on pots lost in 2014, compares to those from previous years. However, it does not include the full comparison of all projects in the Port Gardner Study Area from 2004 to 2015. In order to accurately assess the amount of gear loss between projects in the Study Area, data collected in 2015 on pots lost in 2014 was compared to the data from the 2012 and 2013 projects and gaps identified in survey area coverage were not included in the analysis unless the pots found within those gaps were identified as “New” pots in “Good” condition. Some investigated targets exhibiting dilapidated characteristics as the result of likely being derelict for longer than the amount

of time since the 2013 project were identified as such and not used in the analysis. Additionally, crab pot targets that were beyond maximum diver depth (BMDD), defined as greater than a depth of 32 meters (105 feet) were not included in the analysis.

Results

Sidescan Sonar Survey and Pot Removals

In the 1 day of sidescan sonar surveys conducted in Port Gardner on January 10, 2015, 2.36 km² were covered and 47 potential derelict crab pot targets were detected or 19.9 targets/km². One crab pot target proved to be a tire of similar shape and size to a crab pot and was left in place, two crab pot targets were not found and upon investigation five targets were identified as beyond the safe maximum diver depth (BMDD) of 32 m (105 feet). A total of 39 of the original targets were found to be derelict crab pots, and an additional five crab pots were found adjacent to targets identified in surveys, all of which were removed by divers (Table 1 and Figure 2). Table 1 provides the characteristics of pots removed in Port Gardner.

Derelict Crab Pot Removal

Derelict fishing gear was removed from Port Gardner on January 28 and 29, 2015. A total of 44 crab pots were removed. Thirty-nine of the 44 derelict crab pots removed were identified in the sidescan sonar surveys. Derelict crab pots were removed from water depths ranging from 6.1 m (20 ft) to 29.6 m (97 ft) from mud and mixed sand/mud substrate.

Of the 44 derelict pots removed, 19 (43%) were commercial pots and 25 (57%) were sport pots (Table 1). Seven (16%) pots were determined to be actively fishing and 37 (84%) were no longer fishing. Of the 44 pots removed, five (11%) were not equipped with legal escape cord, 36 (82%) had legal escape cord and three (7%) pots were too deteriorated to determine whether escape cord was used or not. Of the 36 pots equipped with legal escape cord, the escape cord had disintegrated on 24 (67%) and was still intact on 12 (33%) pots.

Of the 19 commercial pots recovered, 12 (63%) were equipped with escape cord, escape cord use could not be determined on three pots (16%), and four pots (21%) were observed to be non-compliant with escape cord regulations. Proper use of escape cord could be determined on all 25 derelict sport pots removed; one (4%) was not equipped with legal escape cord and 24 (96%) did have legal escape cord. The one pot without legal escape cord was equipped with a synthetic (nylon) cord where biodegradable (cotton) escape cord is typically found. Of the seven crab pots found to still be fishing, three (43%) were not equipped with proper escape cord and four (57%) had legal escape cord that had yet to deteriorate.

Of the 44 derelict pots recovered, 15 (34%) pots contained a total of 82 Dungeness crab and one live Red rock crab (*Cancer productus*) (Table 1). Of the 82 crab recovered, 52 (63%) were live and 30 (37%) were dead. Four (5%) of the Dungeness crab recovered were females; all of which were alive. Sixty-eight (83%) were males (48 live and 20 dead) and the sex was not determined for ten (12%) of the crab due to poor shell condition. Derelict pots determined to be still actively fishing contained 50 (61%) Dungeness crab (43 live and 7 dead). Pots determined to be no longer actively fishing contained 32 (39%) Dungeness crab (12 live and 20 dead). Crab pots without legal escape cord contained 27 (33%) Dungeness crab; all of which were live. Crab pots with legal escape cord contained 55 (67%) Dungeness crab (25 live and 30 dead).

Table 1. Total number of derelict pots recovered, type of pot (commercial or sport), fishing status (fishable or not), rot cord use and numbers of live and dead Dungeness crab observed in Port Gardner during the NWSF 2014 derelict fishing gear project. Source: NRC.

Fishable/Not Fishable		Fishable			Not Fishable				All Pots			
		Rot Cord Use	Rot Cord	No Rot Cord	Total	Rot Cord	No Rot Cord	Unknown	Total	Rot Cord	No Rot Cord	Unknown
Commercial	# Pots Recovered	1	3	4	11	1	3	15	12	4	3	19
	# Dungeness Crab Dead	5	0	5	20	0	0	20	25	0	0	25
	# Dungeness Crab Alive	11	27	38	3	0	0	3	14	27	0	41
Sport	# Pots Recovered	3	0	3	21	1	0	22	24	1	0	25
	# Dungeness Crab Dead	2	0	2	3	0	0	3	5	0	0	5
	# Dungeness Crab Alive	5	0	5	6	0	0	6	11	0	0	11
	# Red Rock Crab Alive	0	0	0	1	0	0	1	1	0	0	1
All Pots	# Pots Recovered	4	3	7	32	2	3	37	36	5	3	44
	# Dungeness Crab Dead	7	0	7	23	0	0	23	30	0	0	30
	# Dungeness Crab Alive	16	27	43	9	0	0	9	25	27	0	52
	# Red Rock Crab Alive	0	0	0	1	0	0	1	1	0	0	1
# Total Crab		23	27	50	33	0	0	33	56	27	0	83

Other animals found in the crab pots removed included nine live mottled stars (*Evasterias troscheli*) and one ochre star (*Pisaster ochraceus*).

Four commercial pots with owner identification were returned to commercial crab fishers. Tulalip Tribal marine enforcement personnel retrieved six Tulalip Tribal pots to be returned to owners. The one sport pot with owner identification was returned to its owner two days after removals were completed. A total of 10 sport pots in good condition and not exhibiting owner identification were transported and stored in a secure location to be used as give-away or auction material at derelict fishing gear outreach/education events sponsored by the Northwest Straits Foundation, Snohomish County MRC, and/or

NRC. Pots removed from Port Gardner that were not returned to owners or saved for later use were transported and disposed of at the Snohomish County Southwest Recycling and Transfer Station facility where the total weight of gear disposed was approximately 250 lbs.

Investigating Reasons for Pot Loss

Based on the information provided by removal divers and inspection of recovered gear on the removal vessel deck, the estimated reason for gear loss was determined for 34 (77%) of the 44 pots removed. In cases where the evidence suggested multiple reasons for pot loss, the onboard biologist decided upon the one most likely reason given the evidence, while also providing a potential alternate reason for the pot becoming derelict. Vessel strikes were determined to be the main cause of pot loss during the project. Pots lost by vessel strike often exhibit a clean cut of the buoy line from a fast moving propeller, or they leave an extremely wound-up buoy line after being wrapped multiple times in a slower-moving propeller and shaft. Of the 44 derelict pots removed, 14 (32%) were determined to have been lost by vessel strike (Table 2). This was evident by buoy lines being severed and sometimes wound up, near the terminal end to the line. One of the pots identified as lost by vessel strike also could have been lost by entanglement with other gear. One (2%) additional pot was identified to have been lost either by vessel or barge strike, as the pot appeared to have been dragged across the seafloor prior to the buoy line being severed at the pot. The secondary reason for loss of this pot was determined to be tampering or sabotage, as the line was cleanly severed where it was connected to the pot (Table 2).

Evidence of tampering and/or sabotage of other peoples gear was evident in eight (18%) of the removed pots. The term “suitcased” is used to describe a pot that has been retrieved (probably emptied) and then returned to the water after the buoy line with buoy has been coiled and secured inside the pot. This was evident in one of the pots found, while the remaining seven pots were found to have a cleanly severed buoy line near its connection to the pot. One of these pots had a secondary reason for loss as gear malfunction, and another may have been lost by vessel or barge strike (Table 2).

Six (14%) of the 44 removed pots appeared to have been lost by gear malfunction; identified by broken gear components, insufficient line capacity (too thin) and evidence suggesting that a buoy line was not correctly attached to the pot. The secondary reason for loss on all of these six pots were user error (Table 2), as these two reasons for loss are difficult to distinguish. Two (5%) of the 44 pots, however, were distinctly identified to have been lost by user error, as poorly tied knots were evident at the location where the buoy should have been present (Table 2). Two (5%) of the 44 pots lost were identified as abandoned, rather than lost. Both of these pots were from the commercial fishery and showed no signs of reason for loss other than the fact that they remained on the fishing

grounds after closure of the fishing season. All buoys and lines were attached, with no entanglement with other gear evident (Table 2).

One recreational pot was found with a compressed buoy still attached to the buoy line in water that was deeper than the length of the buoy line. This pot was determined to have been lost by a line-length to water depth mismatch (Table 2).

Finally, 10 (23%) of the 44 pots removed did not exhibit enough evidence to determine a reason for pot loss, and were therefore categorized as ‘unknown’. Of those ten pots, five were thought to potentially be lost by gear malfunction or user error (Table 2).

Table 2. Total number of derelict pots recovered by suspected reason for pot loss observed in Port Gardner during the NWSF 2014 derelict fishing gear project. Source: NRC.

Primary Reason for Pot Loss	Potential Other Reasons for Pot Loss	Number of Pots	% of Total
Vessel Strike	vessel strike	13	32%
	entanglement w/ other gear	1	
	Total Vessel Strike	14	
Tampering / Sabotage	tampering/sabotage	6	18%
	gear malfunction	1	
	vessel or barge strike	1	
	Total Tampering/Sabotage	8	
Gear Malfunction	user error	6	14%
	Total Gear Malfunction	6	
Abandoned	abandoned	2	5%
	Total Abandoned	2	
User Error	user error	2	5%
	Total Entanglement w/ other gear	2	
Vessel or Barge Strike	tampering/sabotage	1	2%
	Total Vessel or Barge Strike	1	
Line Length to Water Depth Mismatch	line length to water depth mismatch	1	2%
	Total Line Length to Water Depth Mismatch	1	
Unkown	Unkown	5	23%
	gear malfunction and/or user error	5	
	Total Unkown	10	
Total Pots Removed		44	100%

Comparing Results from Derelict Pot Removals in Port Gardner

Derelict pot density (pots/km²) and analysis of escape cord compliance within the Study Area were calculated for 2014 based on data collected during this project in January 2015. Pot loss rates were calculated within the Study Area for 2014 fishing based on survey area covered, number of available fishing day opportunities and number of

confirmed derelict crab pots. They are summarized in Tables 3 and 4 along with the corresponding data from 2004/2005, 2008, 2009, 2011, 2012 and 2013.

For the 2014 fishing season derelict pot removal project, 1.93 km² of the entire 2.36 km² survey area was within the bounds of the Study Area and 1.89 km² overlapped the 2013 survey area. A total of 41 confirmed derelict crab pots (18 commercial and 23 sport) or 21.24 pots/ km² (9.33pots/ km² commercial and 11.92 pots/ km² sport) were removed from the 2014 Study Area. Two of these were considered not to be newly lost based on their age and condition, leaving 39 removed derelict crab pots (16 commercial and 23 sport) within the Study Area determined to be newly lost (Table 3 and Figure 3), yielding a newly lost pot density of 20.21 pots/ km² (8.29 pots/ km² commercial and 11.92 pots/ km² sport). Recreational crab fishing opportunities in the Port Gardner area between 2013 and 2014 derelict gear operations included the final 15 days (16.3%) of winter 2013, the entire summer 2014 and the entire winter 2014 seasons. Combined, these seasons totaled 152 available fishing days (45 days in summer and 107 days in winter). To account for the significant difference in effort between summer and winter seasons we standardized the amount of available days to summer day equivalents (SDE) by applying a correction factor of 0.125 to the amount of winter days available resulting in a total of 58 days available for recreational crab fishing during the period. This provides a sport pot loss rate of 0.39 pots lost/day (0.20 pots/km²/day) between 2013 and 2014 derelict gear operations (Table 4). The use of escape cord could be discerned on all 16 newly lost commercial pots removed within the Study Area in 2014, 12 (75%) of which were properly equipped with legal escape cord, and four (25%) were not equipped with legal escape cord. Twenty-two (96%) of the 23 newly lost sport pots removed in 2014 were equipped with legal escape cord, and one (4%) was not (Table 5).

Table 3. Area surveyed, number of derelict pots recovered and average derelict pot density between operational periods 2009, 2011, 2012, 2013 and 2014 within the Port Gardner “Study Area”. Source: NRC.

Year	Survey Area within 'Study Area' (square km)	Total # Pots Removed/Disabled			Pot Density (per square km)			Area w/in 'Study Area' used for New Pot Loss Analysis (square km)	# Newly Lost Pots			Pot Density (per square km)		
		Comm	Sport	Total	Comm	Sport	Total		Comm	Sport	Total	Comm	Sport	Total
2004/2005	1.59	68	98	166	42.77	61.64	104.40	NA	NA	NA	NA	NA	NA	NA
2008	1.87	69	70	139	36.90	37.43	74.33	NA	NA	NA	NA	NA	NA	NA
2009	1.72	48	106	154	27.91	61.63	89.53	1.62	39	91	130	24.07	56.17	80.25
2011	1.81	40	71	111	22.10	39.23	61.33	1.81	33	57	90	18.23	31.49	49.72
2012	1.92	33	88	121	17.19	45.83	63.02	1.92	22	74	96	11.46	38.54	50.00
2013	1.94	14	74	88	7.22	38.14	45.36	1.92	11	73	84	5.73	38.02	43.75
2014	1.93	18	23	41	9.33	11.92	21.24	1.93	16	23	39	8.29	11.92	20.21

The overall number and density (pots per area) of crab pots lost within the Study Area has shown a downward trend over time since derelict gear survey and removals began in 2004, especially within the commercial fishery (Table 3, Figure 4 and 5). The sport pot loss rate (pots lost per day) decreased in 2011 and 2012, then increased from 0.64 pots/day (0.33 pots/km²/day) in 2012 to 1.31 pots/day (0.68 pots/km²/day) in 2013; reflecting an increase of 104% from the previous period. However, the increase seen in the 2013 season was responded to with a substantial decrease from 1.31 pots/day to 0.39 pots per day (0.20 pots/km²/day) in 2014. This equates to a 70% decline in pots lost per day (71% decline in pots lost per km² per day) within the recreational fishery inside the Port Gardner Study Area from 2013 to 2014 (Tables 3 and 4, Figures 9 and 10).

Table 4. Area surveyed, number of derelict pots recovered and average derelict pot density between operational periods 2009, 2011, 2012, 2013 and 2014 within the Port Gardner “Study Area”. Source: NRC.

Year	Sport Crab Seasons since Prior Removal	Summer Season Days since Prior Removal	Winter Season Days since Prior Removal	Total Summer Day Equivalent (SDE)	# Newly Lost Sport Pots	Sport Pots Lost per km ²	Sport Pots Lost per SDE	Sport Pots Lost per km ² per SDE
2009	S'08	37	0	37	91	56.17	2.46	1.52
2011	S'09, S'10	83	0	83	57	31.49	0.69	0.38
2012	S'11, W'11, S'12, W'12	96	155	115	74	38.54	0.64	0.33
2013	S'13, W'13	45	87	56	73	38.02	1.31	0.68
2014	S'14, W'14	45	107	58	23	11.92	0.39	0.20

Escape cord compliance observed in derelict commercial pots within the Study Area has shown an increasing trend from 68% pot compliance (excluding “Unknown”) in 2004/2005 observations to 100% pot compliance in 2013. However, the 2014 data from recovered derelict commercial pots shows a 25% decrease in escape cord use from 2013 (Table 5, Figures 7 and 8). Within the sport fishery, the observed escape cord compliance went from 79% pot compliance in 2004/2005 to 100% pot compliance in 2008, reached a low of 77% pot compliance in 2009 followed by an increase to 95% pot compliance in 2011. Escape cord compliance then dropped to 79% in 2012, then increased in 2013 to 95%, and increased slightly to 96% in 2014 (Table 5, Figures 9 and 10).

Dungeness crab catch and mortality in derelict crab pots removed from the Port Gardner “Study Area” and nearby have been thoroughly reported in the previous section of this document, as well as in previous reports from 2008, 2009, 2011, 2012 and 2013. Therefore, the findings of Dungeness crab catch and mortality are not included in this analysis of newly-lost pots within the “Study Area”.

Table 5. Escape cord compliance observed in derelict pots recovered between operational periods 2009, 2011, 2012, 2013 and 2014 within the Port Gardner “Study Area”. Source: NRC.

Year	Newly Lost Pots Inside "Study Area"		Escape Cord: Used		Escape Cord: Not Used		Escape Cord: Unknown		% of Total Pots Equipped with Legal Escape Cord		% of Pots Equipped with Legal Escape Cord: Excluding Unknown	
	Comm	Sport	Comm	Sport	Comm	Sport	Comm	Sport	Comm	Sport	Comm	Sport
2004/2005*	68	98	28	56	13	15	27	27	41%	57%	68%	79%
2008*	69	70	52	70	16	0	1	0	75%	100%	76%	100%
2009	39	91	27	68	9	20	3	3	69%	75%	75%	77%
2011	33	57	29	54	4	3	0	0	88%	95%	88%	95%
2012	22	74	18	57	4	15	0	2	82%	77%	82%	79%
2013	11	73	11	69	0	4	0	0	100%	95%	100%	95%
2014	16	23	12	22	4	1	0	0	75%	96%	75%	96%

*Pots removed were not determined to be newly lost or old
Only data within 'Study Area' used in this analysis

Conclusions

This project successfully investigated 100% of original 47 sidescan sonar survey targets. Divers removed 39 (83%) of the 47 derelict fishing gear targets found during the sidescan sonar surveys along with five others that were not identified in the surveys. For the second time in derelict crab pot removal operations in the Port Gardner Study Area, the removal team made efforts to identify the reason for pot loss on each of the derelict pots removed, by request from the client. Results from this analysis showed that in 2014, the two most common reasons for pot loss in the area are either vessel strikes or tampering/sabotage. Other reasons for pot loss that were identified were gear malfunction and/or user error, abandonment and line-length to water depth mismatch. Because sidescan sonar surveys during these projects focus on water depths that are within the maximum allowable diver safety depths of 32 m (105 feet), they do not cover the steep slope just west of the Study Area where the water depth quickly increases from ≤ 27 m (90 feet) to over 32 m. In surveys conducted in previous years, several derelict crab pot targets were identified along this slope in water depths beyond 32 m. We assume that the reason for many, if not most, of those crab pots becoming derelict can be attributed to the line length and water depth mismatch, as fishers presume they are deploying their gear on the shallow side of the slope, when actually their pot lands on the deeper side of the slope to the west. Alternatively, pots deployed along the shelf may slide down the hill into deeper waters, submerging the buoy. Targeted sidescan sonar

surveys and pot removals utilizing remotely operated vehicles (ROV) can be performed in this and other areas to identify and remove gear, while also gathering information on the reason for pot loss.

Results show that the number of pots lost per fishing day opportunity within the recreational crab fishery in the Port Gardner Study Area in 2014 was only 30% of what it was over the summer and winter seasons of 2013, and 61% of what it was in 2012. The spike in pot loss rates in 2013 was concerning, as results from the 2012 report concluded that the pot loss rates were continuing to trend downward from year to year. The 2014 data, however, suggests that the increase shown in 2013 may have been an anomaly, as pot loss rates decreased substantially, even below the low rates seen in 2011 and 2012. The long-term trend in sport pot loss in the Study Area continues to have decreased since 2008, as the pots lost per fishing day opportunity in 2014 was 13% to 16% of what it was in 2008 (data collected in 2009 removals). Initial assumptions as to what would explain the dramatic changes seen in the 2014 season were that (a) there was less recreational effort during the 2014 summer and winter season, (b) that there may have been much less commercial traffic in and out of the Port of Everett, or (c) that WDFW enforcement sweeps were increased in the area, removing buoyed pots on closure days. Discussions with WDFW shellfish managers denied that there was any less fishing effort in the area or that there were any more WDFW pot sweeps than usual (Rothaus and Velasquez, WDFW, personal communication). Representatives at the Everett-based commercial marine towing company explained that their vessel activity through Port Gardner was as busy in 2014 as they ever have been. Inquiries into the Snohomish County Sheriff's office regarding their off-season marine sweeps have yet to be responded to, and could potentially provide more information regarding the cause of the decrease in derelict pots within the Study Area. Finally, as educational programs from WDFW, NWSF, Snohomish County MRC and WSU Beach Watchers have continued, the low numbers of derelict pots in the Port Gardner Study Area in 2014 could be the result of a more educated recreational crabbing fleet. Nevertheless, the significant decrease exhibited in the 2014 data suggests that there is a decreasing trend in pot loss that may continue, and further surveys and removals in the Study Area can lead to a better understanding of where the norm lies in pot loss rates in the sport fishery, if one exists.

Results from the 2014 project show a 1% increase in escape cord compliance within the recreational crab fishery in the Port Gardner Study Area from 95% in 2013 to 96% in 2014. The 96% compliance, in general matches the 95% from the 2011 and 2013 project, is higher than those observed in 2012, 2009 and 2004/2005, yet does not reach the 100% achieved in 2008. These observations indicate a potential rising trend in the percentage of sport fisher compliance with WDFW escape cord regulations from year to year. The Port Gardner Study Area is ideal for continuing research to determine further pot loss rates and escape cord compliance within the recreational crab fishery, while also identifying associations with and the effectiveness of ongoing recreational crabber education programs in the area.

Without full investigation of commercial fishing effort between derelict gear projects in the Port Gardner Study Area, a pot loss by effort rate is not available; however, decreasing numbers of derelict commercial pots identified from 39 in 2009 to 33 in 2011 to 22 in 2012 to 11 in 2013 indicated a general decreasing trend in pot loss over time. This may be attributed to both a change in fisher behavior as well as a decrease in available or appropriated fishing opportunities. While there was a slight increase in number of commercial pots found within the study area from 11 in 2013 to 16 in 2014, overall the commercial pot density remains much lower than was observed in 2012 and prior. Unfortunately, the observed use of legal escape cord on commercial derelict pots in 2014 of 75% is a 25% decrease from the 2013 results and has been the lowest seen during this study since 2009.

Recommendations

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

- **Recreational crabbers should be educated on the best fishing practices that prevent crab pot loss. The following is a list of practices that can reduce pot loss, many of which are already included in the Snohomish County MRC and WSU Extension Beach Watchers education curriculums:**
 - Avoid high vessel traffic areas, ferry, barge and log tow routes
 - Remain near pots during soak time
 - Use weighted buoy lines to reduce potential vessel strikes
 - Use buoy lines of proper length (i.e., 1/3 longer than water depth)
 - Know the depth of water where pots are set
 - Use multiple buoys in high current areas to avoid buoy submersion
 - Augment pot weight to avoid pot migration in high currents
 - Leave ample spacing between pot drops to avoid buoy entanglement
- **Education programs should include suggestions to recreational fishers to test the durability and functionality of all gear components and knots prior to deploying crab pots, and replace items or re-tie knots if they seem to be compromised or faulty. This could reduce gear loss through gear malfunction and/or user error.**
- **Education programs should include information regarding proper installation of escape cord, the use of thin vs. thick strands of escape cord and that in order to comply with regulations, escape cord must be made of biodegradable material rather than synthetics such as nylon. In addition,**

special attention should be placed on the placement of bait clips, bait jars, bridles, etc., that can prevent the opening of a crab pot door despite the deterioration of escape cord.

- **The use of legal escape cord on crab pots should continue to be enforced.**
- **Pot loss by vessel strike can be reduced by making buoys more visible to vessel operators. In areas of heavy vessel traffic such as the Port Gardner Study Area, augmenting pot buoys with brightly colored poles (i.e., PVC pipe either painted bright or with flagging) extruding 16 to 28 inches vertically from the buoy, perpendicular to the sea-surface, would significantly increase the visibility of a buoy to vessel operators, and therefore reduce the amount of pots that are lost by vessel strikes. Such practices should be encouraged in educational programs and outreach opportunities, and could be considered as a potential regulatory requirement in specific locations where vessel strikes are a prominent reason for gear loss.**
- **In many instances, the deterioration of escape cord does not effectively disable the fishing capabilities of a crab pot, nor does it ensure the successful escape of an entrapped crab. Research should continue to be conducted to identify the crab pot construction style that is most effective in becoming disabled upon escape cord disintegration.**
- **The Study Area should be surveyed and gear removed annually for the next two to three years to further determine crab pot loss rates and gain greater information on the effectiveness of crab pot fishing education programs being conducted.**

Acknowledgements

The Port of Everett kindly provided free moorage for the dive support vessel during the project, their assistance is greatly appreciated. We also wish to thank the Snohomish County MRC for their continued support and cooperation during the project, and their dedication to eliminating the harmful effects of derelict crab pots in Puget Sound marine waters. Don Velasquez and Don Rothaus of WDFW, Cathy Stanley and Mike McHugh of Tulalip Fisheries assisted in planning by providing valuable fisheries updates and information prior to derelict gear operations. Many thanks to Joan Drinkwin at the Northwest Straits Foundation for the continued interest in the Port Gardner Study Area projects, and continued dedication to eliminating the impacts of derelict fishing gear in the Puget Sound. Finally, we thank Chris Robertson as Washington DNR for providing the funds to conduct the 2014 Port Gardner Study Area project.

Figure 3. Derelict crab pot targets removed or disabled during the 2014 operations within the Port Gardner “Study Area”.
 Source: NRC, Inc. and Fenn Enterprises.

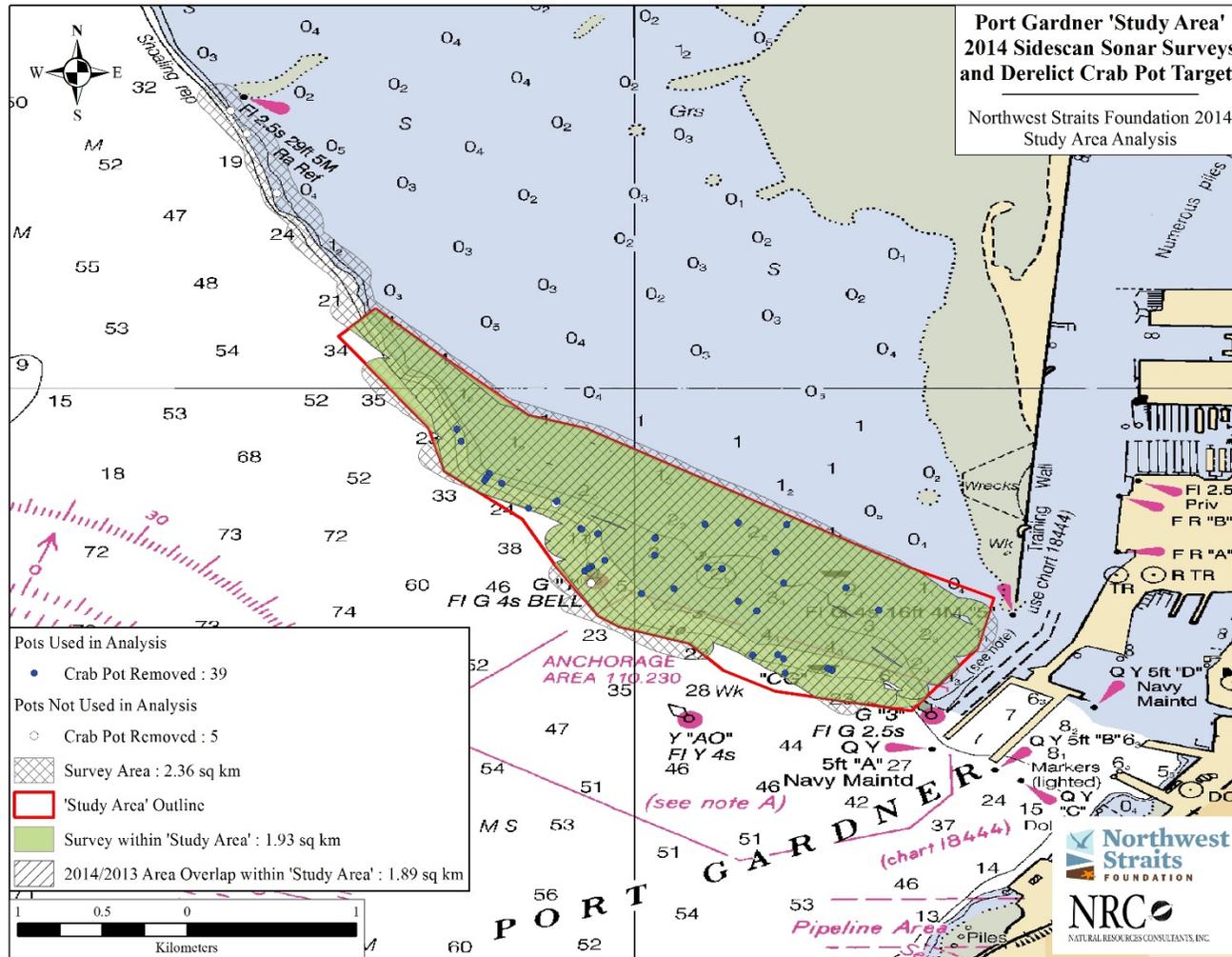


Figure 4. Number of derelict crab pots removed/disabled within the Port Gardner “Study Area” by project from 2004/2005 through 2014. Source: NRC, Inc.

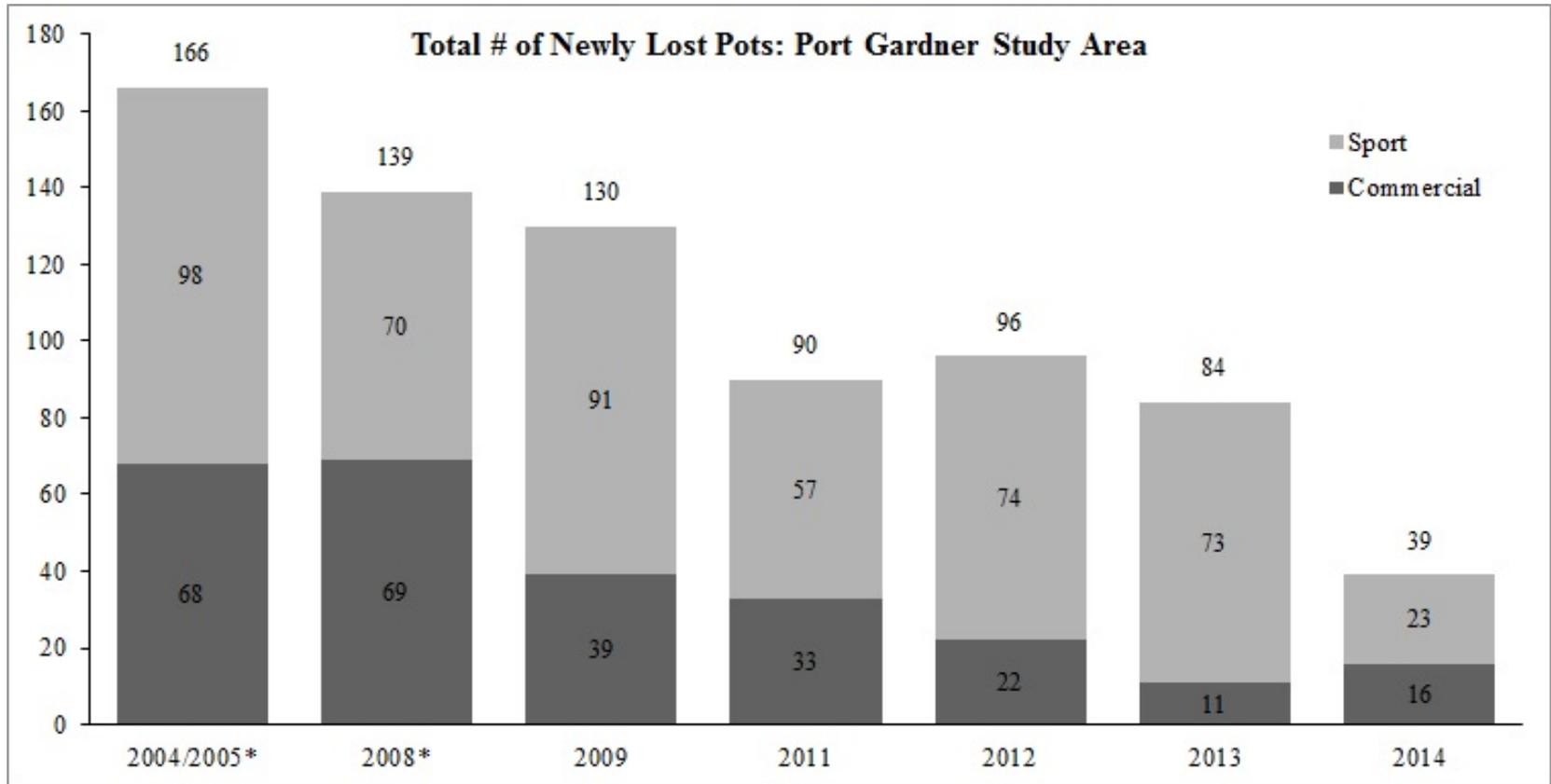


Figure 5. Number of derelict sport pots removed/disabled within the Port Gardner “Study Area” by project and number of recreational crab fishing days available between projects Source: NRC, Inc. and WDFW.

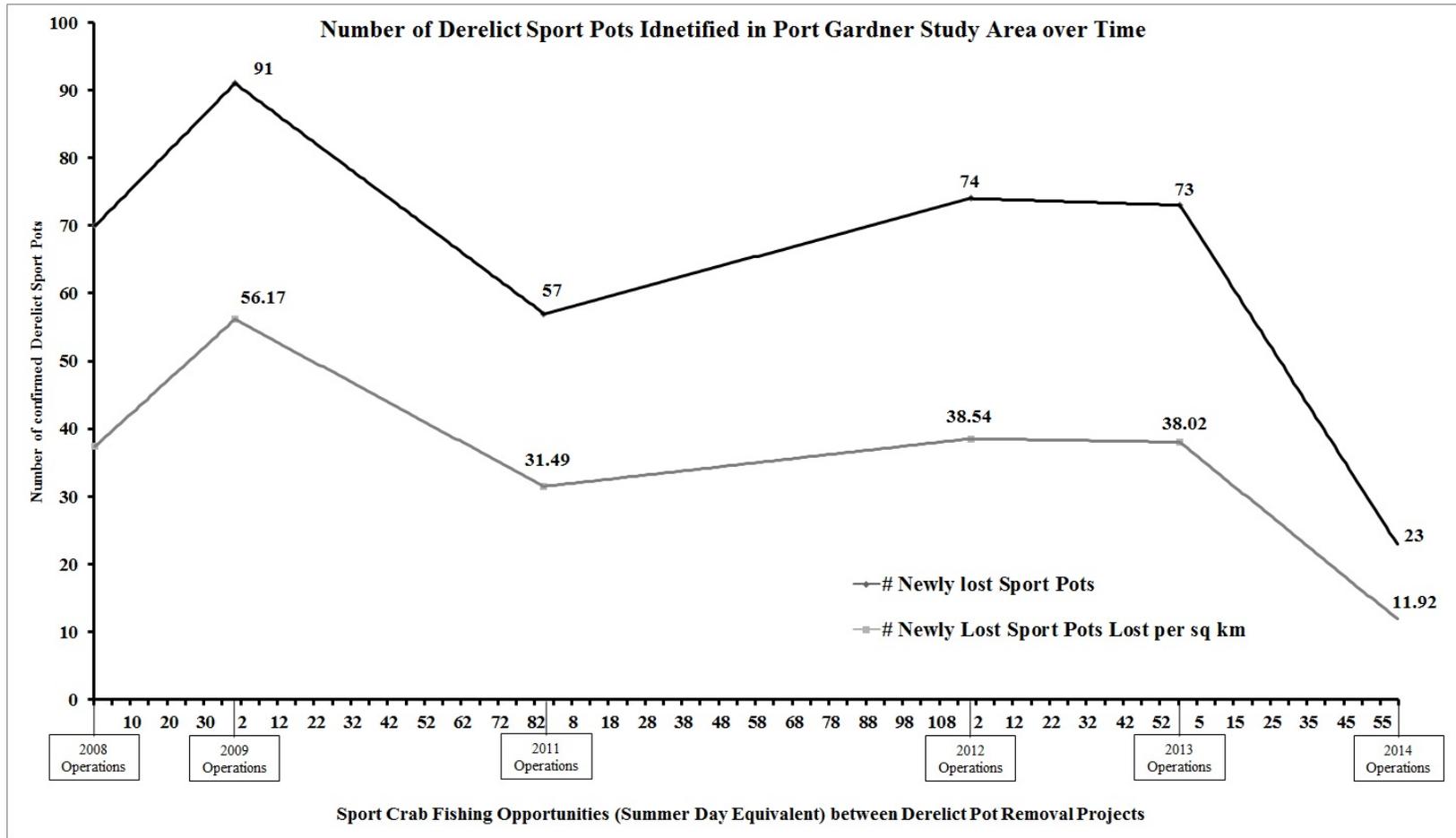


Figure 6. Observed sport pot loss per available fishing day within the Port Gardner “Study Area” by year. Source: NRC, Inc. and WDFW.

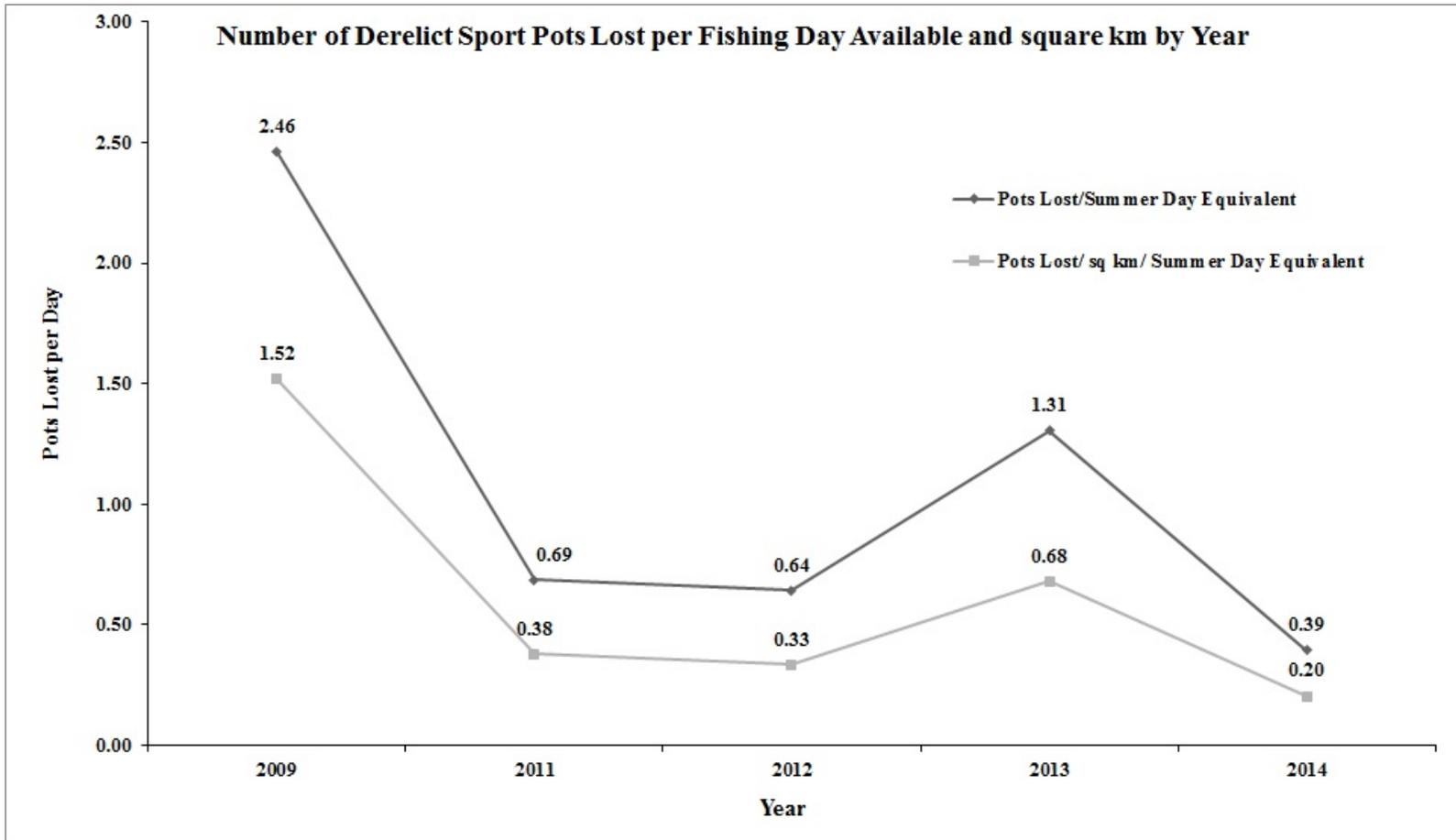


Figure 7. Summary of escape cord compliance observed on commercial derelict crab pots removed in the Port Gardner “Study Area” from 2004/2005 to 2014. Source: NRC, Inc.

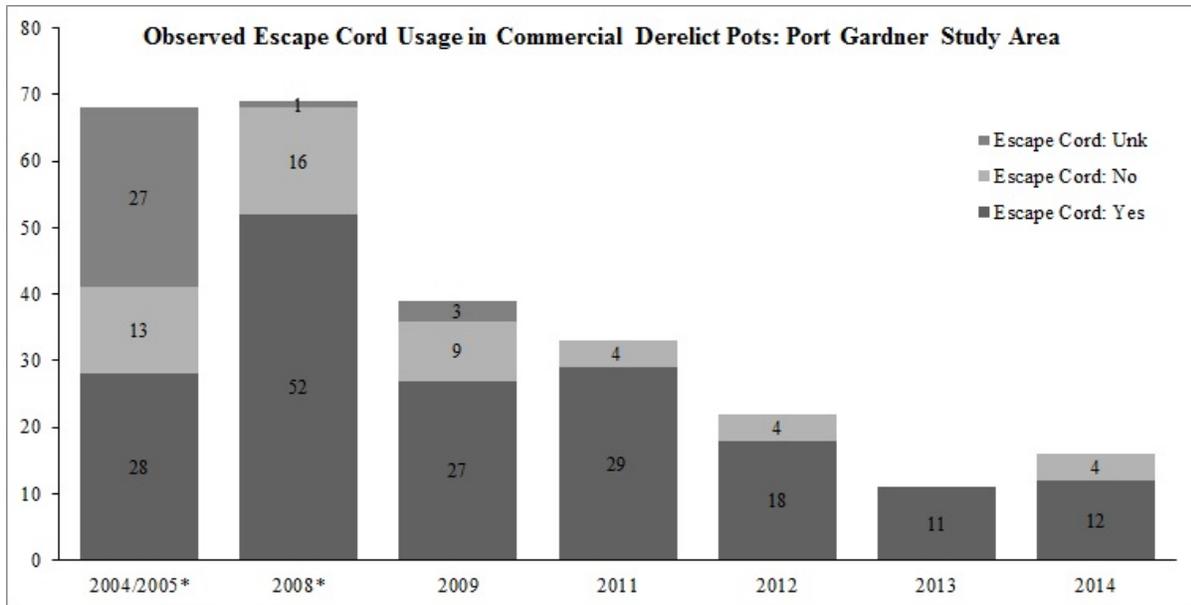


Figure 8. Percentage of legal escape cord compliance exhibited in derelict commercial pots removed exhibiting legal escape cord in the Port Gardner “Study Area” from 2004/2005 to 2014. Source: NRC, Inc.

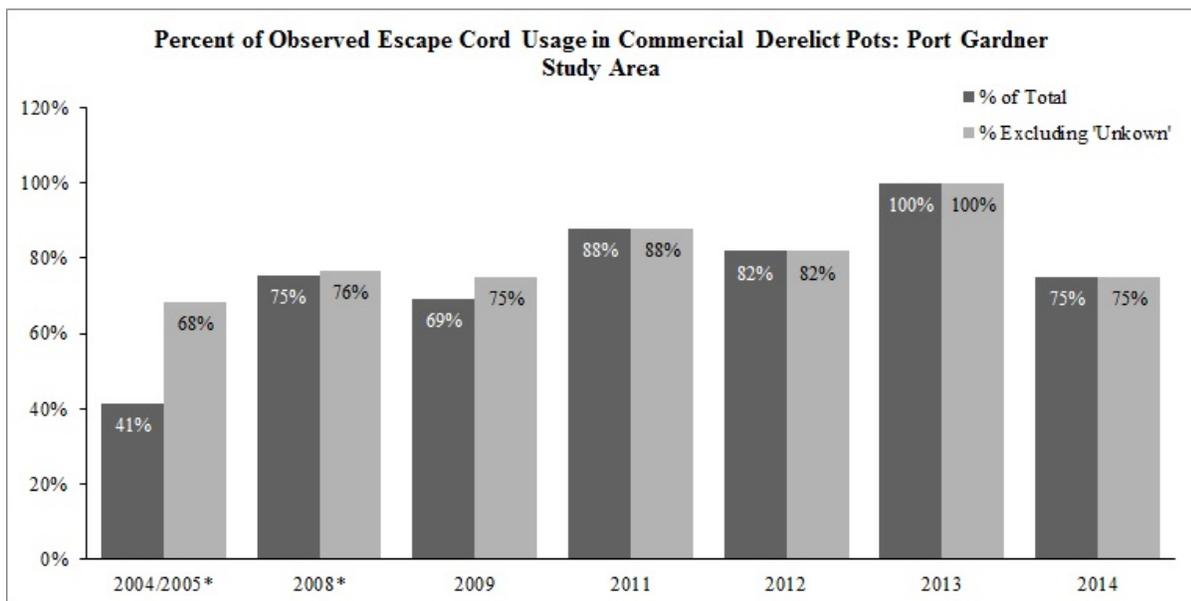


Figure 9. Summary of escape cord compliance observed on sport derelict crab pots removed in the Port Gardner “Study Area” from 2004/2005 to 2014. Source: NRC, Inc.

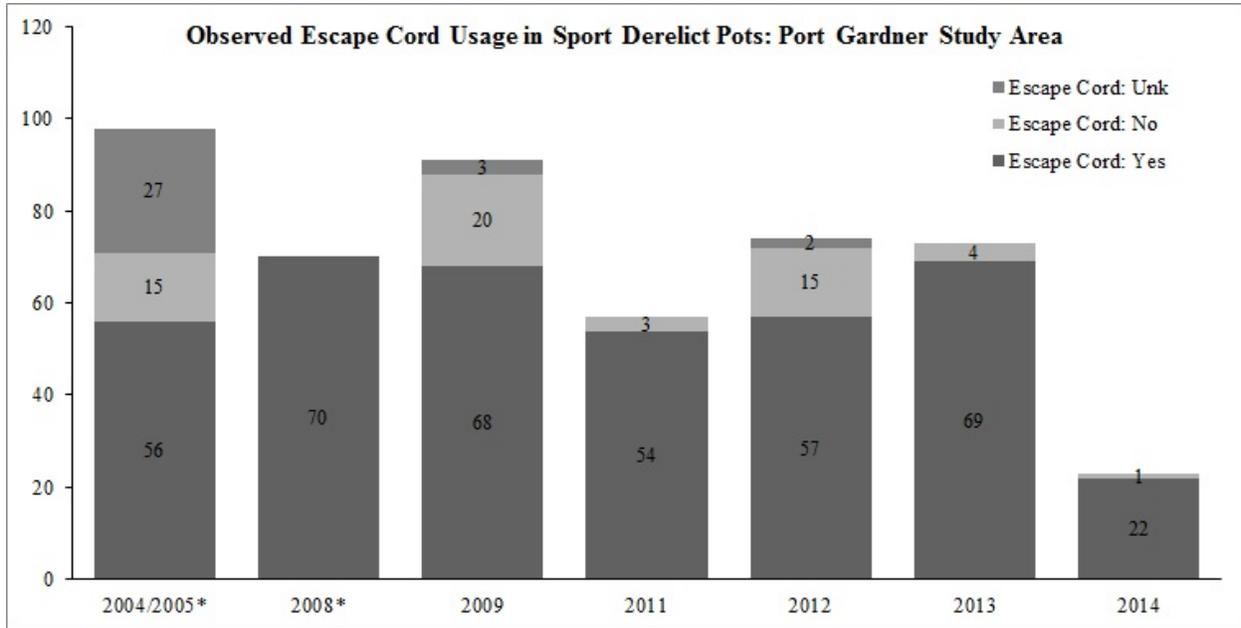


Figure 10. Percentage of legal escape cord compliance exhibited in derelict sport pots removed exhibiting legal escape cord in the Port Gardner “Study Area” from 2004/2005 to 2014. Source: NRC, Inc.

