

# M/V SELENDANG AYU Oil Spill, December 8, 2004, Unalaska, Alaska

NRDA Pre-Assessment Studies

Summary of Field Surveys of Bird Carcass Persistence, Searcher Efficiency, and Background Bird Stranding Rates at Chernofski, Unalaska Island and Nikolski, Umnak Island, Alaska.

## FINAL

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Prepared by:

Dan Varoujean  
MARZET  
2269 Broadway Street  
North Bend, Oregon 97459

and

Polaris Applied Sciences, Inc.  
12509 130<sup>th</sup> Lane N.E.  
Kirkland, WA 98034

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## **INTRODUCTION**

On 8 December 2004, the Malaysian freighter M/V Selendang Ayu grounded in stormy seas off the northern coast of Unalaska Island in the Aleutian Islands, Alaska (Figure 1). The ship broke apart and portions of its Number 6 fuel oil were released into the sea. The US Fish and Wildlife Service (USFWS) and representatives of the Responsible Party (RP) conducted three studies jointly; a carcass persistence study; a searcher efficiency study; and a background mortality study. The background mortality study was conducted at Chernofski Harbor on Unalaska Island and Nikolski Bay on Umnak Island (Figures 2 and 3). The carcass persistence and searcher efficiency studies were conducted only at Chernofski Harbor. Summaries of the results of these studies are presented in this report.

## **CARCASS PERSISTENCE STUDY**

A total 64 carcasses were deployed at 4 locations within 2 SCAT (Shoreline Cleanup Assessment Technique) shoreline segments over 4 days in the Chernofski Harbor area on the west end of Unalaska, west of the Selendang Ayu spill area (Figure 2). The two shoreline segments were identified as CK2 and CK6 identified in the SCAT database. The purpose of the study was to estimate the rates at which carcasses persisted on the test beach, or, alternatively, disappeared due to scavenging or rewash.

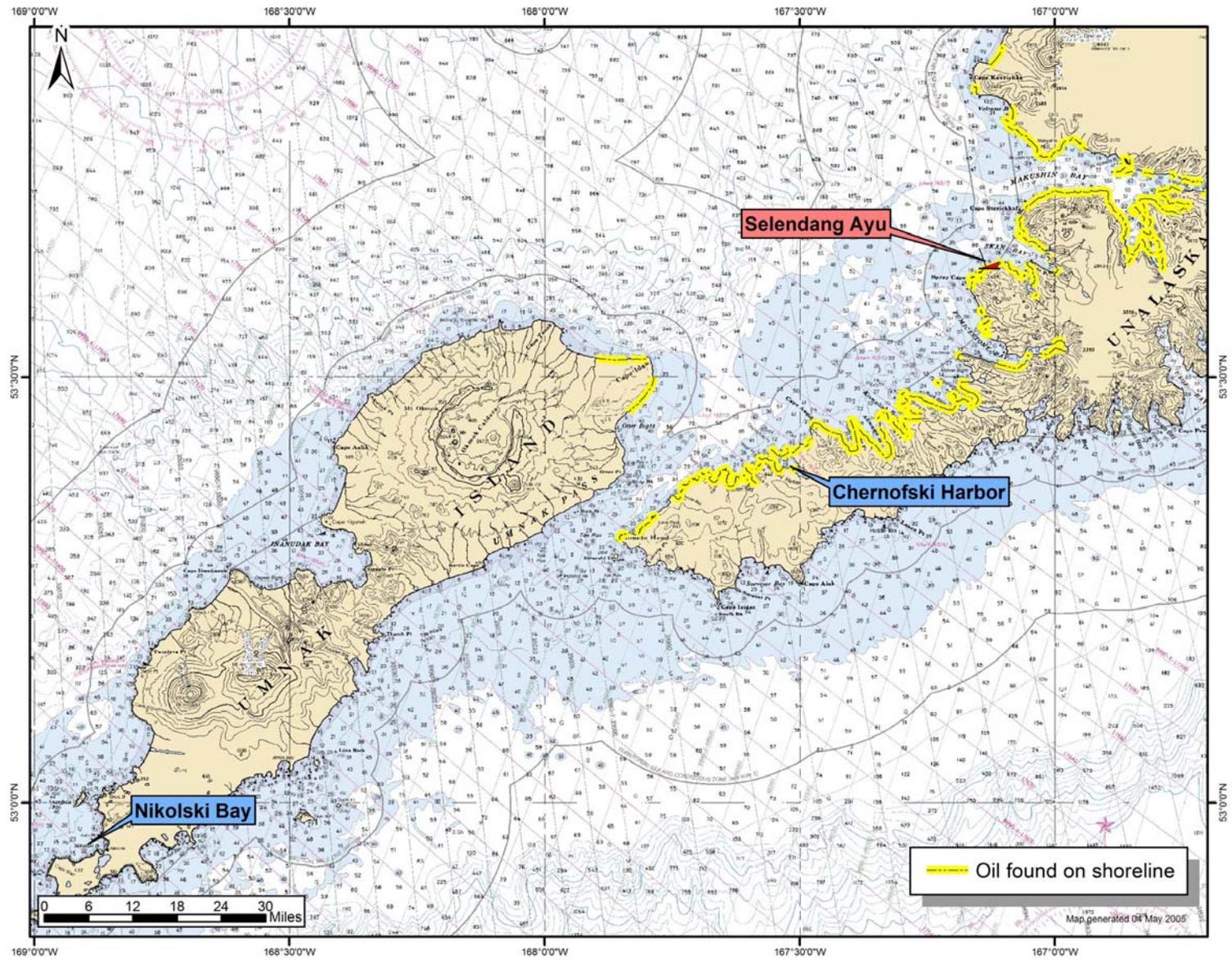
### **Methods**

Bird carcasses were received at Chernofski on 3 February 2005. Sixty-four carcasses were thawed and divided into 4 deployment groups of 16 birds each to allow simple comparisons between groups. Wing chord was measured and an aluminum wing tag was placed on each wing, typically as close to the “wrist” as possible; wing tags were useful for identification especially when wings became detached by scavenging.

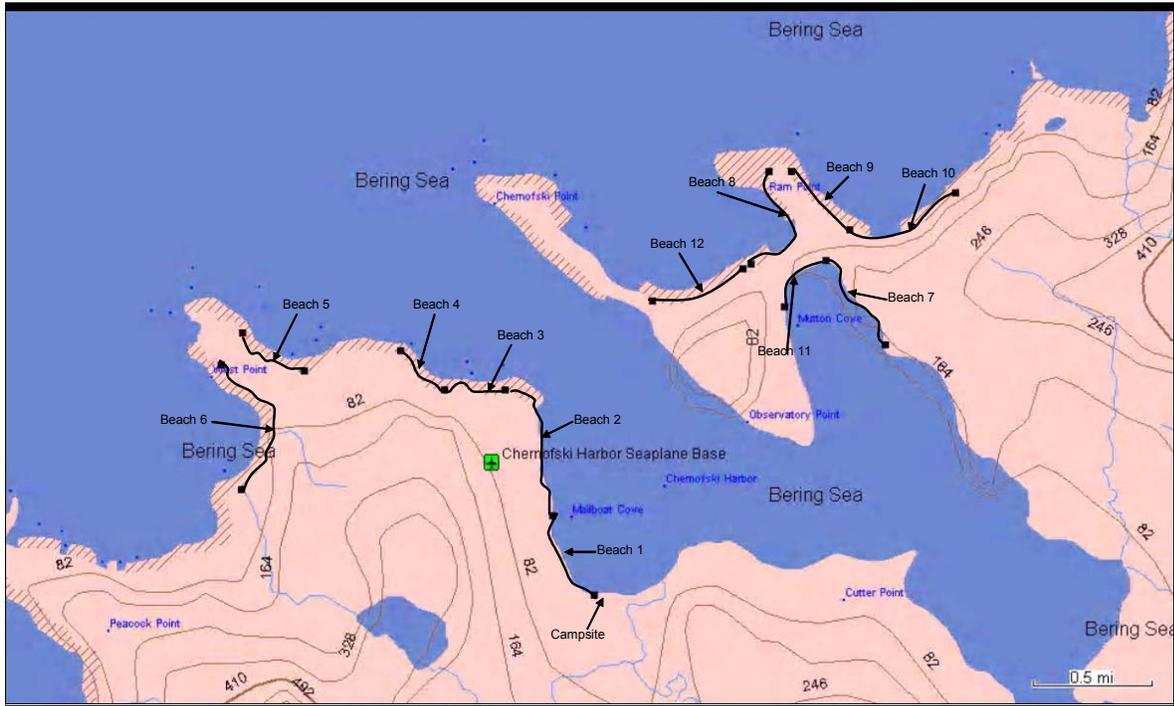
Deployments were located on one protected shoreline (CK2) and one exposed shoreline (CK6). Birds were randomly assigned to groups of 1-5 birds per 100 meters of beach until 16 birds were deployed. Within each 100 meters of beach, the distance of the birds from each other and species order were also randomly determined (Table 1).

Carcasses were sorted into groups to try and balance their distribution in each deployment by size and species. Unfortunately, ten specimens were in poor condition and were not used. The eiders were identified by the USFWS as being collected following another incident involving the collision of two vessels. These birds had been opened and the breast tissues completely removed, so care in determining whether scavenging had actually occurred was noted.

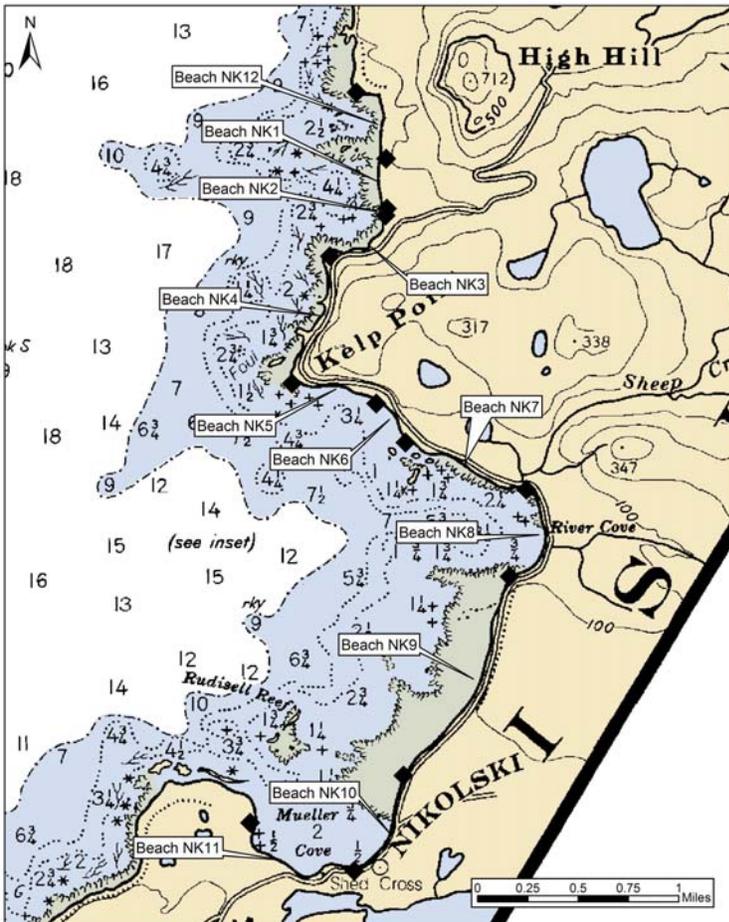
Birds were deployed along the beach by first locating the positions of the high tide and strand line, where birds would likely be deposited. Information describing the site was noted on field sheets to relocate carcasses, as well as placing flagging above the strand line to facilitate measuring distances. Most of the 64 locations were given a GPS position.



**Figure 1. Unalaska Island and Location of Vessel grounding, Chernofski Bay and Umnak Island.**



**Figure 2. Location of shorelines at Chernofski Harbor, Unalaska Island for carcass persistence and searcher efficiency studies.**



**Figure 3. Location of shorelines at Nikolski Bay, Unmak Island, for background mortality studies.**

**Table 1. Distribution and Fate of Species across Carcass Deployments in the Persistence Study.**

Species	Sex	CARCASS DEPLOYMENT NUMBER					CARCASS FATE							
		1	2	3	4	Total	Removed	Rewashed	Present/Intact	Later	Later	Later	Present/ Scavenged	Later
		Beach 2	Beach 6	Beach 2	Beach 6					Scav.	Gone	Rewash		Gone
Northern Fulmar	Unknown		1			1							1	1
Common Eider	Male	4	3	6	6	19	10	2	3	3			4	
	Female	3	4	1	2	10	5	3					2	1
	Imm Male	1	1	1	1	4		1					3	
Black Scoter	Female	1		2	1	4	4							
Harlequin Duck	Male	1				1		1						
	Female	1		1		2	1		1		1			
Goldeneye sp.	Female	1		1	1	3	3							
Long-tailed Duck	Male			1	1	2		1					1	1
	Female	1	1	1	1	4	3		1		1			
Red-breasted Merganser	Female	1				1		1						
Tufted Puffin	Unknown		1		1	2	1	1						
Common Murre	Unknown	2	2	1	2	7	1	2	3		3		1	
Pigeon Guillemot	Unknown		1			1	1							
Glaucous-winged Gull	Unknown			1		1		1						
Black-legged Kittiwake	Unknown		2			2	1	1						
<b>Total</b>		<b>16</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>64</b>	<b>30</b>	<b>14</b>	<b>8</b>				<b>12</b>	

Small plywood cards (3 x 4 inches, 0.5 inch thick) painted white and numbered were placed under the carcasses. A majority of the birds did not have any major coloration differences between dorsal and ventral surfaces, but, since some beaches had extensive amounts of calcium carbonate as shell hash, some birds with white plumage were difficult to visually detect.

## **Summary of the Deployments**

### Deployment 1 Beach CK2, 4-February 1800

The first deployment was in the evening of 4 February, with the first re-visit to the site on the late afternoon of the 5th. Beach CK2 had no carcasses found with indications that 5 of the cards had rewashed, as 3 disappeared and 2 were found in different locations. Card #3 was over 300 meters from its original location, indicating it was very easy for cards to move off the entire searched beach.

### Deployment 2: Beach CK6, 5-February, Noon

Beach CK6 was only accessible by a long walk, so deployment was arranged with help from UFWS carcass searching personnel who helped carry carcasses to the beach. The beach was revisited on 6 February at Noon, 24hrs after deployment. There was significant rewash and carcass removal on this beach, as tides were extremely high. Only small parts of 4 birds remained, with only one heavily scavenged carcass remaining, the rest consisted of wing parts and feathers. The few feathers of the common eider at Card #26 were not enough to warrant a collection, so it was scored as missing.

The partial carcass of the wings and breastbone of the common murre was found at Card #25 and provides an excellent example of the type of carcass that was being found on the beaches. This carcass was originally located adjacent to Card #23, which also happened by chance to be a common murre, so its identity as belonging to Card #25, which was missing on the primary search, was not immediately determined until the wing tag confirmed its rewash or movement by a scavenger. Since the card was observed in the kelp at the surf zone on the return search, it also provides some evidence that some birds may also have been scavenged prior to their rewash, resulting in their re-deposition on the beach in the form that was typically found by the searchers.

A revisit of the beach in the afternoon of 7 February, after Beach CK6 Deployment 2, added important information. The wing present at Card #18 (a fulmar) was scavenged, there was more scavenging of the common murre, and more of the female eider carcass at Card #28 was eaten. A wing noted near Card #28 with a new Card #66 had wing tag #2328, indicating that the common eider at Card #32, deployed at 622 meters, moved, or more likely was carried, 300 meters to Card #28.

### Deployment 3: Beach CK2, 5 February 1800

Deployment 3 was the 2nd deployment to Beach CK2, which occurred on the evening of 5 February. During this deployment, the card for carcass #33 was placed at the end of the deployment when it was too dark to properly locate its position. It was placed adjacent to Card #42, the most distant location at 821 meters, so that 2 birds were placed within a meter of each other.

The first revisit was made on 6 February at approximately 1500 hours, with a second visit that evening. In contrast to other deployments, this one had considerable retention of carcasses on the beach. After 15 hours, 6 untouched carcasses were still present. After 24 hours, 5 of the 6 were still untouched, and 1 rewashed. By 40 hours, however, only 1 untouched carcass remained, though 6 were still present as major scavenged carcasses. The one remaining untouched carcass was hidden in a cove, and not observed during the 15-hour survey. Reasons for increased persistence are unknown. Scavengers were present in the area. A juvenile eagle was flushed off the eider carcass at Card 38 on 6 February on the first check at 1000, and a raven flew over the beach at 1015. A different eagle was observed at 1800 at approximately 450-500 meters on the beach, near several whole carcasses. On 7 February, a third differently plumaged immature eagle was flushed off the carcass at Card 38 again. Evidence of fox scat was also present on the beach at some of the carcasses.

### Deployment 4: Beach 6, 7-February, Noon

Deployment 4 was the 2nd deployment to Beach CK6 and was performed on 7 February. The site was revisited on 8 February, just prior to a major storm from the north. This storm prevented a subsequent visit to the beaches on the 8th due to the extreme wind, freezing weather and snow. The location of the carcasses was on Beach CK6 farther down the beach from Deployment 2.

Due to extreme high tides, care was taken in placing carcasses between the high tide and strand line. This resulted in only 4 cards showing signs of movement. Two carcasses were found close to where they were deployed, with one card gone and the other card showing slight movement. The other two cards had no carcasses present and were likely removed by scavengers. The three carcasses found scavenged included one with only some internal organs remaining, another with a small piece of bone easily missed in a carcass search, and one eider with its head removed.

The intense wave action and high tides changed the morphology of Beach CK6. The priority for the USFWS was to re-survey Beaches CK7-CK12 on the Mutton Cover side of the beaches once the weather cleared, so the fate of the 2 retained murre and the scavenged eider is unknown.

## Results

Of the 64 carcasses deployed, 14 (21.9%) of the missing carcasses were presumed to have rewash (i.e., the bird and associated wooden blocks were absent) within the first 24 hours after deployment; and, after 24 hours there were 30 (46.9%) carcasses absent with nothing left except the rewash block - they were presumed to have been removed by scavengers. The 20 (31.2%) remaining carcasses, 12 of which were partially scavenged, declined in number through rewash and complete removal by scavengers to 12 carcasses over the next 24 hours. With snowstorms occurring over several days at the end of the deployment, the persistence of the scavenged carcasses on the beaches in the form of feathers, wings, or entrails was difficult to estimate.

Some bird wings and associated feathers of the typical crested auklet and murrelet-sized birds were found away from the beaches in the hills and on the traverses between beaches, indicating that some small carcasses were removed from beaches. One murre deployed at Beach CK6 presented a pattern typical of recovered carcasses found during beach searches having a freshly cleaned sternum and 2 pairs of wings remaining after one day of deployment.

An assessment of a potential difference in the rate of complete removal of eider carcasses compared to ducks and smaller alcid and gull carcasses was undertaken (Table 2). After removing the rewash birds, there was not a substantial difference in the data, with 88.9% of eiders removed, as compared to 85.7% of the other birds. There did appear to be a larger percentage of eiders scavenged on the beach as compared to the ducks and smaller alcids, perhaps relating to the weight of the eiders.

**Table 2. Comparison of persistence for eider carcasses compared to the other bird species deployed.**

	Total	w/o Rewash	Removed	%	Scavenged	%
Eiders	33	27	15	55.6	9	33.3
Other Birds	31	21	15	71.4	3	14.3

High tides during the first deployment produced higher rates of rewash; rewash was less during the second deployments, possibly because of lower high tides. It was difficult to determine whether some carcasses were moved down the beach due to carcass dragging or rewash. In one case on Beach CK6, the bird was found only a few meters from the original deployment location, but the card was gone. Another time the card was located floating in the surf near its deployment area.

There were at least four animals that could have been responsible for removal or scavenging: Glaucous-winged Gull (*Larus glaucescens*), Bald Eagle (*Haliaeetus leucocephalus*), Common Raven (*Corvus cora*) and red fox (*Vulpes vulpes*). At least six eagles were seen in the area, and were seen on carcasses on several occasions. Bald eagles were seen daily at Chernofski and in many cases individuals could be discerned to help provide an estimate of their local population. Individuals were seen at all beaches and at all the beaches where carcasses were deployed. The average daily number of eagles observed was 5.5, which increased slightly over the 28 days, with

a high count of 15 on 10 February. Several adult pairs were observed soaring together indicating some territory formation was starting in February.

Ravens were also seen regularly flying over the test sites. Ravens were less common, with an average of 1.4 birds seen daily on 22 days and only a maximum of 4 birds. Individuals or pairs were seen flying along the shoreline, but no birds were seen on carcasses deployed. A raven was disturbed one morning in Nikolski during the background mortality surveys and inspection of the site discovered a scavenged carcass, indicating that they are willing to eat small prey items.

No gulls were observed flying the beaches after the deployments, but they were in the area. The primary gull species observed was the glaucous-winged gull, though it was likely there were other gull species offshore. Gull numbers were variable. They were most frequently observed outside the kelp beds and thus not consistently counted. When counted, daily numbers ranged from 1 to 16, averaging 6.3. There was no direct evidence of gulls scavenging on the carcasses.

Foxes were seen on two beaches after deployments, and fox feces were observed next to carcass deployment locations, but no foxes were observed on carcasses. At least 3 different foxes were seen in the area where the carcasses were deployed; indicating that multiple foxes could have been on the beaches between re-visits. Fox are known to cache food and are a likely candidate for removal of carcasses at night, as occurred on Beach CK2

## **Discussion**

Based on the results of 12 out of 64 carcasses persisting during the study, it appears that only about 18% of the carcasses that wash ashore remain on a beach for more than a couple of days. It should be noted that it was not possible to acquire and use relatively small seabirds (e.g. auklets) for the study. Based on results from other studies, it is known that small seabirds are taken by scavengers from beaches at a more rapid rate, nearly double the rate, than the larger species used in this study. If four auklets, for example, had been added to each of the four carcass deployments of 16 birds, and all but one of the 16 auklets were removed by scavengers, then there would have been only 13 carcasses left out of 80 carcasses deployed, i.e. only about 16% of the carcasses washed ashore persists for more than a couple days.

## **SEARCHER EFFICIENCY STUDY**

### **Methods**

Two deployment trials of bird carcass pieces were conducted on 3 February using actual collected specimens from the beaches at Chernofski Harbor on Unalaska. Both trials were made on Beach CK1 (Table 3). The two USFWS survey crews from the Chernofski Harbor area Background Mortality Study were used as the search teams in the test. One team was made up of the first crew that had been surveying the beaches for weeks prior to the conducting the test, the other team was made up of two members of the newly arrived second crew and one member from the first, and was considered to be less “experienced” at searching beaches. A total of 20 carcasses were placed in each trial at typical locations where carcasses were found, between the low tide line and the strand line. Locations were randomly selected for placement of 1 to 5 birds per 100 meter segment, resulting in birds placed over the entire 700 meter length of Beach CK1. The beach was representative of the types of beaches where carcasses were encountered at Chernofski, with less percentage of cobble and small boulder since it was a protected beach. The distribution of carcasses was randomly altered between the two deployments.

### **Results**

The first “experienced” team found 9 and 8 of the test carcasses, and 4 new carcasses on the beach during the two test trials (Table 3). This team had previously searched this beach 8 times and found only 2 carcasses on 23 January. The range of search times for the previous 8 searches ranged from 13 to 43 minutes. The speed at which some searches of Beach CK1 were performed and location of 4 new carcasses indicates that search efficiency performance may be variable, depending upon effort, the weather, time of day, etc.

The second less experienced team found 8 and 6 carcasses, including 2 new carcasses on their first search (which were also found by the experienced team on their second search).

An important factor in calculating searcher efficiency is the number of carcasses found by both groups, and the total number of carcasses found. These numbers were similar in both tests, with 4 and 5 carcasses found by both teams on the two tests, and a total of 13 and 9 of the 20 carcasses found, respectively.

### **Discussion**

In general, it appears that searchers missed approximately half of the carcasses/carcass remains present on a beach. The carcasses placed were all pieces of small birds, in contrast to the large carcasses placed in the persistence study, which were not missed on searches. The searcher efficiency study may have limited value to injury assessment for this reason. However, since many birds encountered during dead bird surveys in the spill zone were in a poorly deteriorated condition and consisted of clusters of feathers and/or disarticulated bones (V. Byrd, pers. comm.), the data may be conservative, yet representative of a larger portion of the birds encountered.

**Table 3. Carcass Search Efficiency Test - Chernofski Harbor, Unalaska Feb 2005**

Test 1							Test 2						
Segment	Location	ID #	Found by				Segment	Location	ID #	Found by			
			Original Team	New Team	Both	Total				Original Team	New Team	Both	Total
1 0-100m	Cobble	131	yes			1	1 Kelp Line Cobble/Kelp	131					
	Cobble	136		yes		2		118*		yes			1
	Cobble/Kelp	118											
2	Strand Line	106	yes	yes	1	3	2 Stand Line Intertidal Intertidal	136	yes	yes	1	2	
	Low Tide Kelp	109		yes		4		106	yes	yes	2	3	
	Intertidal	125	yes	yes	2	5		129	yes	yes	3	4	
	Strand Line	001'											
3	Cobble	129					3 Cobble/Pebble Low Tide Line Strand Line Cobble Wrack Line	001'					
			125	yes				5					
			109										
							003'						
							122	yes	yes	4	6		
4	Intertidal	122	yes	yes	3	6	4 Wrack Line Low Tide Line	114	yes			7	
	Strand Line	003'	yes			7		119					
	Log Line	114		yes		8							
5	Intertidal	119	yes			9	5 Low Tide Line Strand Line Strand Line	124					
	Wrack Line	124	yes			10		108					
	Log Line	108						138					
6	Kelp Line	002'		yes		11	6 Strand Line Hi Tide Line Intertidal	102					
	Intertidal	138						127**					
	Strand Line	102						002'					
	Strand Line	127											
7	Low Tide Kelp	97	yes	yes	4	12	7 Intertidal Low Tide Line	97**	yes	yes	5	8	
	Wrack Line	98	yes			13		98	yes			9	
	<b>Summary</b>		45%	40%	20%	65%	<b>Summary</b>		40%	30%	25%	45%	
			1 new	2 new					4 new				

\* Same location as first trial, \*\* near location of first trial

## **BACKGROUND MORTALITY STUDY**

### **CHERNOFSKI HARBOR**

On 17 January 2005, USFWS biologists Ken Gates, Fred Broerman, and Pat Walsh traveled to Dutch Harbor, Alaska, where Alaska Maritime Refuge Biologist Vernon Byrd met them. Mr. Byrd provided a mission briefing and investigation plan to the team. The objective of the project was to determine the level of background mortality of birds in the vicinity of Chernofski Harbor.

Chernofski Harbor is located on the north shore of Unalaska Island, approximately 40 km southwest of the Selendang Ayu wreck site. It was hypothesized that this location was sufficiently distant from the spill to be relatively unaffected, yet close enough to be occupied by similar bird communities. The orientation of the bay and its beach types are similar to the bays and beaches found in the oiled region.

### **Methods**

#### Site Selection

Beach types were identified as Protected, Exposed, or Collector Beaches and a minimum of two of each were selected for study. Beach types were defined as (1) Protected when beaches were sheltered from open ocean waves and storm surges; (2) Exposed when beaches were exposed to open ocean waves and storm surges; and (3) Collector when greater than 50% of the length of the beach contains accumulated log piles and other wave-deposited debris.

#### Beach surveys

Observers searched beaches by walking abreast and equally spaced across the width of each beach. Beach boundaries were defined as the water edge to the rooted vegetation line or cliff face. GPS was used to locate beach endpoints and measure beach length. Beach length was calculated by averaging the distance tracking function from three separate handheld GPS units. Observers collected and recorded each bird carcass encountered. Carcasses were defined as any part of a bird that indicated mortality, such as a feather pile, isolated wing, sternum, or more intact elements. Individual feathers were not considered carcasses. Information collected on each carcass included species when identifiable, presence of oiling, evidence of scavenging, location, and evidence of whether the carcass appeared freshly killed or relatively old. Criteria used to judge relative age of death included desiccation of tissue and yellowing of skin. All carcasses were placed into individual paper bags, which were then placed into plastic bags. An information tag containing carcass number, date, collector, and location was placed between the paper and plastic bags.

On 19-21 January 2005, the team explored beaches by foot and selected a total of 12 beaches (Figure 1). Beach lengths were determined on 28 January – 1 February 2005. Beaches CK1-CK6 were located on the same side of Chernofski Harbor as the campsite; thus they were accessible by hiking from the campsite. Beaches CK7-CK12 were located on the north side of Chernofski Harbor and accessed by boat.

Four of the beaches were classified as Protected (Table 4). These included beach CK2, which was located within Chernofski Harbor northwest from the campsite; Beach 6, which was located on the southwest side of West Point; and beaches CK7 and CK11, which were located at the upper end of Mutton Cove, which is the most sheltered shoreline within Chernofski Harbor. Four of the beaches were classified as Exposed. These included beaches CK3 and CK4, which were located near the mouth of Chernofski Harbor where they were more exposed to the open ocean than beaches deeper within the bay. Beaches CK9 and CK10 were also classified as Exposed. These beaches were located on the northeast side of Ram's Point, and were fully exposed to the open ocean. Beaches CK1, located in Chernofski Harbor, and CK8, located on a somewhat sheltered area on the west side of Ram's Point, consisted of both protected and exposed shorelines. We classified these beaches as Exposed-Protected. Collector areas occurred on seven of the beaches, but accounted for the majority of beaches CK5 and CK12. Thus, we classified these beaches as Collector.

Surveys took place daily during the period 19 January—12 February 2005, except from 8-11 February when no surveys took place due to weather and personnel changes (Figure 4, Table 5). Six beaches (either beaches CK1-CK6 or beaches CK7-CK12) were surveyed each day.

## Results

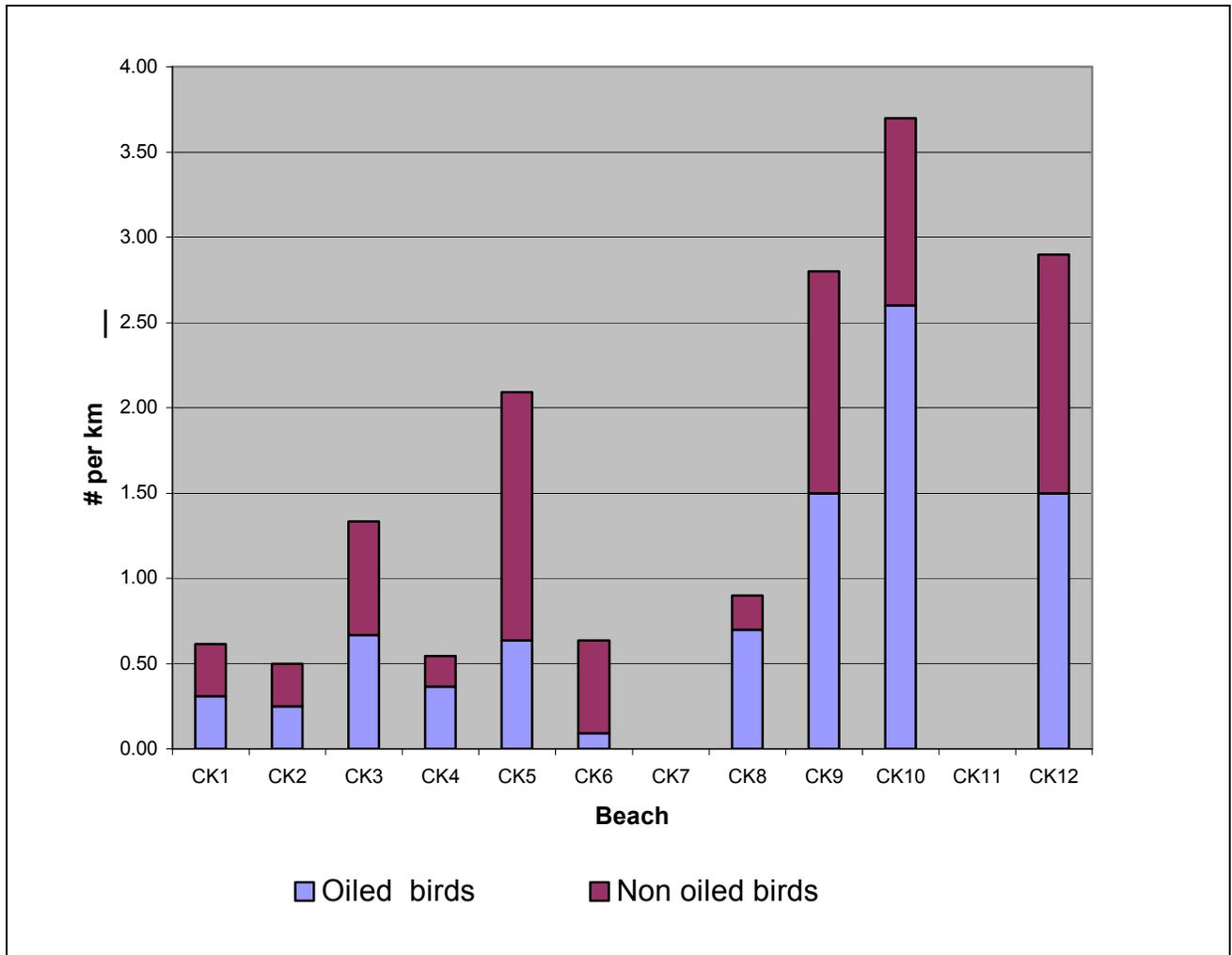
A total of 169 bird carcasses were located during the course of the survey. Carcasses varied in integrity, ranging from relatively intact birds (of which only one carcass was found) to small fragments of a dead bird, such as a sternum, single wing, or shred of skin with feathers attached. One hundred percent of carcasses appeared to be scavenged. Positive identification was made on two carcasses in the field: a Tufted Puffin (*Fratercula cirrhata*) and a Glaucous-winged Gull (*Larus glaucescens*).

Positive identification was not possible on the remaining carcasses in the field. However, most of the carcasses appeared similar in size, coloration, and wing conformation. Wing chord measurements were taken on a sample of approximately 10 carcasses, and ranged from 128-140mm. Coloration was a uniform slate gray. Based on these characteristics, and through consultation with Byrd, the team found it likely that the majority of the dead birds were Crested Auklets (*Aethia cristatella*). Interestingly, the team saw no live crested auklets, although a total of 35 bird species was identified during the course of the survey. The Crested Auklet is a pelagic species, wintering on open seas rather than immediately on the coast. Thus, if the unidentified carcasses truly are crested auklets, it is likely that their oiling occurred on the open sea.

Carcass sighting distance (CSD) is defined as the perpendicular distance to either side of the path walked by the observer that bird carcasses are seen. CSD was highly variable depending on beach substrate. Substrates ranged from uniform volcanic sand to talus boulder fields and debris piles of logs and other materials in collector areas. CSD ranged from approximately 10 m in the most open substrates to 1 m in the coarsest substrates. Beach widths ranged from approximately 2 m to 100 m.

**Table 4. Location, length and types of beaches surveyed and used for testing carcass persistence and searcher efficiency at Chernofski Harbor, Unalaska Island.**

Beach	Type	Length (km)	Start location				End location			
CK1	Exposed/Protected	0.7	N 53°	23.398	W 167°	32.607	N 53°	23.684	W 167°	32.857
CK2	Protected	1.36	N 53°	23.684	W 167°	32.857	N 53°	24.146	W 167°	33.17
CK3	Exposed	0.31	N 53°	24.146	W 167°	33.17	N 53°	24.145	W 167°	33.521
CK4	Exposed	0.42	N 53°	24.145	W 167°	33.521	N 53°	24.288	W 167°	33.801
CK5	Collector	0.59	N 53°	24.21	W 167°	34.389	N 53°	24.347	W 167°	34.764
CK6	Protected	1.19	N 53°	24.234	W 167°	34.895	N 53°	23.779	W 167°	34.757
CK7	Protected	0.51	N 53°	24.634	W 167°	31.201	N 53°	24.449	W 167°	31.438
CK8	Exposed, Protected	0.91	N 53°	24.604	W 167°	31.653	N 53°	24.943	W 167°	31.543
CK9	Exposed	0.76	N 53°	24.941	W 167°	31.404	N 53°	24.731	W 167°	31.047
CK10	Exposed	0.88	N 53°	24.731	W 167°	31.047	N 53°	24.868	W 167°	30.403
CK11	Protected	0.82	N 53°	24.311	W 167°	30.826	N 53°	24.634	W 167°	30.201
CK12	Collector	0.77	N 53°	24.586	W 167°	31.712	N 53°	24.47	W 167°	32.261



**Figure 4.** Number of bird carcasses/survey for the beaches surveyed at the Chernofski Harbor study site.

**Table 5. Daily summary of bird carcasses found during the Chernofski Harbor background mortality study.**

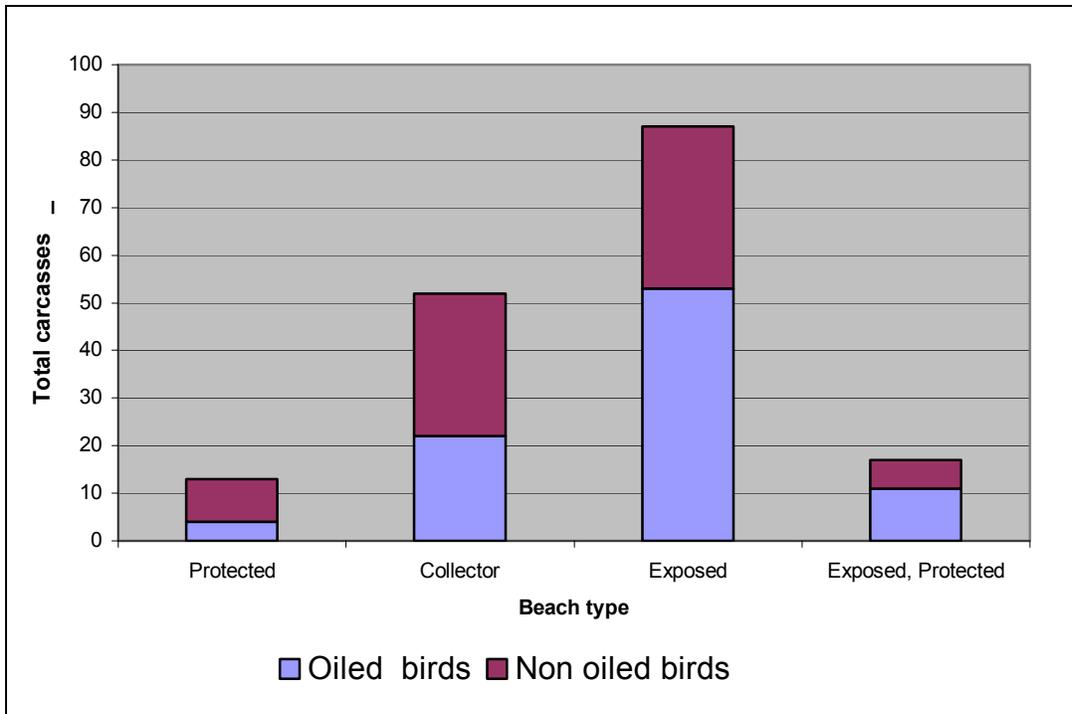
Date	Daily Totals			Running totals		
	Oiled birds	Non-oiled birds*	Daily total	Oiled birds	Non-oiled birds*	Grand total
19-Jan-05	1	0	1	1	0	1
20-Jan-05	5	2	7	6	2	8
21-Jan-05	11	3	14	17	5	22
22-Jan-05	12	3	15	29	8	37
23-Jan-05	1	10	11	30	18	48
24-Jan-05	2	12	14	32	30	62
25-Jan-05	11	20	31	43	50	93
26-Jan-05	0	1	1	43	51	94
27-Jan-05	3	1	4	46	52	98
28-Jan-05	0	2	2	46	54	100
29-Jan-05	0	1	1	46	55	101
30-Jan-05	6	0	6	52	55	107
31-Jan-05	1	1	2	53	56	109
1-Feb-05	9	10	19	62	66	128
2-Feb-05	10	4	14	72	70	142
3-Feb-05	3	2	5	75	72	147
4-Feb-05	4	1	5	79	73	152
5-Feb-05	5	0	5	84	73	157
6-Feb-05	1	2	3	85	75	160
7-Feb-05	2	2	4	87	77	164
8-Feb-05	No Survey					
9-Feb-05	No Survey					
10-Feb-05	No Survey					
11-Feb-05	No Survey					
12-Feb-05	1	4		88	81	169
		Percent		0.52071	0.47929	

The total number of carcasses found varied among dates and beaches (Figures 3 and 4). The number of birds found daily increased over the first 7 days of surveys from a single carcass to 31 carcasses, then dropped to relatively low numbers, until 1 February 2005, the day after a storm front passed through, at which time the number increased to 19 carcasses. The number of carcasses found per survey then tapered off to a relatively low number until the end of the survey. No carcasses were found on beaches CK7 and CK11 (both located in the protection of Mutton Cove). However, a single unidentified carcass was found in the grass approximately 2 m above the beach on beach CK7. This was not included in the carcass totals. The greatest number of carcasses was found on beaches CK9, CK10, and CK12, all of which are outside Chernofski Harbor and exposed to the open sea. Exposed beaches produced the greatest total number of carcasses and protected beaches produced the fewest number of carcasses (Figure 5). Collector Beaches produced an intermediate number of carcasses. However, when carcass density was determined by calculating the number of carcasses/km/survey, a different pattern emerged. Collector areas produced the greatest density of carcasses, followed by Exposed Beaches (Figure 6, Table 6). Protected beaches produced the least density of carcasses.

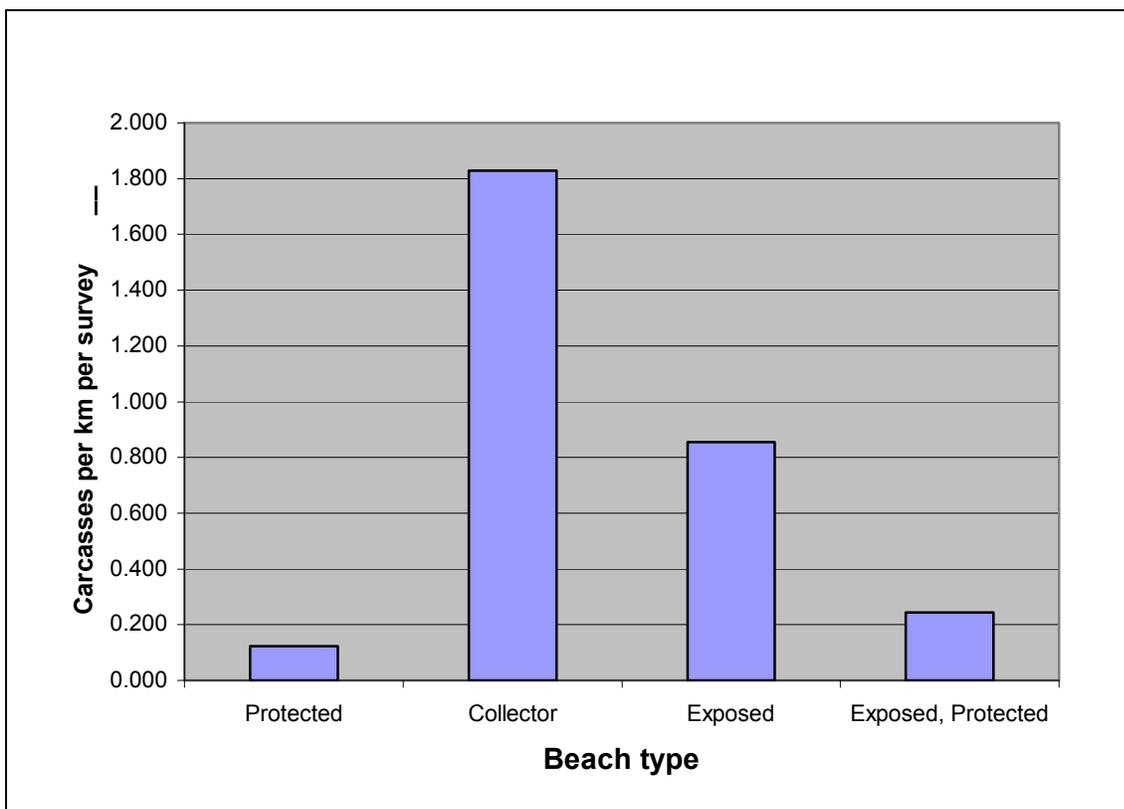
Oiled carcasses were found during the course of the survey. There were 88 oiled carcasses found and 81 carcasses found that were not apparently oiled. Both oiled and non-oiled carcasses were found on each beach type. Thick, tar-like oil was observed in small, scattered clumps, predominantly on exposed beaches, from the onset of the surveys. Oil did not appear to turn up in new locations as surveys were replicated—it consistently was found in the same places. Over time, it appeared thicker and older than when first observed. No oil was observed on the water at any time.

There were several predators/scavengers observed in the study area. Red foxes (*Vulpes vulpes*) and their tracks were observed daily on the beaches. Their scat was often found in the immediate vicinity of scavenged carcasses. During the course of the survey, only a single bird (a tufted puffin) was found that included a complete head and neck. The breast and entrails had been eaten. This bird was found at the immediate surf line, suggesting that it had just been deposited by wave wash. As the bird was picked up, a fox walked to within 40 m of the survey crew. It was believed that if the crew had arrived a few minutes later the fox may have completed the scavenging and deposited the carcass above the surf line. The majority of carcasses found were located significantly above the high tide line, arguing against placement by the tides.

Bald Eagles (*Haliaeetus leucocephalus*) were also seen daily. Eagles used the beach cliffs for perches, and were often found scavenging carcasses at the base of cliffs, where it was assumed they had been discarded by eagles perched above. Relatively small numbers of Common Ravens (*Corvus corax*) and Glaucous-winged Gulls were seen daily. Merlins (*Falco columbarius*) were seen on two occasions.



**Figure 5. Total number of carcasses found by beach type at the Chernofski Harbor study site.**



**Figure 6. Bird carcass discovery rate by beach type at the Chernofski Harbor study site.**

**Table 6. Summary by Beach and Beach Type**

Summary by Beach						Carcasses per survey				
Beach	Type	Times surveyed	Oiled birds	Non oiled birds	Total	Oiled birds	Non oiled birds	Total	Beach Length	Km Surveyed
CK1	Exposed,Protected	13	4	4	8	0.31	0.31	0.62	0.70	9.10
CK2	Protected	12	3	3	6	0.25	0.25	0.50	1.36	16.28
CK3	Exposed	12	8	8	16	0.67	0.67	1.33	0.31	3.68
CK4	Exposed	11	4	2	6	0.36	0.18	0.55	0.42	4.58
CK5	Collector	11	7	16	23	0.64	1.45	2.09	0.59	6.45
CK6	Protected	11	1	6	7	0.09	0.55	0.64	1.19	13.09
CK7	Protected	11	0	0	0	0.00	0.00	0.00	0.51	5.57
CK8	Exposed, Protected	10	7	2	9	0.70	0.20	0.90	0.91	9.10
CK9	Exposed	10	15	13	28	1.50	1.30	2.80	0.76	7.60
CK10	Exposed	10	26	11	37	2.60	1.10	3.70	0.88	8.83
CK11	Protected	10	0	0	0	0.00	0.00	0.00	0.82	8.20
CK12	Collector	10	15	14	29	1.50	1.40	2.90	0.77	7.67
Total		131	90	79	169	8.62	7.41	16.02	9.20	100.16
Summary by Beach Type						Carcasses per km per survey				
	Beach type	No. Surveys	Oiled birds	Non oiled birds	Total	Length (km)	Oiled birds	Non oiled birds	Total	
	Protected	44	4	9	21	3.87	0.023	0.053	0.123	
	Collector	21	22	30	52	1.35	0.774	1.056	1.830	
	Exposed	43	53	34	87	2.37	0.521	0.334	0.855	
	Exposed, Protected	23	11	6	9	1.61	0.297	0.162	0.243	
						169	9.20	Mean =	0.763	

## **BACKGROUND MORTALITY STUDY**

### **NIKOLSKI BAY**

A background seabird mortality study was also conducted at Nikolski Bay, located at the southwest end of Unmak Island, Alaska. As in the Chernofski study, beaches were surveyed for seabird carcasses principally by USFWS personnel who employed the same methods used by the Chernofski survey crews.

#### **Methods**

Nine beaches, five classified as collector and four as exposed, were surveyed starting on 24 January and continuing until 13 February 2005 (Figure 3) (Table 7). None of the beaches at the Nikolski study area were classified as protected. Beaches NK2, NK4 and NK10 were delineated as study areas, but were not sampled due to time constraints and suitability of other beaches. Individual beaches were surveyed about every other day, except Beach NK8, which was not added to the list until 1 February (Table 8).

#### **Results**

Of the total 48 carcasses found over the study period, three (6%) were observed to have oil on them (Table 8). Most of the carcasses were represented by clusters of feathers or disarticulated bones as in the Chernofski study, with only two carcasses being found relatively intact. The total number of carcasses found varied among dates and beaches (Figures 7 and 8; Table 8). The daily number of carcasses found was never greater than eight, and was typically less than four. The total number of carcasses found on the Collector Beaches was higher than on the Exposed Beaches (Table 9, Figure 9), yet, when the survey effort is accounted for, the number of carcasses found per survey on Exposed Beaches was approximately double that found on Collector Beaches (Table 9). Carcass discovery rate, measured as number of carcasses/km/survey, for the Collector Beaches was over double that for Exposed Beaches (Figure 10).

#### **Discussion**

The oiling rate of stranded birds at Nikolski is substantially lower than Chernofski. This may be due in part to bird mortality at Chernofski resulting from the spill, greater amounts of background oil near Chernofski, or birds being oiled post-mortem by Selendang and/or background oil contamination. More carcasses per kilometer were found at Chernofski (mean = 0.763) compared to Nikolski (mean = 0.262), which may have been due to spill effects, differences in background mortality causation, and local bird populations, which were noticeably less near Nikolski.

**Table 7. Location, length and type of beaches surveyed at Nikolski Bay, Unmak Island.**

segment	sampled	start lat.	start long.	end lat.	end long.	beach type	length (m)
NK1	yes	52.96937	168.86125	52.9672	168.86119	collector	275
NK2	no	52.9672	168.86119	52.9669	168.86128	exposed	
NK3	yes	52.9669	168.86128	52.96514	168.86528	collector	484
NK4	no	52.96514	168.86528	52.95961	168.868	kelp	
NK5	yes	52.95961	168.868	52.95875	168.86195	exposed	474
NK6	yes	52.95875	168.86195	52.95705	168.85985	collector	262?
NK7	yes	52.95705	168.85985	52.95501	168.85117	exposed	679?
NK8	yes**	52.95501	168.85117	52.95124	168.85237	collector	513?
NK9	yes	52.95124	168.85237	52.9426	168.85999	exposed	1009
NK10	no	52.9426	168.85999	52.93846	168.86353	collector	
NK11	yes*	52.93846	168.86353	52.94055	168.871	exposed	863
NK12	yes	52.97224	168.86337	52.96937	168.86125	exposed	417

\*beach added into sample during 2nd replication

\*\*beach added into sample during 3rd replication

**Table 8. Daily summary of bird carcasses found during the Nikolski Bay background mortality study.**

Date	Daily Totals		Daily total	Running totals		Grand total
	Oiled birds	Non-oiled birds*		Oiled birds	Non-oiled birds*	
24-Jan-05	0	0	0	0	0	0
25-Jan-05	0	2	2	0	2	2
26-Jan-05	0	5	5	0	7	7
27-Jan-05	0	1	1	0	8	8
28-Jan-05	0	1	1	0	9	9
29-Jan-05	2	4	6	2	13	15
30-Jan-05	0	8	8	2	21	23
31-Jan-05	1	5	6	3	26	29
1-Feb-05	0	1	1	3	27	30
2-Feb-05	0	1	1	3	28	31
3-Feb-05	0	4	4	3	32	35
4-Feb-05	0	1	1	3	33	36
5-Feb-05	No Survey					
6-Feb-05	0	3	3	3	36	39
7-Feb-05	0	4	4	3	40	43
8-Feb-05	0	0	0	3	40	43
9-Feb-05	0	1	1	3	41	44
10-Feb-05	0	2	2	3	43	46
11-Feb-05	0	1	1	3	44	47
12-Feb-05	0	1	1	3	45	48
13-Feb-05	0	0	0	3	45	48
		Percent		6.3	93.8	

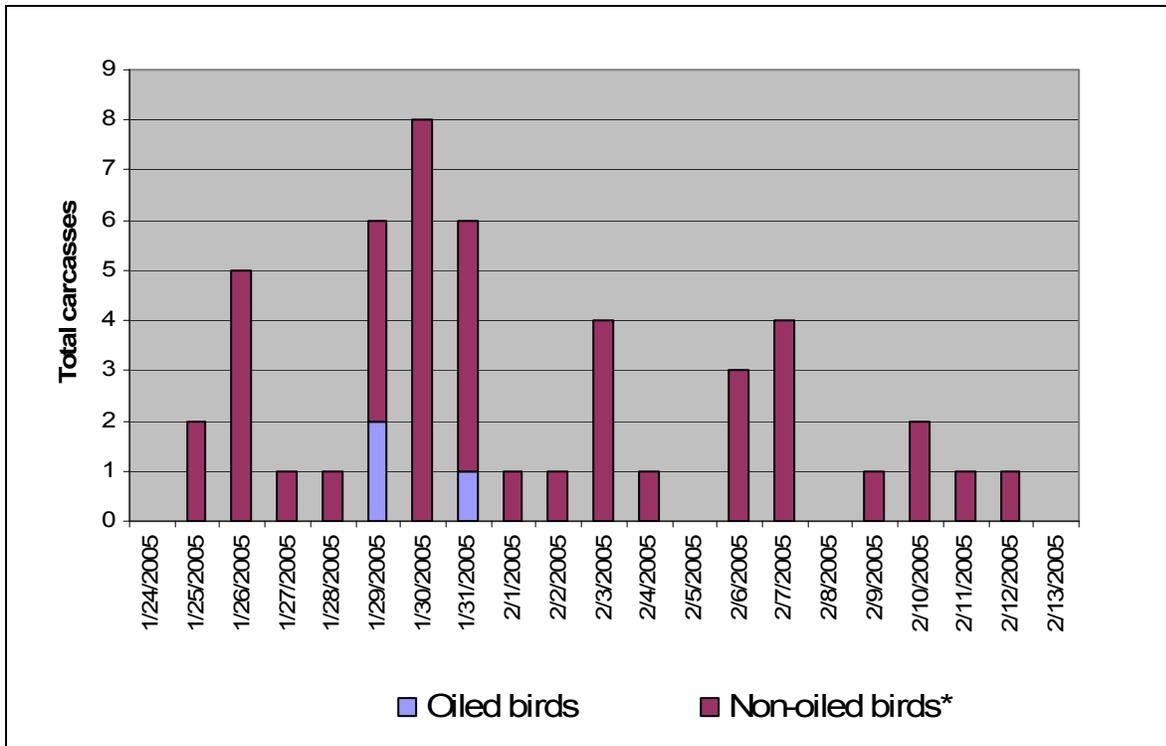


Figure 7. Number of carcasses found daily on the Nikolski Bay study site beaches.

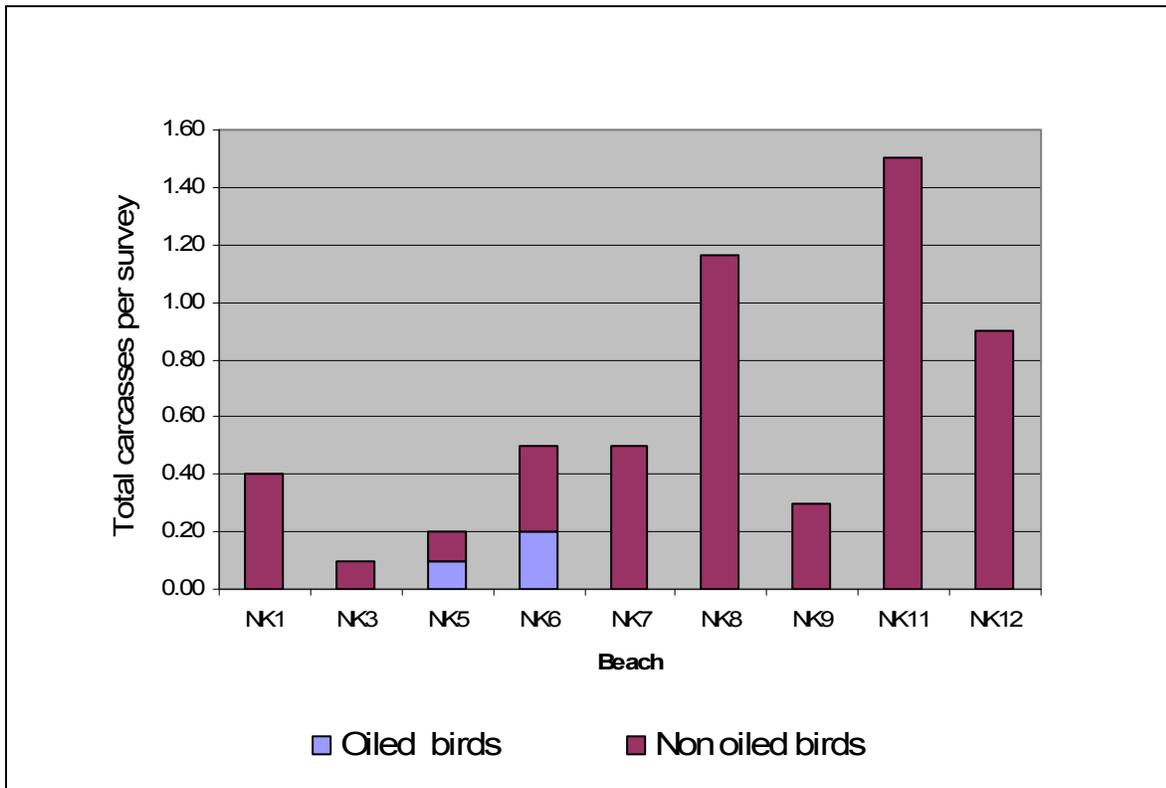
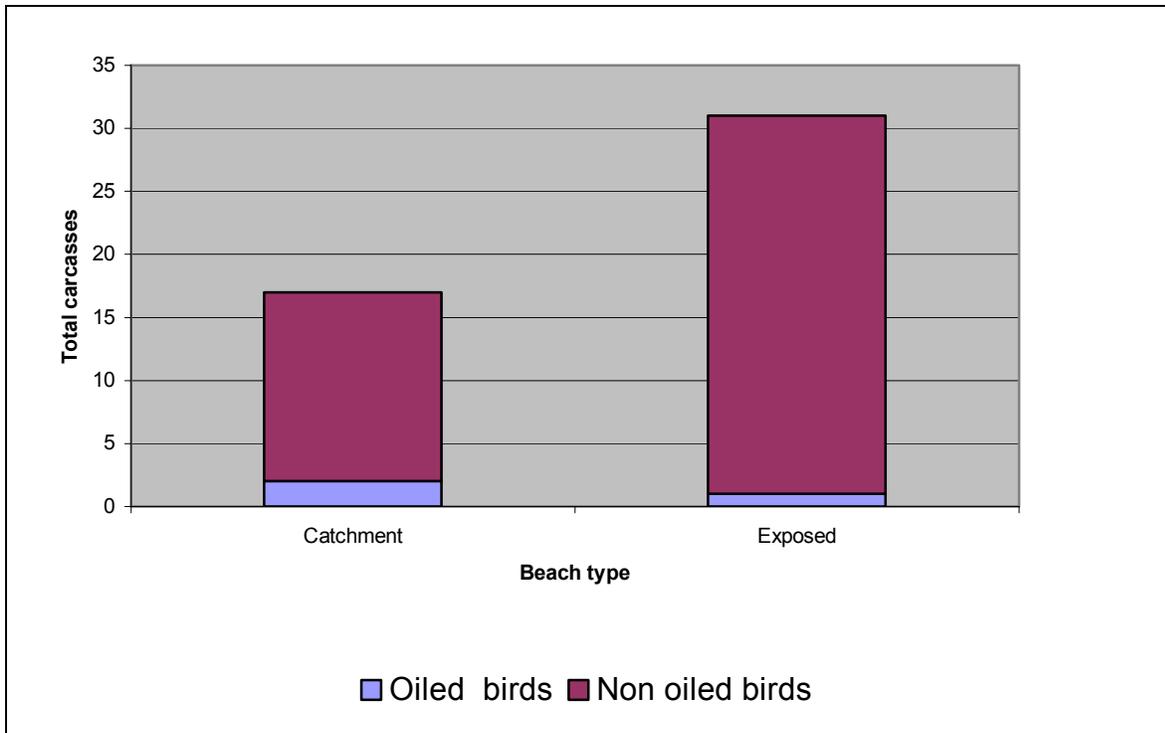


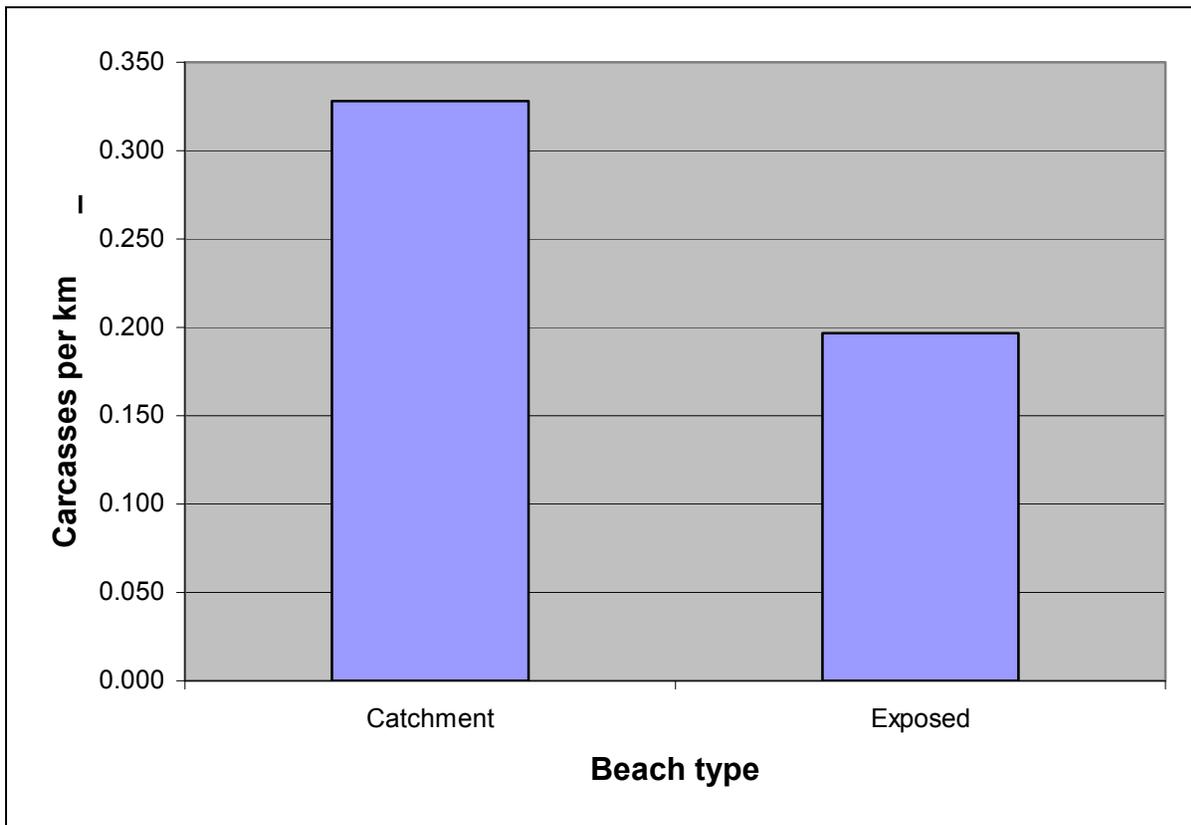
Figure 8. Number of bird carcasses/survey for the beaches surveyed at the Nikolski Bay study site.

**Table 9. Nikolski Bay survey result by beach and beach type.**

Summary by Beach						Carcasses per survey				
Beach	Type	Times surveyed	Oiled birds	Non oiled birds	Total	Oiled birds	Non oiled birds	Total	Beach Length	Km Surveyed
NK1	Collector	10	0	4	4	0.00	0.40	0.40	0.25	2.50
NK3	Collector	10	0	1	1	0.00	0.10	0.10	0.39	3.90
NK5	Exposed	10	1	1	2	0.10	0.10	0.20	0.43	4.30
NK6	Collector	10	2	3	5	0.20	0.30	0.50	0.25	2.50
NK7	Exposed	10	0	5	5	0.00	0.50	0.50	0.64	6.40
NK8	Collector	6	0	7	7	0.00	1.17	1.17	0.55	3.30
NK9	Exposed	10	0	3	3	0.00	0.30	0.30	1.13	11.30
NK11	Exposed	8	0	12	12	0.00	1.50	1.50	0.66	5.28
NK12	Exposed	10	0	9	9	0.00	0.90	0.90	0.42	4.20
	Total	84	3	45	48	0.30	5.27	5.57	4.72	43.68
Summary by Beach Type						Carcasses per km per survey				
	Beach type	No. Surveys	Oiled birds	Non oiled birds	Total	Length (km)	Oiled birds	Non oiled birds	Total	
	Collector	36	2	15	17	1.44	0.039	0.289	0.328	
	Exposed	48	1	30	31	3.28	0.006	0.191	0.197	
					48	4.72				
									Mean =	0.262



**Figure 9. Total number of carcasses found by beach type at the Nikolski Bay study site.**



**Figure 10. Bird carcass discovery rate by beach type at the Nikolski Bay study site.**