



NATURAL RESOURCES CONSULTANTS, INC.

4039 21st Ave. W, Suite 404
SEATTLE, WASHINGTON 98199-1252, U.S.A.
TELEPHONE: (206) 285-3480
TELEFAX: (206) 283-8263
E-Mail: kantonelis@nrccorp.com

FINAL REPORT

SNOHOMISH COUNTY 2013 DERELICT FISHING GEAR PROJECT

PREPARED FOR:

SNOHOMISH COUNTY MARINE RESOURCES COMMITTEE

PREPARED BY:

NATURAL RESOURCES CONSULTANTS, INC.

December 31, 2013

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 2013 Snohomish County Marine Resources Committee (MRC) 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 characteristic 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 2013 has been added to the analysis provided in the NRC report for Snohomish MRC completed December 31, 2012, 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.

An additional goal of this project was to conduct sidescan sonar surveys to identify derelict crab pot densities throughout the crab fishing grounds to the north and southeast of Gedney Island, to better understand the magnitude and extent of derelict pots in those areas.

The Snohomish County MRC secured funding from Snohomish County for derelict crab pot survey and removal operations. Snohomish County 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 1.25 days 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 3.25 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. After investigation and removal of all derelict pot targets in the Port

Gardner Study Area, another 1.25 days of sidescan sonar surveys were conducted in the waters offshore both the northern and southeastern ends of Gedney Island, followed by 0.25 days of post-survey processing. During derelict gear removal operations, project personnel increased 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 December 16, 2013, in Port Gardner followed by 0.25 days of post-survey processing. Additional sidescan sonar surveys were conducted near Gedney Island on December 29, 2013, also 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 and Gedney Island 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 2013 sidescan sonar survey was to locate derelict crab pots to be removed from the previously cleaned Port Gardner Study Area, and to investigate derelict crab pot densities in two specific crab fishing areas near Gedney Island. 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 and 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 commercial or sport, 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 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 in a locked secure waste container in the parking lot of the 10th Street public boat ramp in the Port of Everett until disposal at the Snohomish County solid waste facility. 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.

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 area, and the full story behind each lost pot cannot be found through inspecting a derelict crab pot. However, much information about the probable reasons for pot loss can be found by investigating the gear both underwater and out-of-water. Therefore, in addition to the standard data collection methods performed by NRC during derelict crab pot removal operations, careful attention was given to investigating the reason for pot loss. The anticipated reasons for pot loss were divided into eight

categories: (1) line length to water depth mismatch, (2) vessel strike, (3) barge strike, (4) tampering / sabotage, (5) gear malfunction/user error, (6) entanglement with other gear, (7) entanglement with non-gear, and (8) unknown. Divers were instructed to report to the biologist any visual evidence they may witness 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, and now in 2013. 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 are significantly less than summer seasons and estimates from 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. This document reports on how the data collected in 2013 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 2013. In order to accurately assess the amount of gear loss between projects in the Study Area, data from 2013 was compared to the data from the 2012 project 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 2012 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 1.25 days of sidescan sonar surveys conducted in Port Gardner on December 16, 2013, 2.26 km² were covered and 94 potential derelict crab pot targets were detected or 41.6 targets/km². Three targets identified in the survey were in close proximity to actively fishing recreational crab pot buoys observed by the surveyors and during dive operations were identified as actively fishing and left in place. One crab pot target proved to be a round piece of wood debris of similar shape and size to a crab pot, and was left in place, and upon investigation two targets were identified as beyond the safe maximum diver depth (BMDD) of 32 m (105 feet). A total of 89 of the original targets were found to be derelict crab pots, 87 of which were removed by divers, one was buried and disabled and one was completely buried and left in place (identified as a pot by the buoy line extruding from the muddy seafloor). Four additional pots were found within close proximity to sidescan targets and removed during dive operations for a total of 92 derelict crab pots removed or disabled (Table 1 and Figure 2). Table 1 provides the characteristics of pots removed in Port Gardner.

In the additional 1.25 days of sidescan sonar surveys north and southeast of Gedney Island on December 29, 2013, 2.21 km² were covered and 81 derelict crab pot targets were detected for a total density of 36.65 targets/km² (Figure 1). The survey area north of Gedney Island covered 0.51 km² and detected 29 derelict crab pot targets, or 56.86 targets/km². The sidescan sonar surveys over the area to the southeast of Gedney Island covered 1.69 km² with 52 derelict pot targets identified, for a density of 30.70 targets/km². For comparison, derelict crab pot surveys conducted in 2004 that overlap the southeastern Gedney Island survey area in 2013 produced 24 derelict gear targets. Thirteen of the targets from 2004 were removed that year, while the remaining 11 are considered to have become dilapidated since. This survey operations shows that in 2013 the derelict pot density in the fishing grounds to the southeast of Gedney Island is more than twice what it was in 2004.

Derelict Crab Pot Removal

Derelict fishing gear was removed from Port Gardner on December 17, 18, 19 and 27, 2013. A total of 92 crab pots were removed (91) or disabled (1). A total of 88 of the derelict crab pots removed were identified in the sidescan sonar surveys and four derelict pots not identified in the survey were found adjacent to surveyed pots and removed. Derelict crab pots were removed from water depths ranging from 4.6 m (15 ft) to 29.3 m (96 ft) from mud and mixed sand/mud substrate.

Of the 92 derelict pots removed, 17 (18%) were commercial pots and 75 (82%) were sport pots (Table 1). Sixteen (17%) pots were determined to be actively fishing and 76 (83%) were no longer fishing. Of the 92 pots removed, 4 (4%) were not equipped with legal escape cord, 86 (93%) had legal escape cord and 2 (2%) pots were too deteriorated to determine whether escape cord was used or not. Of the 86 pots equipped with legal escape cord, the escape cord had disintegrated on 65 (76%) and was still intact on 21 (24%) pots.

Of the 17 commercial pots recovered, 16 (94%) were equipped with escape cord, escape cord use could not be determined on one pot (6%), and no pots were observed to be non-compliant with escape cord regulations. Four (5%) of the 75 sport derelict pots were not equipped with legal escape cord, 70 (93%) did have legal escape cord and on one (1%) sport pots escape cord use could not be determined. Of the 16 crab pots found to still be fishing, 2 (13%) were not equipped with proper escape cord and 14 (87%) had legal escape cord that had either yet to deteriorate (10 pots) or were still fishing even after the escape cord had disintegrated (4 pots) due to the pot lid being stuck closed or escape the egress route being blocked. Two commercial pots were not disabled after escape cord deterioration because the bait jars were clipped to the central meshes of the door, supplying enough weight to keep the door closed.

Of the 92 derelict pots recovered, 28 (30%) pots contained a total of 82 Dungeness crab and one live Red rock crab (*Cancer productus*) (Table 1). Of the 82 crab recovered, 59 (72%) were live and 23 (28%) were dead. Eight (10%) of the Dungeness crab recovered were females (two live and six dead), 72 (88%) were males (57 live and 15 dead) and the sex was not determined for two (2%) of the crab due to poor shell condition. Derelict pots determined to be still actively fishing contained 50 (61%) Dungeness crab (35 live and 15 dead). Pots determined to be no longer actively fishing contained 32 (39%) Dungeness crab (24 live and 8 dead). Crab pots without legal escape cord contained 3 (4%) Dungeness crab (2 live and 1 dead). Crab pots with legal escape cord contained 79 (96%) Dungeness crab (57 live and 22 dead).

Other animals found in the crab pots removed included 18 live sunflower stars (*Pycnopodia helianthoides*) and one ochre stars (*Pisaster ochraceus*).

Five commercial pots with owner identification remain stored in a secure location until they are returned to commercial crab fishers. Tulalip Tribal marine enforcement personnel retrieved five Tulalip Tribal pots to be returned to owners. A total of 30 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 Snohomish County MRC, Northwest Straits Foundation and/or NRC. Pots removed from Port Gardner that were not returned to owners or saved for later use were placed in a dumpster/trailer provided by Eastside Hauling®. Pots were transported and disposed of at the Waste Management Seattle facility where the total weight of gear disposed was approximately 1,000 lbs.

Table 1. 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 Snohomish County MRC 2013 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	3	0	3	13	0	1	14	16	0	1	17
	# Dungeness Crab Dead	5	0	5	2	0	0	2	7	0	0	7
	# Dungeness Crab Alive	18	0	18	10	0	0	10	28	0	0	28
Sport	# Pots Recovered	11	2	13	59	2	1	62	70	4	1	75
	# Dungeness Crab Dead	9	1	10	6	0	0	6	15	1	0	16
	# Dungeness Crab Alive	15	2	17	14	0	0	14	29	2	0	31
	# Red Rock Crab Alive	0	0	0	1	0	0	1	1	0	0	1
All Pots	# Pots Recovered	14	2	16	72	2	2	76	86	4	2	92
	# Dungeness Crab Dead	14	1	15	8	0	0	8	22	1	0	23
	# Dungeness Crab Alive	33	2	35	24	0	0	24	57	2	0	59
	# Red Rock Crab Alive	0	0	0	1	0	0	1	1	0	0	1
# Total Crab		47	3	50	33	0	0	33	80	3	0	83

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 74 (80%) of the 92 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. Of the 92 derelict pots removed, 30 (33%) were determined to have been lost by gear malfunction and/or user error (Table 2). This was often identified by broken gear components,

insufficient line capacity (too thin) and evidence suggesting that a buoy line was not correctly attached to the pot.

A distinction was made between vessel strikes and barge strikes based on the often mangled condition of relatively new pots, suggesting that their buoys had been snagged by a slow moving vessel (barge) and the pot was dragged across the seafloor until the line severed. Vessel strikes, on the other hand, often exhibit a clean cut of the buoy line from a fast moving propeller, or they leave an extremely wound-up buoy line with a much less clean cut after being wrapped multiple times in a slower-moving propeller and shaft. Vessel strikes were determined to be the cause of pot loss for 27 (29%) of the pots recovered, and were evident by buoy lines being severed and sometimes wound up, near the terminal end to the line. Barge strikes were found to be the cause for 6 (7%) of the recovered pots to be lost (Table 2).

Evidence of tampering and/or sabotage of other peoples gear was evident in 6 (7%) 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 two of the pots found, while one recreational pot was found to have a severed buoy line with the pot doors deliberately held open by three bait clips. One commercial crab pot was found with its buoy removed, rather than severed from the buoy line, and connected to the pot with a karabiner was another line (approx. 40 ft) that led to a small sport pot. In this case we presume both pots were sabotaged (Table 2).

Four (4%) of the 92 removed pots seemed to have been lost by entanglement with other gear, as their lines were wrapped with that from another derelict pot. One (1%) commercial pot was found nearby a large Coast Guard mooring buoy, with evidence showing that it had been become entangled with the either the buoy chain or anchor (entanglement with non-gear) (Table 2).

Finally, 18 (20%) of the 92 pots removed did not exhibit enough evidence to determine a reason for pot loss, and were therefore categorized as ‘unknown’. Of those 18 pots, 12 were thought to potentially be lost by gear malfunction or user error, one was potentially struck by a barge, and another was potentially sabotaged (Table 2).

Table 2. Number of derelict pots recovered by suspected reason for pot loss observed in Port Gardner during the Snohomish County MRC 2013 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	25	29%
	tampering/sabotage	1	
	entanglement w/ other gear	1	
	Total Vessel Strike	27	
Barge Strike	barge strike	5	7%
	gear malfunction/user error	1	
	Total Barge Strike	6	
Tampering / Sabotage	tampering/sabotage	5	7%
	entanglement w/ other gear	1	
	Total Tampering/Sabotage	6	
Gear Malfunction or User Error	gear malfunction/user error	21	33%
	barge strike	2	
	tampering/sabotage	1	
	entanglement w/ other gear	1	
	entanglement w/ non-gear	1	
	Unkown	4	
	Total Gear Malfunction/User Error	30	
Entanglement w/ Other Gear	entanglement w/ other gear	3	4%
	gear malfunction	1	
	Total Entanglement w/ other gear	4	
Entanglement w/ non-gear	tampering/sabotage	1	1%
	Total Entanglement w/ non-gear	1	
Unkown	Unkown	4	20%
	barge strike	1	
	tampering/sabotage	1	
	gear malfunction/user error	12	
	Total Unkown	18	
Total Pots Removed		92	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 2013 based on data collected during this project. Pot loss rates were calculated within the Study Area for 2013 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 and 2012.

In 2013, 1.94 km² of the entire 2.26 km² survey area was within the bounds of the Study

Area and 1.91 km² overlapped the 2012 survey area. A total of 88 confirmed derelict crab pots (14 commercial and 74 sport) or 47.42 pots/ km² (7.22 pots/ km² commercial and 38.14 pots/ km² sport) were removed from the Study Area in 2013. Four of these were considered not to be newly lost based on their age and condition, leaving 84 removed derelict crab pots (11 commercial and 73 sport) within the Study Area determined to be newly lost (Table 3 and Figure 3), yielding a newly lost pot density of 43.75 pots/ km² (5.73 pots/ km² commercial and 38.02 pots/ km² sport). Recreational crab fishing opportunities in the Port Gardner area between 2012 and 2013 derelict gear operations included the final 10 days (12.5%) of winter 2012, the entire summer 2013 and the majority portion (84%) of winter 2013 seasons. Combined, these seasons totaled 132 available fishing days (45 days in summer and 87 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 56 days available for recreational crab fishing during the period. This provides a sport pot loss rate of 1.31 pots lost/day (0.68 pots/km²/day) between 2012 and 2013 derelict gear operations (Table 4). The use of escape cord could be discerned on all 11 newly lost commercial pots removed within the Study Area in 2013, all (100%) of which were properly equipped with legal escape cord. Sixty-nine (95%) of the 73 newly lost sport pots removed in 2013 were equipped with legal escape cord, and four (5%) were not (Table 5).

Table 3. Area surveyed, number of derelict pots recovered and average derelict pot density between operational periods 2009, 2011 and 2012 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

The overall number and density (pots per area) of lost 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). While the sport pot loss rate (pots lost per day) dropped from previous years in 2011 and 2012, over the course of the 2013 summer and winter season these loss rates rose from 0.64 pots/day (0.33 pots/km²/day) in 2012 to 1.31 pots/day (0.68 pots/km²/day) in 2013. This

reflects an increase of 104% pots lost per day and the same for pots lost per km² per day from the previous period. This equates to a 47% decline in pots lost per day (55% decline in pots lost per km² per day) within the recreational fishery inside the Port Gardner Study Area after the 2008 summer season, with variance from year to year (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 and 2013 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

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 (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 followed by another increase in 2013 to 95% (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 and 2012. 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 and 2013 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%

*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 94 sidescan sonar survey targets. Divers removed 88 (94%) of the 94 derelict fishing gear targets found during the sidescan sonar surveys along with four others that were not identified in the surveys. Additionally, sidescan sonar surveys identified 81 potential derelict crab pot targets in fishing grounds to the southeast and north of Gedney Island.

For the first 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 the two most common reasons for pot loss in the area are either gear malfunction and/or user error and vessel strikes. Other reasons for pot loss that were identified were barge strikes, tampering or sabotage and entanglement with either other gear or non-gear items. While in some cases the onboard biologist concluded that a buoy lines were excessive in length compared to the depth of water in which it was placed, often causing entanglement with other gear, there were no instances of buoy lines being less in length than the water depth where it was placed. This, however, is not to say that the line length to water depth mismatch does not contribute to derelict pot loss in the region, as it is presumed to be a major cause of derelict gear in the Puget Sound. 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. Or when pots deployed along the shelf 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 2013 was more than double what it was over the summer and winter seasons of 2011 and 2012. This short-term data is concerning, as results from the 2012 report concluded that the pot loss rates were continuing to trend downward from year to year. Nevertheless, 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 2013 was 47% to 55% of what it was in 2008 (data collected in 2009 removals). It is unclear which, if any, of the yearly results in pot loss per day represent a deviation from the norm; the recent spike in 2013, or the low numbers reflected in the 2011 and 2012 data. Similarities in results from data collected in the 2011 and 2012 projects suggest that the pot loss rates trend lower than those derived from the 2013 project. However, the results from the 2009 project suggest that the 2013 results may reflect something closer to the norm, rather than an aberration. Further surveys and removals in the Study Area can lead to a better understanding of where the norm lies, if one exists.

Results from the 2013 project show a 16% increase in escape cord compliance within the recreational crab fishery in the Port Gardner Study Area from 79% in 2012 to 95% in 2013. The 95% compliance matches that from the 2011 project, is higher than those observed in 2009 and 2004/2005, yet does not reach the 100% achieved in 2008. These observations indicate a continued variance 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 indicates 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 fishing opportunities. Additionally, the observed use of legal escape cord on commercial derelict pots indicates an increasing trend in escape cord compliance within the commercial fishers utilizing the Port Gardner fishing grounds.

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 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.**
- **Consider complete derelict crab pot survey and removal operations in the fishing grounds to the north and southeast of Gedney Island.**

Acknowledgements

The Port of Everett kindly provided free moorage for the dive support vessel during the Port Gardner portion of the project and allowed storage of a waste container at the 10th Street public boat ramp. Their assistance is greatly appreciated. We also wish to thank the Snohomish County MRC for their cooperation during the project, with a special thanks to Brent Hackney for providing assistance in coordinating amongst the different stakeholder groups. Don Velasquez 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, helping ensure that the completion of operations prior to December 31, 2013.

Figure 3. Derelict crab pot targets removed or disabled during the 2013 operations within the Port Gardner “Study Area”.
 Source: NRC, Inc. and Fenn Enterprises.

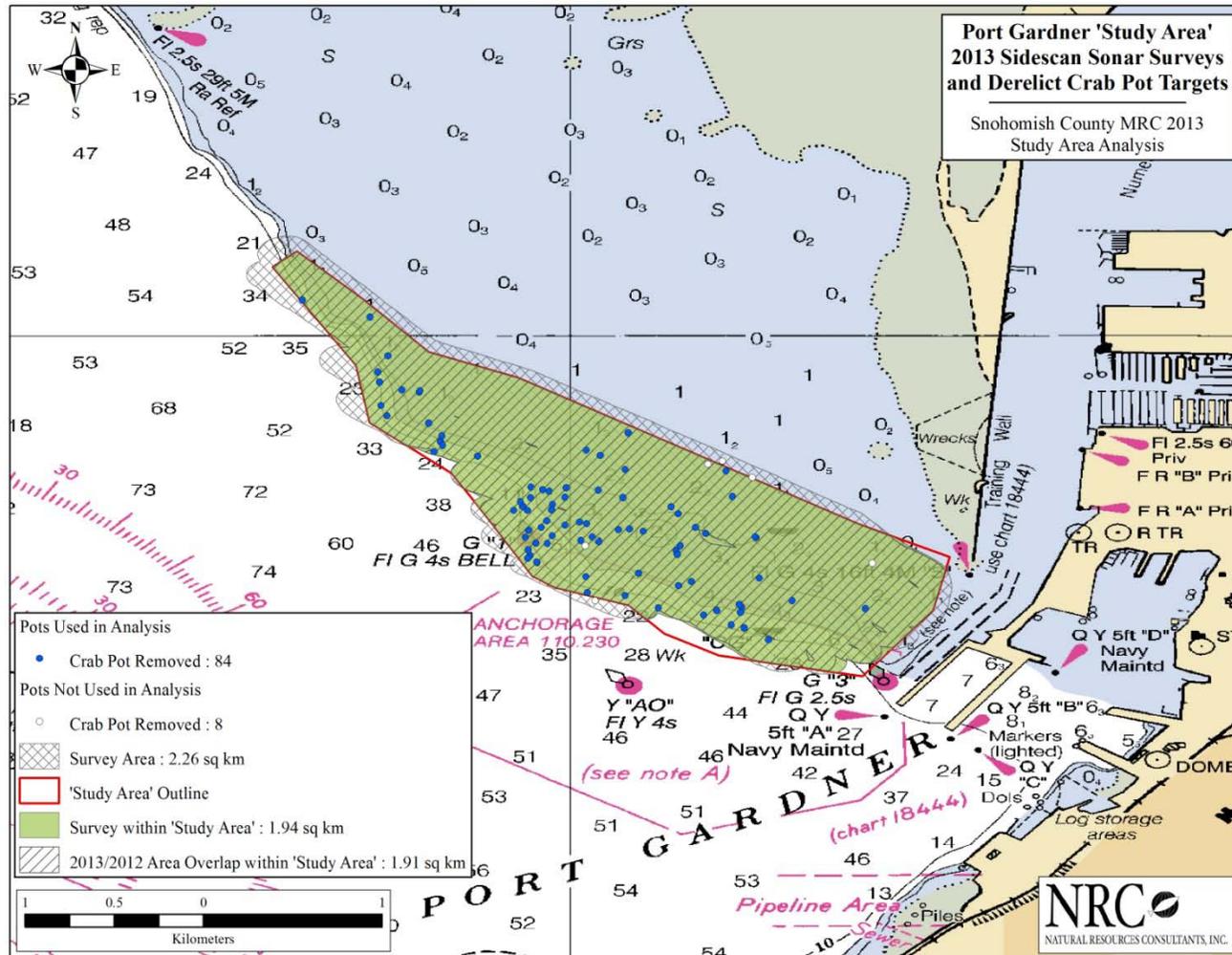


Figure 4. Number of derelict crab pots removed/disabled within the Port Gardner “Study Area” by project from 2004/2005 through 2013. Source: NRC, Inc.

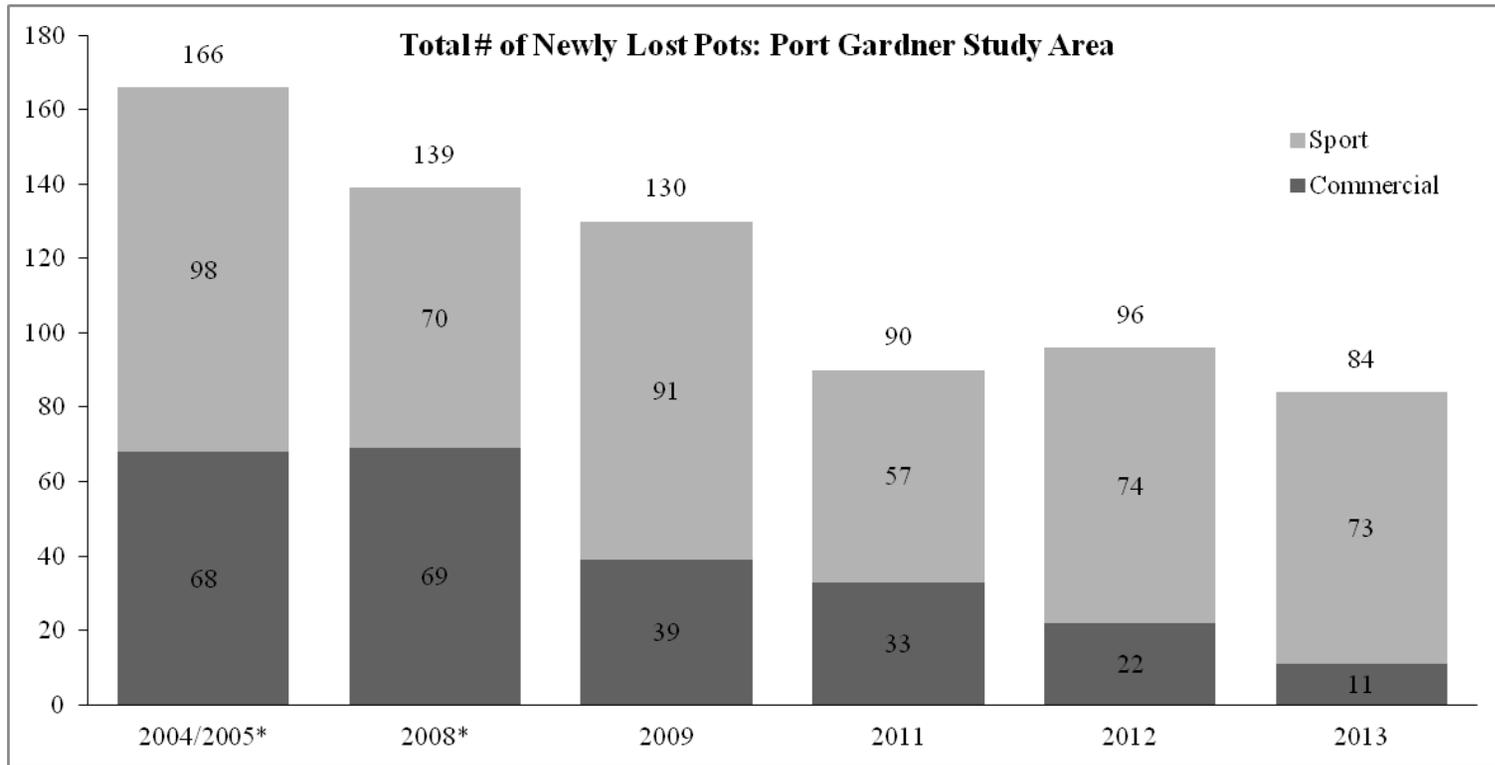


Figure 5. Number of derelict sport pots removed/disabled within the Port Gardner “Study Area” by project and number of recreational crab fishing days available between projects Source: NRC, Inc. and WDFW.

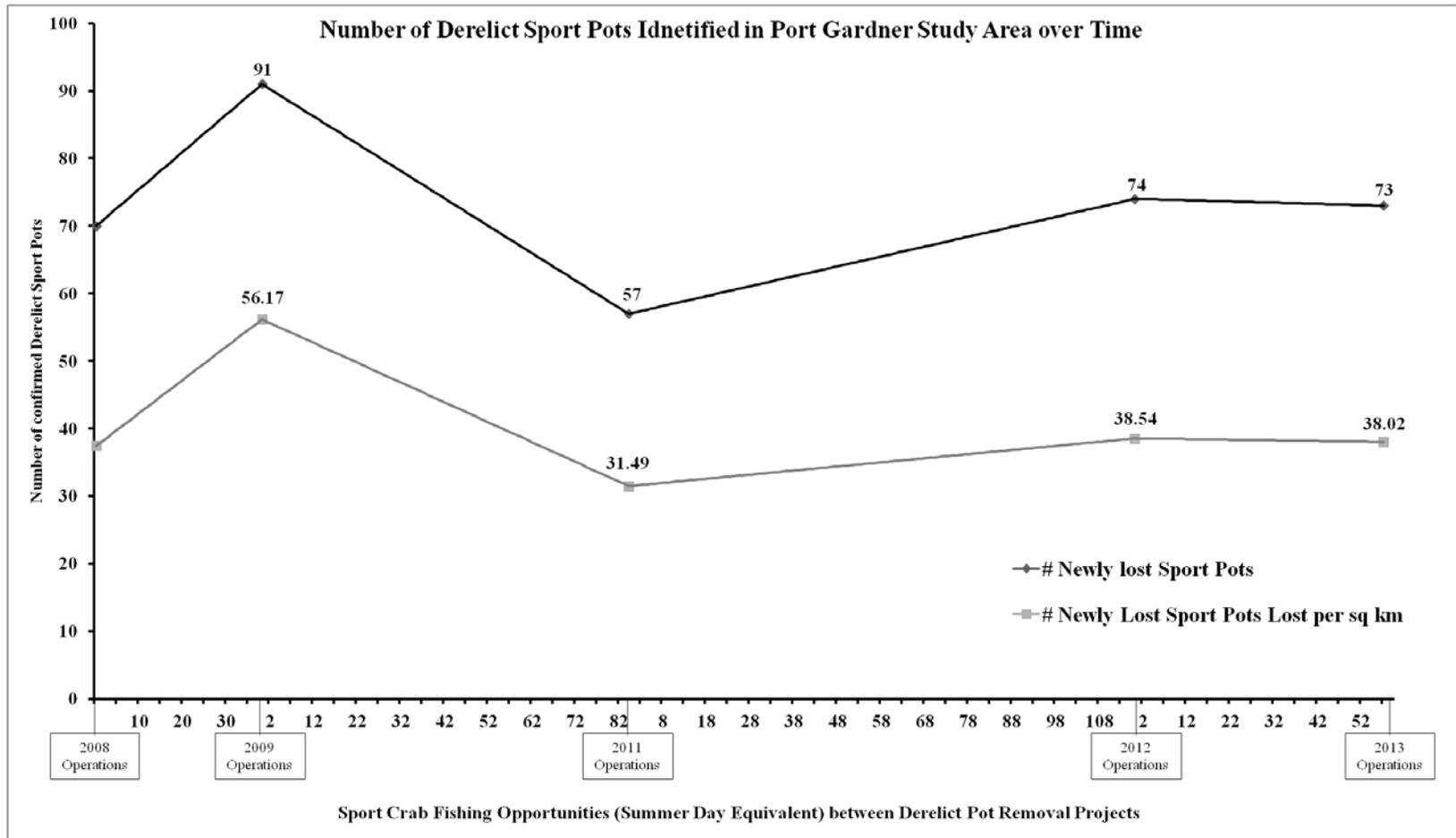


Figure 6. Observed sport pot loss per available fishing day within the Port Gardner “Study Area” by year. Source: NRC, Inc. and WDFW.

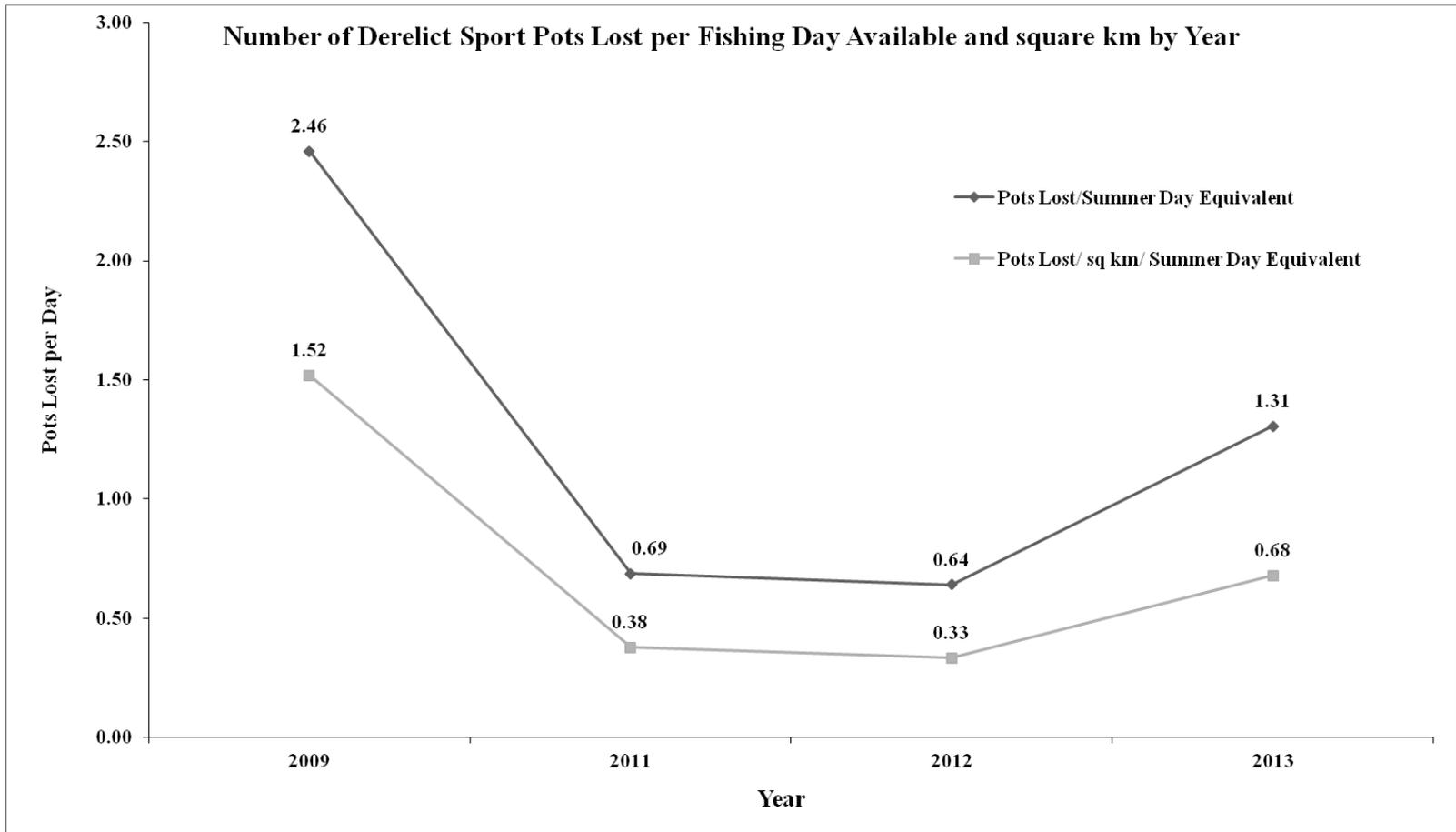


Figure 7. Summary of escape cord compliance observed on commercial derelict crab pots removed in the Port Gardner “Study Area” from 2004/2005 to 2013. Source: NRC, Inc.

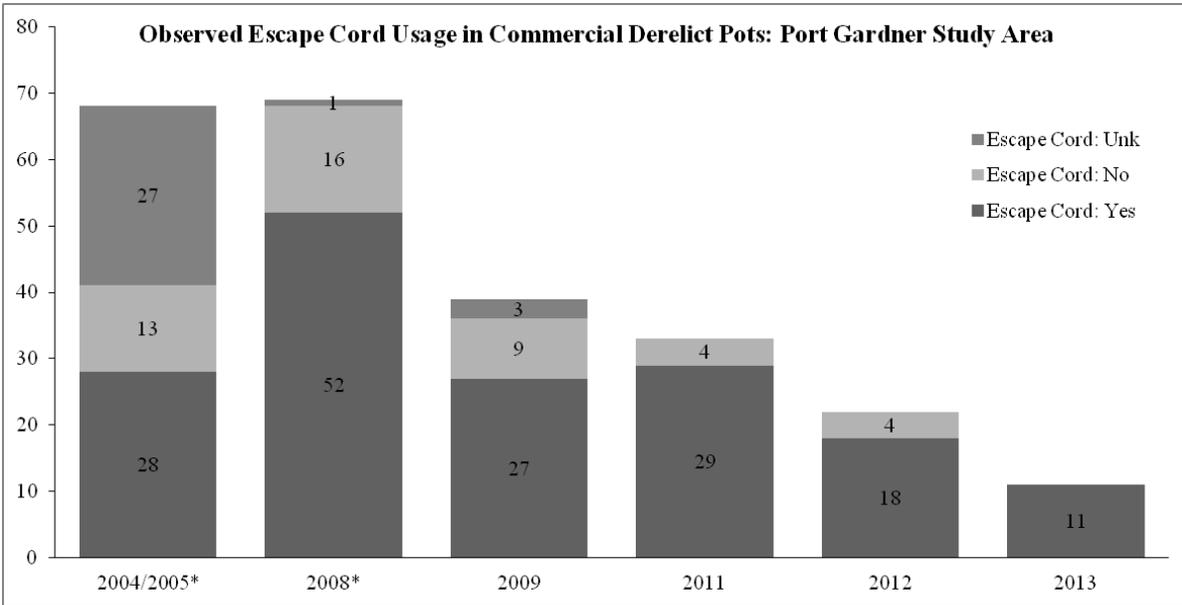


Figure 8. Percentage of legal escape cord compliance exhibited in derelict commercial pots removed exhibiting legal escape cord in the Port Gardner “Study Area” from 2004/2005 to 2013. Source: NRC, Inc.

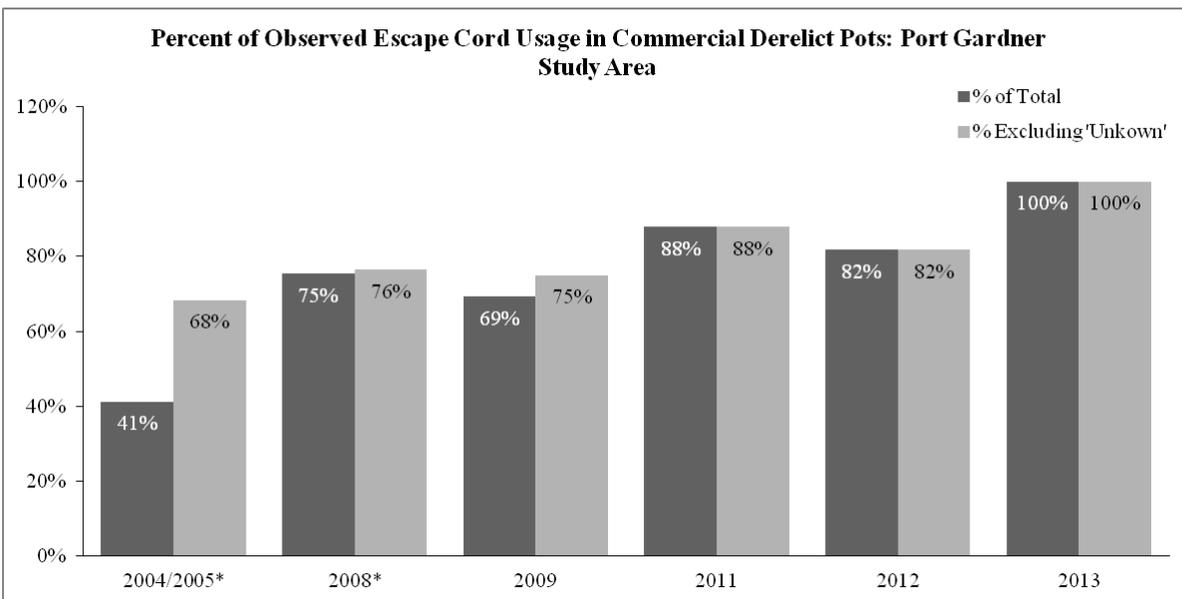


Figure 9. Summary of escape cord compliance observed on commercial derelict crab pots removed in the Port Gardner “Study Area” from 2004/2005 to 2013. Source: NRC, Inc.

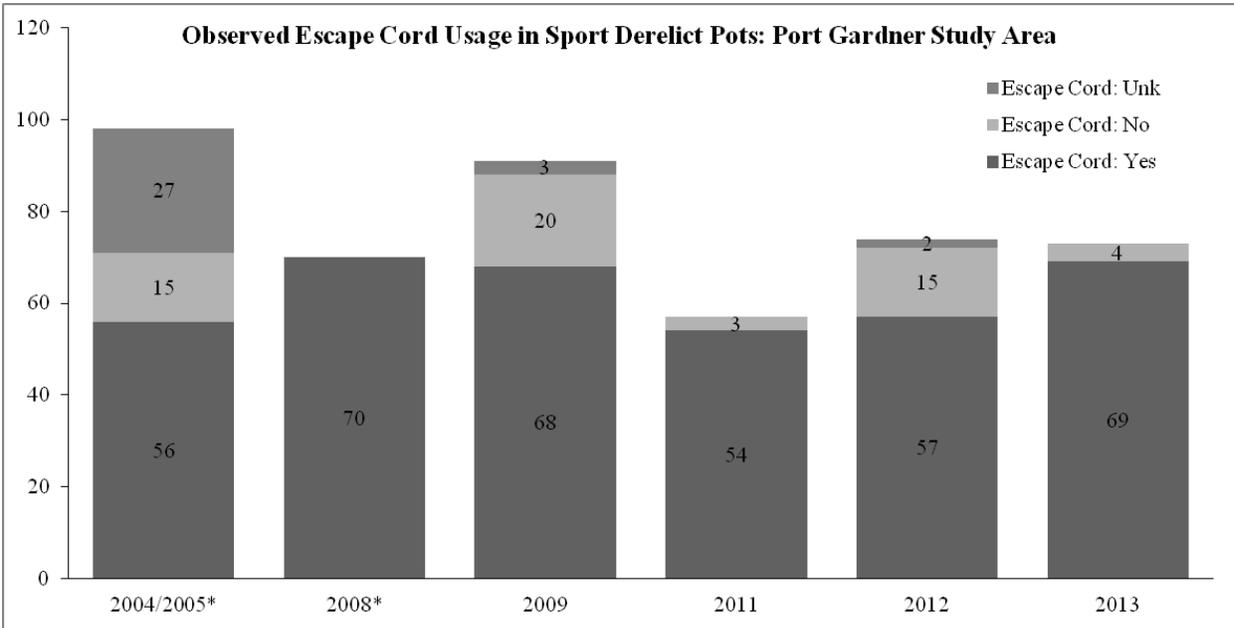


Figure 10. Percentage of legal escape cord compliance exhibited in derelict commercial pots removed exhibiting legal escape cord in the Port Gardner “Study Area” from 2004/2005 to 2013. Source: NRC, Inc.

