United States Department of the Interior

U.S. Fish and Wildlife Service
Izembek National Wildlife Refuge
P.O. Box 127
Cold Bay, Alaska 99571

Izembek National Wildlife Refuge Report for the Kodiak/Aleutians Federal Subsistence Regional Advisory Council Fall Meeting – September 26-27, 2017, Cold Bay, Alaska

Brown bears, a common site on Izembek National Wildlife Refuge. (Photo: Greg Risdahl)

INVENTORY AND MONITORING STUDIES
Greg Risdahl

CARIBOU
Federal Subsistence Hunt—Unit 9D (Southern Alaska Peninsula)
In total, 75 bull caribou permits were allocated to five communities (15 permits each; Cold Bay, King Cove, Sand Point, False Pass, and Nelson Lagoon) for the 2016-17 federal subsistence permit hunt. The caribou subsistence hunt was a split season in 2016-2017 and opened from August 10 to September 20, 2016 and November 15, 2016 to March 31, 2017. At the close of the season, 7 caribou had been harvested during the hunt (Table 1).

The harvest decreased by 3 from 2015-2016 (n=10). Since 2012, 6 caribou have been harvested annually on average during the federal subsistence caribou hunt. With the Southern Alaska Peninsula (SAP) population showing continued growth there is no limit on the number of permits available for the 2017-2018 federal subsistence caribou hunting season. The bag limit is still one bull.

Table 1. Summary of federal subsistence caribou permits issued and number of bulls harvested by each community during the 2016-2017 hunt.

Community	# Permits Allocated	# Permits Issued	# Caribou Harvested
Cold Bay	15	3	0
False Pass	15	10	6
King Cove	15	7	0
Nelson Lagoon	15	0	0
Sand Point	15	11	1
Total	75	31	7

State Caribou Hunt—SAP Unit 9D

The Alaska Department of Fish and Game (ADF&G) management objectives for the SAP in Unit 9D are:

1) Sustain a total population with a minimum of 3,000 caribou and a maximum of 4,000 caribou
2) Maintain a fall bull:cow ratio of 35:100
3) Provide limited harvest of bulls when the herd exceeds 1,000 caribou
4) Cow harvests may be authorized when the population exceeds 2,000 caribou and population size is increasing

Since the state caribou season re-opened in 2013, an average of 22 caribou has been harvested annually (Table 2). Currently, state biologists believe that the SAP is nearing the limits of its carrying capacity and are considering increasing the bag limit to two caribou (Personal Communication, Dave Crowley, September 6, 2017).

Table 2. Summary of SAP caribou harvested under ADF&G (state) regulations, 2013-2016. (Data provided by ADF&G.)

Year	Cows	Bulls	Total
2013	1	17	18
2014	1	11	12
2015	2	17	19
2016	4	36	40
Totals	8	81	89
Averages	2	20	22

Caribou Population Surveys—SAP Unit 9D

With a reduction in staff at Izembek National Wildlife Refuge (NWR), no annual winter minimum population count was conducted for the SAP herd in 2017. However, the ADF&G conducted a recruitment survey for the SAP in October 2016. ADF&G classified 1,442 caribou during this survey and estimated a total population size of 2,200 animals. ADF&G biologists observed 757 cows, 291 calves and 374 bulls during the aerial survey, giving a calf:100 cow ratio of 38:100 and bull:100 cow ratio of 49:100 (Table 3). The results of this trend count indicate that the SAP is continuing to grow.

Table 3. Southern Alaska Peninsula caribou herd winter minimum population counts and fall composition surveys (2004 to 2017) conducted by U.S. Fish and Wildlife Service (Service) and ADF&G, respectively.

Year	Winter minimum population count	Fall Bulls : 100 Cows	Fall Calves : 100 Cows	Fall composition sample size
2004-2005	1,872	36	7	966
2005-2006	1,651	30	6	1,040
2006-2007	770	16	1	713
2007-2008	NA	15	1	431
2008-2009	NA	10	39	570
2009-2010	NA	21	43	679
2010-2011	NA	28	47	532
2011-2012	1,061	40	20	920
2012-2013	NA	45	20	500
2013-2014	NA	50	40	600
2014-2015	1,316	45	45	884
2015-2016	1,568	NA	NA	NA
2016-2017*	2,200	49	38	1,442

"NA" indicates no data was collected.
"Year" covers the period October-April.
USFWS winter minimum population counts are normally conducted December through April.
ADF&G fall composition ratios are calculated from an October survey.
*The minimum winter population is estimated from a population simulation model for 2016-2017.

Caribou Population Surveys—Unit 10 (Unimak Island)

No winter minimum population count was conducted for the Unimak Island caribou herd (UCH) in 2017. However, the ADF&G conducted a recruitment survey for the UCH in October 2016, as note above. ADF&G biologists classified 258 caribou during the aerial survey, including 149 cows, 60 calves and 49 bulls, giving a calf:100 cow ratio of 40:100 and bull:100 cow ratio of 32:100 (Table 4). Like the SAP, the results of this trend count indicate that the UCH is continuing to grow. Technically, the SAP and UCH are the same herd.

Table 4. Summary of Unimak Island caribou herd winter minimum population counts and fall composition surveys (2004 to 2017) conducted by the Service and ADF&G, respectively.

Year	Winter minimum population count	Fall Bulls : 100 Cows	Fall Calves : 100 Cows	Fall composition sample size
2004-2005	1,006	NA	NA	NA
2005-2006	1,009	45	7	730
2006-2007	806	NA	NA	NA
2007-2008	NA	31	6	433
2008-2009	NA	9	6	260
2009-2010	400	5	3	221
2010-2011	224	8	8	284
2011-2012	94	6	7	117
2012-2013	NA	9.5	3	83
2013-2014	NA	10	19	67
2014-2015	230	15	22	127
2015-2016	NA	NA	NA	NA
2016-2017	NA	33	40	258

"NA" indicates no data was collected.
"Year" covers the period October-April.
USFWS winter minimum population counts are normally conducted December through April.
ADF&G fall composition ratios are calculated from an October survey.

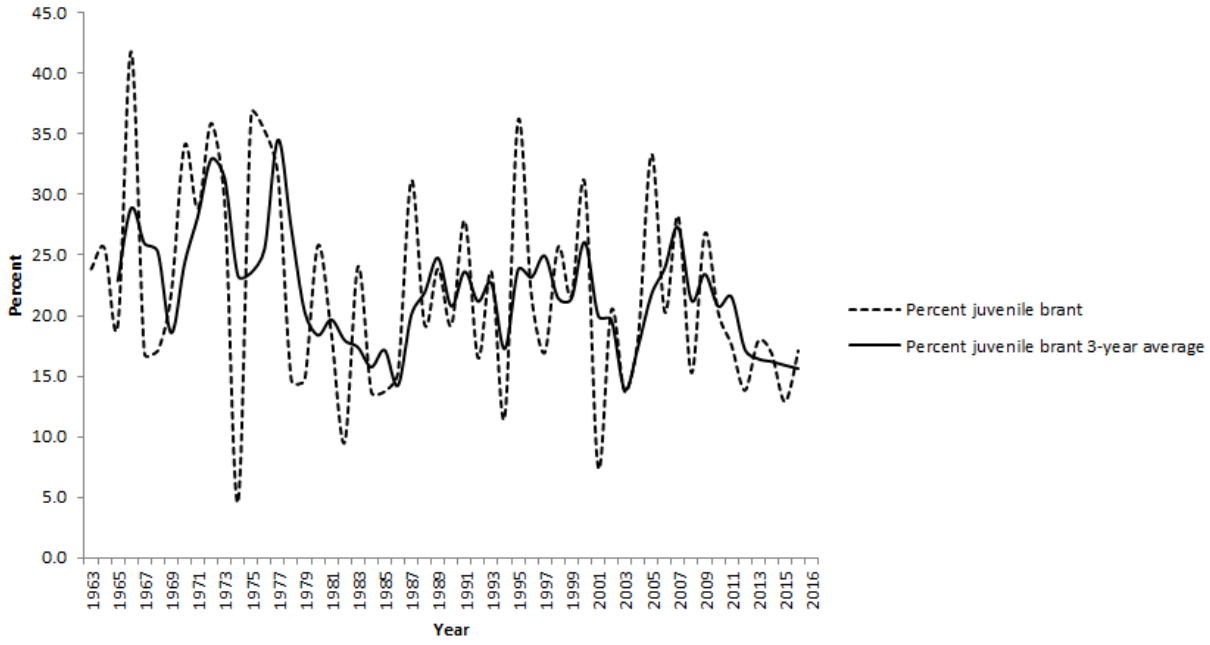
WATERFOWL

Pacific Brant—Age-ratio Survey

Brant productivity data have been collected at Izembek NWR for over 50 consecutive years and aids the Migratory Bird Program in determining the status and trends of this population, and is used as a tool to determine the fall harvest bag limit. The productivity index for the entire Pacific brant population is generated from ground-based count ratios of adult to juvenile birds conducted in Izembek Lagoon and adjacent areas each fall when the birds are staging for migration.

In 2016 a new survey method was implemented to increase the quality of the survey data. During the first week of October 2016, ten biologists collected over 30,000 observations in just under a week. This methodology allowed for simultaneous collection of observations across the lagoon in a single day, thereby reducing some of the bias in the data collection. The percentage of juveniles in the fall of 2016 was 17.1%, an increase from 2015 (12.9%). This survey methodology will be repeated in October 2017 with USGS biologist David Ward taking the lead.

Figure 1. Index of productivity for juvenile Pacific black brant in Izembek Lagoon, Cold Bay, Alaska 1963-2016.



Pacific Brant—Fall Population Aerial Survey

Between September and November each year, nearly the entire world population of Pacific black brant (*Branta bernicla nigricans*) stages at Izembek Lagoon and surrounding estuaries (Reed et al. 1998, Ward et al. 2005). Fall-staging brant have been counted in the Izembek Lagoon area since 1975 with standardized surveying beginning in 1976. The primary objective of the Fall Izembek Brant Survey is to provide an annual index of the entire post-breeding Pacific brant population. A secondary objective is to provide annual fall population indices for cackling geese (*Branta hutchinsii taverneri and B.h. minima*), emperor geese (*Chen canagica*), and Steller's eiders (*Polysticta stelleri*). Other waterbird species observed during the survey are also reported annually.

Given almost all of the Pacific brant population is believed to stage within the Izembek Lagoon complex (Izembek complex), the Fall Izembek Brant Survey provides a comparative overall population measure to the Pacific Mid-Winter Survey of brant, which combines mid-winter counts from Mexico, California, Oregon, Washington, British Columbia, and Alaska to create a composite 'total' population index (Pacific Flyway Council 2002, Olsen 2016). Together, the Fall Izembek Brant Survey and Mid-Winter Brant Survey are currently ranked as the highest priorities for population assessment of Pacific black brant by the Pacific Flyway Council. The Pacific brant population count was conducted in October 2016 on the Izembek complex. The 2016 index for brant was 203,735, an increase of 21% from 2015 (160,735), the highest in the history of the survey. The 2016 index is 33% higher than the long term average of 136,693, suggesting moderate growth of the overall population (Wilson 2017b), with the most significant growth occurring during the past decade.

Cackling Goose—Fall Aerial Population Survey
The 2016 cackling goose index was 55,530 (Wilson 2017a). The long-term (1976-2016) fall population trend indicated no significant change over the history of the survey, while the most recent 10-year (2007-2016) trend suggests moderate growth.

Emperor Goose—Fall Aerial Population Survey
The 2016 emperor goose index was 1,497 (Wilson 2017a). The long-term (1976-2016) fall population trend of emperor geese at Izembek complex indicates a significant decline in the population, not counting the most recent 10-years, which have been relatively stable. However, the Izembek complex typically represents only 3% of the total fall emperor geese staging on the Alaska Peninsula (Wilson 2017a), with the largest aggregations of emperor geese occurring north of Izembek in the estuaries of Cinder River (20%), Port Heiden (15%), Seal Islands (20%), and Nelson Lagoon/Port Moller (20%).

Steller's Eider—Fall Population Aerial Survey
The 2016 index for Steller's eiders was 6,953 (Wilson 2017a). The long-term (1976-2016) fall population index of Steller's eiders at the Izembek complex indicates no significant trend, while the most recent 10-year trend indicates a decline. Historically, the Izembek complex has represented <8% of the total fall Steller's eiders staging on the Alaska Peninsula (Wilson 2017). The largest aggregations have typically occurred in the estuaries of Nelson Lagoon/Port Moller (~70%), Port Heiden (6%), and the Seal Islands (14%). As such, changes in the numbers of Steller's Eiders at Izembek may represent changes in distribution, as opposed to real changes in population size.

Brant—Mid-level Aerial Photographic Age-ratio Survey
In late August 2017, Migratory Bird Division pilot Brad Shults, and biologists Dennis Marks and Tim Bowman, initiated a pilot survey to improve accuracy of fall population indices of Pacific brant using mid-level photographic samples with the objective of replacing the ground-based ocular surveys. Replicate photographs were taken over the Izembek complex at 1500-2000 feet above ground level. The results of this survey are currently being analyzed.

Emperor goose—Low-level Aerial Photographic Age-ratio Survey
From mid-September through October, most of the emperor goose population congregates in seven lagoons on the north side of the Alaska Peninsula (Shults and Marks, 2016). The annual age-ratio of hatching-year to adult emperor geese have been monitored since 1985. This survey is now accomplished by taking high resolution aerial photographs at 300-400 feet above ground level and counting the number of juvenile and adult geese in the photographs. Hatching-year (juvenile) emperor geese retain a gray/black head and neck while adults have completely white heads. This survey is used to estimate the annual production in the fall staging population.

In September 2016, Migratory Bird Division biologists classified 21,138 emperor geese from 377 photographs. They estimated that 2,045 of the photographed geese were hatching-year/juvenile birds. The proportion of juvenile geese was 48% below the long-term average and the second lowest since the inception of the survey. Data from the Yukon-

Kuskokwim Delta Nest Plot survey suggested that the emperor geese produced low numbers of eggs, had low nest success, and low clutch sizes (Fischer, 2017). The 2016 total count of emperor geese in Izembek Lagoon was 1,025, representing less than 5% of the total birds classified.

Steller's eiders—Mid-level Aerial Photographic Molting Survey

Migratory Bird Division pilot Brad Shults, and biologists Alison Williams and Tim Bowman, completed the fifth consecutive mid-level (700-900 feet above ground level) aerial photographic survey of molting endangered Steller's eiders along the north side of the Alaska Peninsula in late August and early September, 2016. Biologists estimated 40,025 molting Steller's eiders, with 24,716 (62%) observed at Nelson Lagoon (Williams et. al. 2017). The Izembek count (6,457) represented 16% of the total birds counted. The 2016 estimate was 25% below the 2012-2015 average of 53,651. Biologists believe that 99% of the molting Steller's eiders were present in the Seal Islands and Nelson and Izembek Lagoons at the time of the 2016 survey.

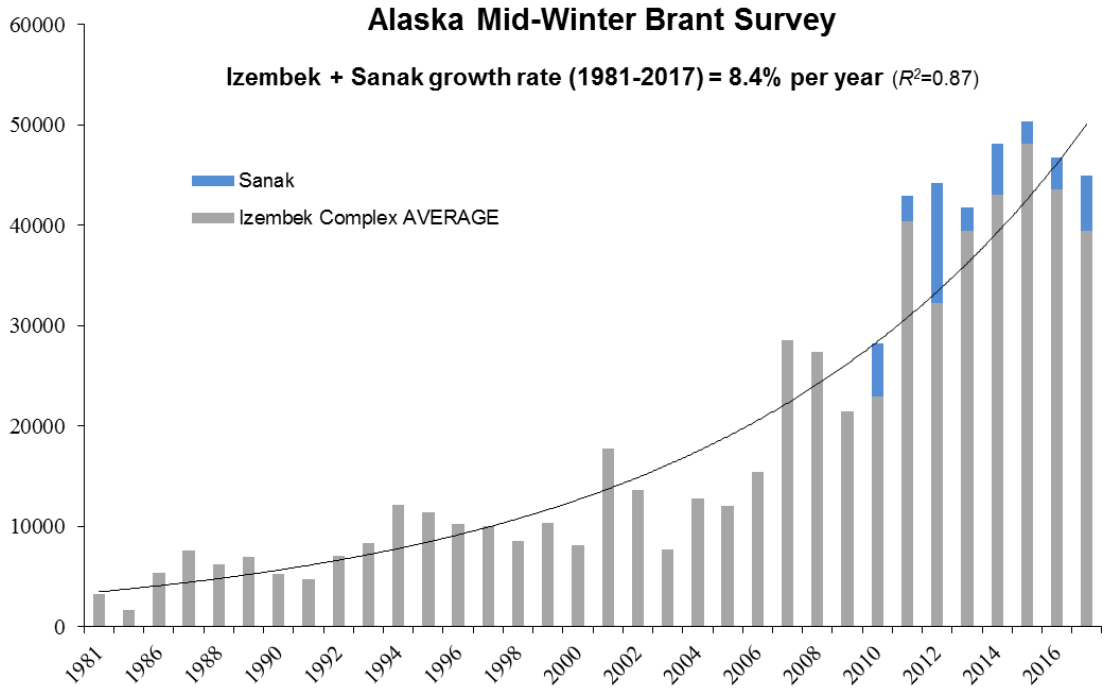
Pacific Brant—Mid-winter Aerial Population Survey

Aerial surveys of wintering Pacific brant at the Izembek NWR, including refuge coastlines and adjacent marine estuaries, have been conducted annually since the winter of 1980-1981 (Wilson 2017a). The survey serves as the Alaska component of the Pacific Flyway Mid-winter Survey for brant, and documents winter distribution, abundance, population trend, and habitat use by brant and other species. Results from the Alaska survey are combined with mid-winter surveys in British Columbia, Washington, Oregon, California and Mexico, and used by the Pacific Flyway Study committee to recommend changes to harvest strategy as specified in the management plan for Pacific brant (Pacific Flyway Council 2002). The aerial mid-winter survey of Pacific brant utilizing the Izembek complex (includes Sanak Island) was flown by the Service's Migratory Bird Division on January 21-24, 2017. An estimated total of 44,899 brant were counted (Figure 2), of which 88% were observed in the Izembek complex (Wilson 2017a). The long-term average for the mid-winter count is 18,566 brant. The 2016 survey indicates an increasing, long-term trend of 8.4% per year. Currently, Alaska supports approximately 30% of the mid-winter population of Pacific brant. The Alaska wintering population appears to have stabilized since 2011 averaging 45,591 birds, with a growth rate of 1.5% per year.

Emperor Goose—Spring Aerial Survey

Since 1985, this survey by the Migratory Bird Division has been the primary population index conducted for emperor geese, and includes coastline and estuarine habitats from the mouth of the Kuskokwim River to Wide Bay, including both sides of the Alaska Peninsula. The 2016 count of 79,348 geese was below the 2015 estimate (98,155) by 24%, but 28% above the long-term average (66,871) (Wilson and Shults 2017). The 3-year average of 85,812 is the highest since 1983 and is above the threshold for consideration for opening a hunting season, per the Yukon Delta Goose Management Plan and 2006 Pacific Flyway Council Management Plan. Thus, in 2017, the emperor goose hunting season opened for the first time in over 30 years. The final 2016 survey results were published in February 2017.

Figure 2. Alaska component of the Pacific Flyway Mid-Winter index for brant, 1981-2017. Annual totals represent averages of within-winter replicates at Izembek (grey bars), plus counts at the Sanak Islands, Alaska (blue bars). (Graph from Wilson 2017a.)



Emperor Goose—Mid-winter Population Survey

Migratory Bird Division biologists estimated a combined total of 7,502 emperor geese for the Izembek complex (average 2,911) and Sanak Island (4,591), with Sanak representing 60% of the combined total. The 2017 total for emperor geese represents the highest count on record—20% higher than the previous year, and 154% higher than the long-term average (Wilson 2017a).

Steller's Eider—Mid-winter Population Survey

Migratory Bird Division biologists estimated a combined total of 12,725 Steller's eiders during the mid-winter survey. The Izembek complex averaged 9,689 (76%) Steller's eiders; while 3,036 were observed at the Sanak Islands (Wilson 2017a). The 2017 average mid-winter count was 36% lower than the previous long-term average of 20,037 (1981-2016. As with emperor geese, mid-winter counts of Steller's eiders have been highly variable. The winter range of Steller's eiders in Alaska spans from Cook Inlet through the Aleutian Islands; thus, inferences about population change from this survey are not necessarily reflective of the entire species.

Avian Influenza and Avian Blood Parasites

Izembek NWR continues to collaborate with the U.S. Geological Survey (USGS) to collect avian influenza samples from hunter-harvested waterfowl during September and October Each year, almost 1,000 samples are collected and tested to help monitor for avian influenza in Alaska. Additional samples are obtained from live birds through fecal collection in the field. A report was published in 2016 in the journal: Infection, Genetics and

Evolution, which summarizes data collected beginning in 2014 (Ramey et. al, 2016). Researchers specifically looked for (1) ancestral origins of evidence for dispersal of the highly pathogenic clade influenza A viruses (H5N1 and H5N2) from East Asia through Alaska, and (2) ancestral origins of clade 2.3.4.4 H5 in Beringia. No highly pathogenic viruses have been detected so far, but gene segments in some viruses contained a common ancestry with H5N1 and H5N2 viruses.

Tundra Swans—Aerial Population Survey

The annual tundra swan survey was conducted on the Izembek and Pavlof Units June 16-24, 2017. A total of 735 swans and 11 nests were observed in both units combined. In the Izembek Unit a total of 155 swans and 1 nest were observed (Figure 3a). There were 8 single swans, 41 pairs, 1 pair on a nest, no single swans on nests, and 66 in flocks (Figure 3b). The density of swans in 2017 in the Izembek Unit (0.38 swans/mi^2) was lower than in 2016 (0.49 swans/mi^2), but slightly above the long term average (0.31 swans/mi^2; $\pm$ 0.03 SE; 1998-2016). The density of breeding pairs observed on the Izembek Unit (0.11 swans/mi^2) was slightly lower than in 2016 (0.13 swans/mi^2), but slightly above the long term average (0.10 swans/mi^2; $\pm$ 0.01 SE; 1998-2016).

Figure 3a. Location of tundra swans (singles and pairs) observed in the Izembek Unit on Izembek NWR, Alaska, in June 2017.

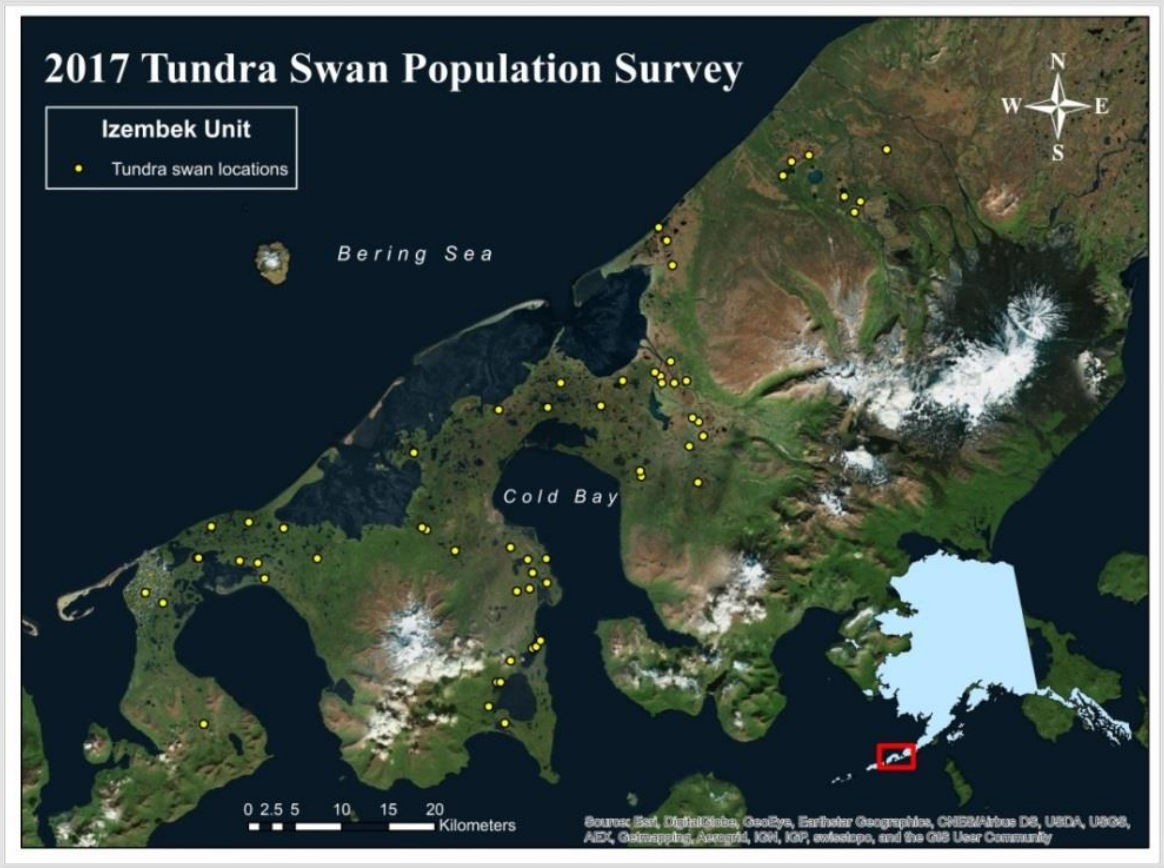
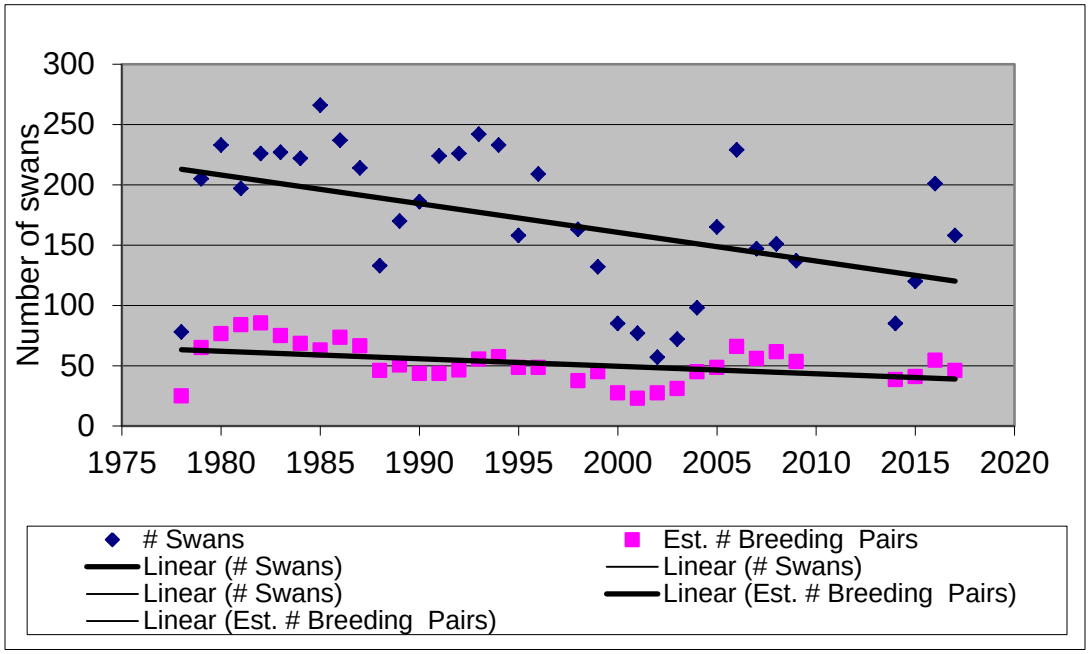


Figure 3b. Annual tundra swan aerial population survey trends (1978-2017) for the Izembek Unit on Izembek NWR, Alaska.



In the Pavlof Unit, a total of 580 swans and 10 nests were observed (Figure 4a). The total was composed of 25 single swans, 140 pairs, 8 pairs with nests, 2 single swans with nests, and 273 flocks. The largest flocks observed contained 34, 35, 52, and 73 swans.

Figure 4a. Location of tundra swans (singles and pairs) observed in the Pavlof Unit on Alaska Peninsula NWR (managed by Izembek NWR), Alaska, in June 2017.

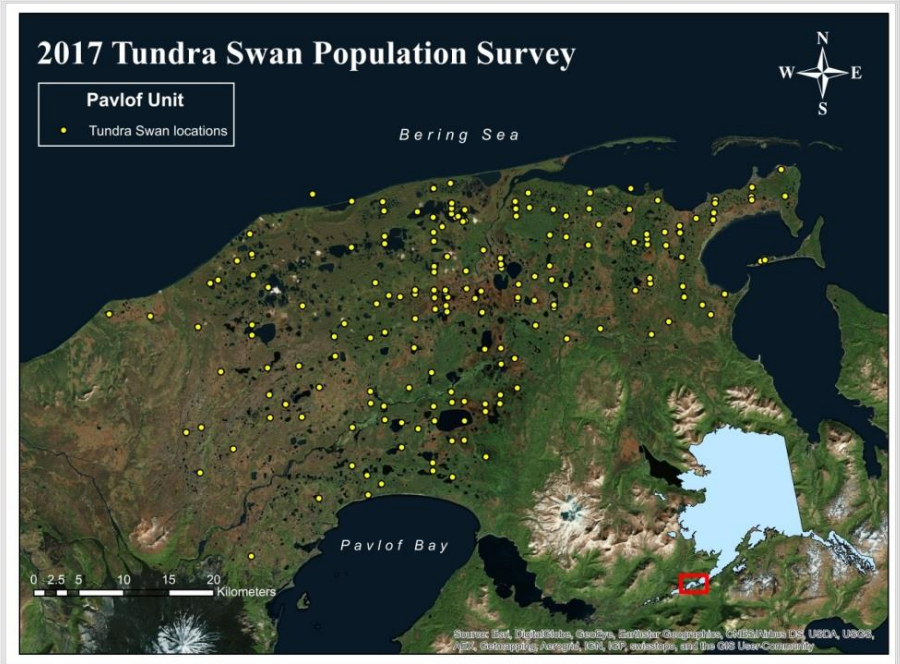
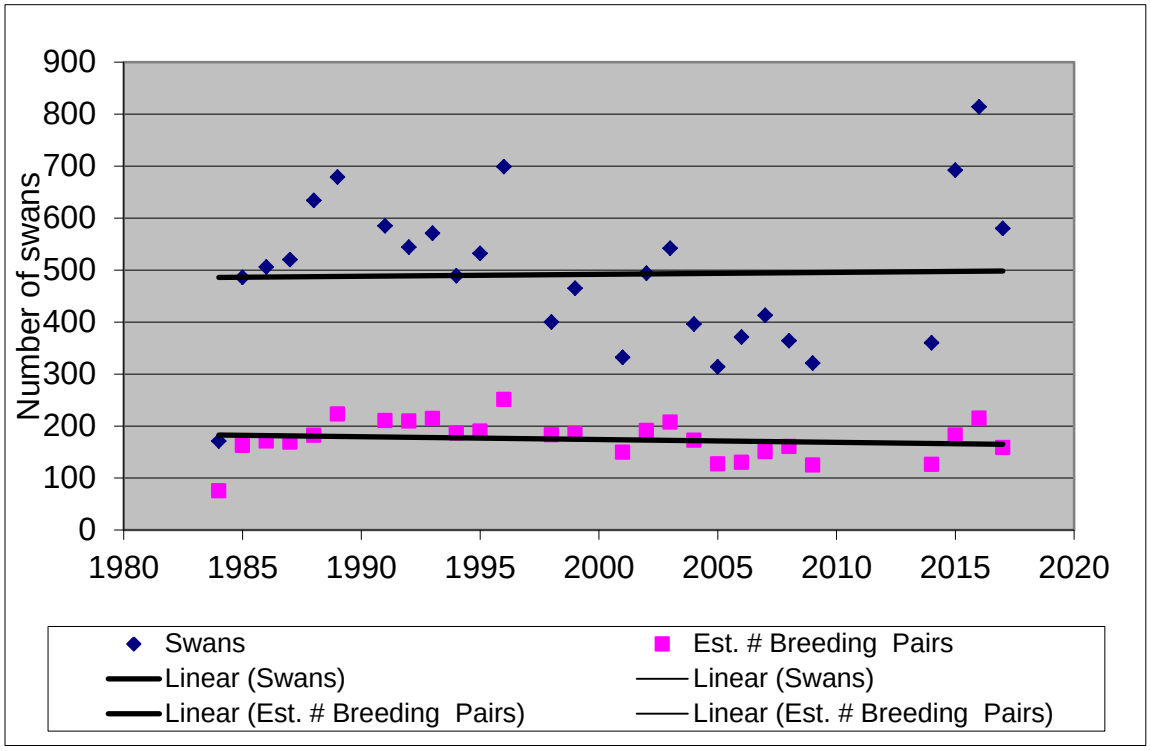


Figure 4b. Annual tundra swan aerial population survey trends (1984-2017) for the Pavlof Unit on Alaska Peninsula NWR (managed by Izembek NWR), Alaska.



Brown Bears—Aerial Population Survey

From August 28 – September 1, 2017, an aerial survey was conducted for brown bears in the Joshua Green and Frosty Creek watersheds, Thinpoint Lake area (Izembek Bear Unit 9D), and on Unimak Island (Unit 10); 281 total bears were classified.

In Izembek Unit 9D, 144 total bears were observed, including 46 single bears and 32 sows accompanied by cubs (Figure 5). There were 33 cubs of the year (COY) and 32 yearlings. Only 1 2.5-year old cub was observed. Compared to 2016, the number of single bears observed increased by about 5%, from 137 to 144; the number of sows decreased by 3, from 36 to 33; and the number of cubs remained unchanged (66).

On Unimak Island (Unit 10) 137 total bears were observed, including 43 singles and 21 sows with cubs (Figure 6). There were 19 COY, 28 yearlings and 26 2.5-year olds. Compared to 2016, the number of single bears observed on Unimak Island decreased by 27%, from 59 to 43 bears; the number of sows decreased by 43%; and the number of cubs remained similar from 77 to 73 cubs.

Figure 5. Brown bear population data collected from aerial stream surveys on Izembek Unit 9D, 1968-2017.

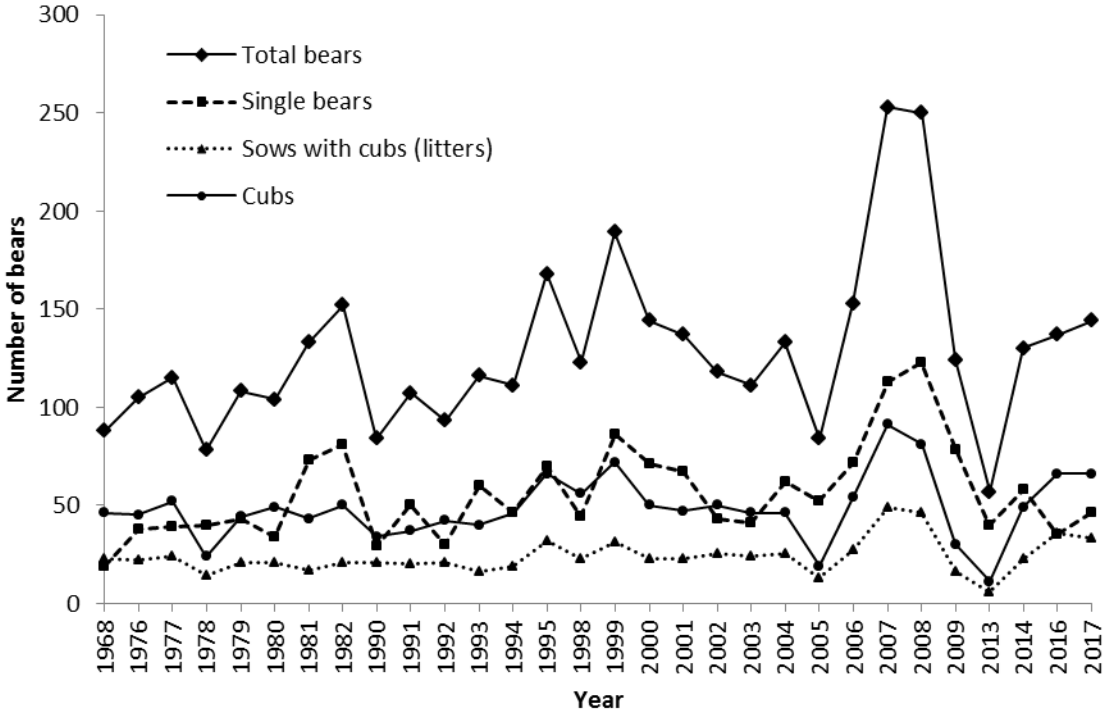
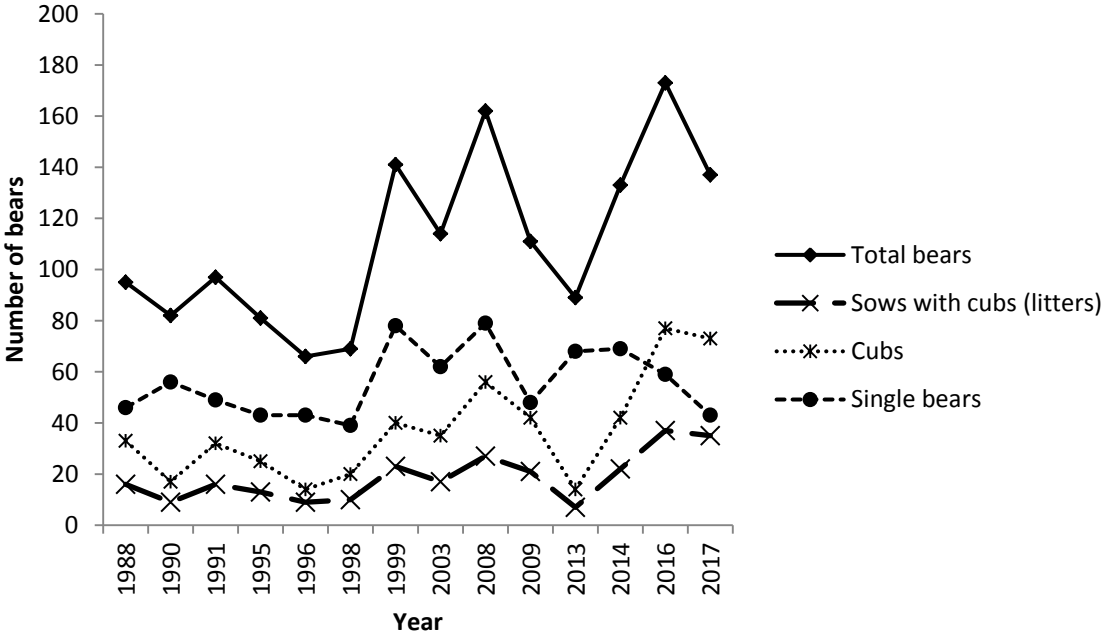


Figure 6. Brown bear population data collected from aerial stream surveys on Unimak Island Unit 10, 1988-2017.



Brown Bear Management
Brown bear hunting is managed by ADF&G in both Units 9D and 10.

The ADF&G management goal for brown bears in these units is to:

> *Provide opportunities to hunt large brown bears under aesthetically pleasing conditions.*

The Management objective is to:

> *Maintain a high bear density with a sex and age structure that will sustain a harvest of at least 60% males.*

The number of hunters is limited and harvests are maintained below maximum sustained yield (Dave Crowley, Personal Communication, September 6, 2017). The old rule of thumb for managing brown bear hunting programs was to limit harvest to 5% of the population. According to Dave Crowley, ADF&G biologist in King Salmon, the harvest can be increased up to 8% in highly productive populations where food supplies are abundant, such as on the Alaska Peninsula in Units 9D and 10.

Brown Bear Harvest—Unit 9D
The brown bear fall hunting season takes place during odd numbered years in Unit 9D; thus, in 2017, the fall hunt will run from October 1-21, 2017. The brown bear spring hunt takes place during even numbered years from May 10-31 (2018). The bag limit is one bear by state registration permit every four regulatory years. The average harvest during the alternate fall-spring hunting season in Unit 9D has been 68 brown bears since 1988 (Table 5). On average, approximately 81% of the brown bears taken in Unit 9D have been by non-resident hunters.

Brown Bear Harvest—Unit 10 (Unimak Island)
Though Unimak Island is part of the Alaska Maritime NWR, it is managed out of the Izembek NWR office. The annual brown bear hunting season on Unimak Island (Unit 10) is managed through a limited draw by ADF&G. The bag limit is one bear every four regulatory years from October 1-31 and May 10-31. The average annual harvest has been 9 bears since 1988 (Table 6). On average, approximately 37% of the harvest is by non-resident hunters.

Table 5. Unit 9D brown bear harvest, 1988-2016. Data provided by ADF&G.

Regulatory Year	Male	Female	Total	% Nonresident
1988	1	0	1	0
1989	86	41	127	76
1990	0	0	0	0
1991	71	40	111	74
1992	2	1	3	0
1993	77	38	115	77
1995	70	35	105	79
1996	1	0	1	0
1997	84	36	120	83
1999	103	42	145	88
2000	1	0	1	0
2001	113	41	154	90
2002	0	0	0	0
2003	103	43	146	85
2004	0	0	0	0
2005	92	37	129	84
2006	1	0	1	0
2007	98	27	125	82
2008	0	2	2	0
2009	115	38	153	82
2010	0	1	1	0
2011	100	33	133	80
2012	3	5	8	0
2013	98	42	140	76
2014	2	1	3	0
2015	94	22	116	81
2016	1	1	2	0
Totals	1316	526	1842	-----
Averages	49	19	68	81%

Table 6. Unit 10 (Unimak Island) brown bear harvest, 1988-2016. Data from ADF&G.

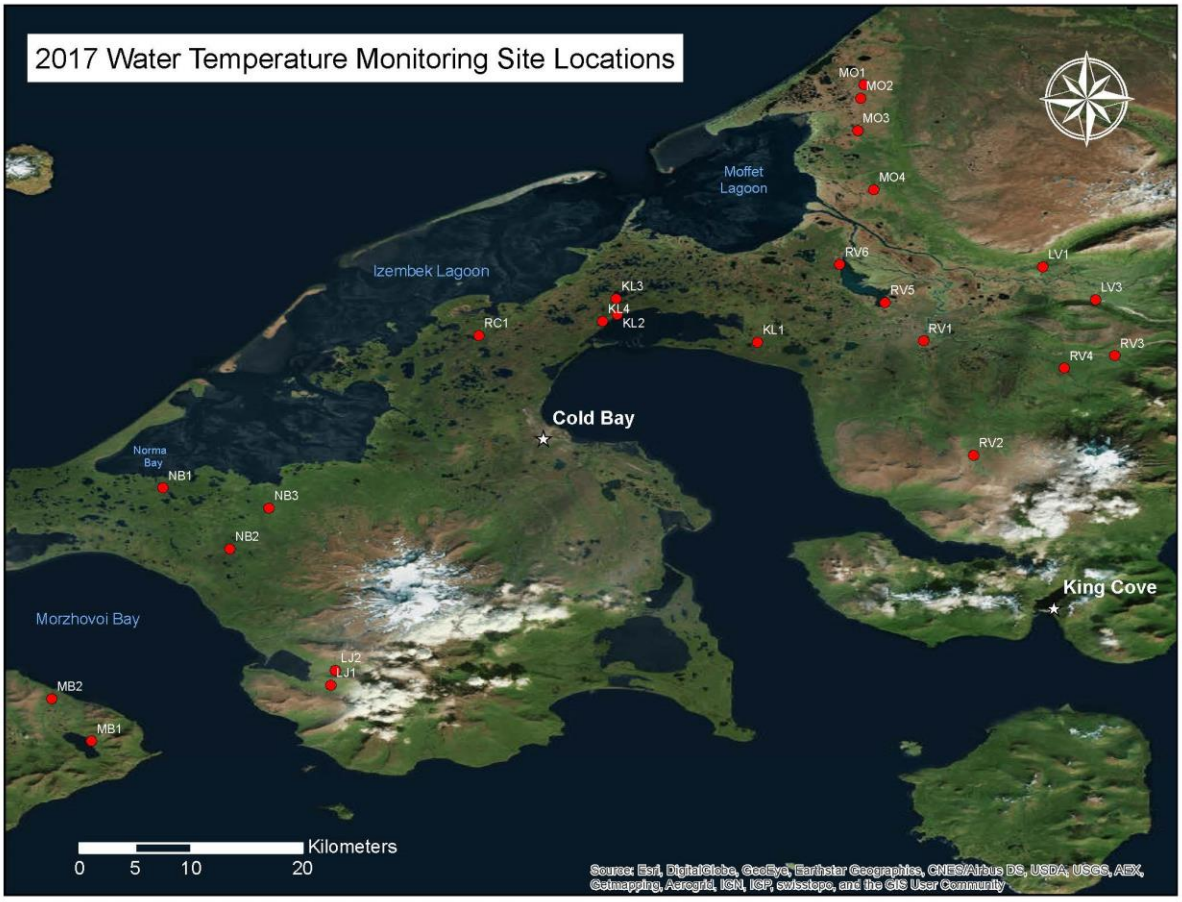
Regulatory Year	Male	Female	Total	% Nonresident
1988	3	2	5	0
1989	4	1	5	0
1990	8	0	8	13
1991	1	3	4	25
1992	5	0	5	0
1993	7	2	9	11
1994	6	1	7	0
1995	5	4	9	44
1996	7	2	9	44
1997	6	6	12	42
1998	12	0	12	58
1999	12	1	13	62
2000	7	4	11	27
2001	7	1	8	75
2002	7	3	10	50
2003	11	1	12	42
2004	6	4	10	50
2005	8	1	9	78
2006	6	1	7	57
2007	10	3	13	69
2008	10	1	11	36
2009	11	1	12	58
2010	7	1	8	13
2011	9	2	11	27
2012	8	2	10	40
2013	4	2	6	33
2014	12	3	15	40
2015	10	1	11	45
2016	6	1	7	43
Totals	215	54	269	-----
Averages	7	2	9	37%

Water Temperature Monitoring

In August 2017, Meg Perdue from the Water Resources Branch of the Service led the lake and stream water temperature monitoring baseline database collection on Izembek NWR

with help from SCA interns Angelina Perez and Charlie Musser. All 24 monitoring sites with existing data loggers (Tidbits) were visited over the course of a week to retrieve temperature sensors that had been deployed the previous year (Figure 7). Cross section measurements of stream temperature are recorded at hourly intervals throughout the year to document site variability and stream velocity water information is collected to calculate stream discharge. At each monitoring site pH, dissolved oxygen (mg/l and %), and conductivity (specific and uncompensated) are collected, as well. These data will be used to establish a baseline record of annual lake and stream water parameters on Izembek NWR. They will also be added to a statewide database that hosts a long term monitoring network for water temperature data in southwest Alaska.

Figure 7. Water temperature monitoring site locations on Izembek NWR, 2017.



A total of 27 sites have had data loggers deployed since the start of the project in 2014. This year only 13 loggers were recovered at the 24 water monitoring sites. Brown bears are believed to be the primary reason for lost data loggers. (Several logger housings recovered had bite marks.) A secondary reason for lost data loggers resulted from flooding events. At five sites only one Tidbit was recovered, illustrating the importance of deploying two loggers at each monitoring location. In addition, fast water precluded a thorough search for the data loggers at two sites in 2017.

The most important issue going forward for this project is the need for a written survey protocol that addresses the following:

1) Identifying the questions and objectives of the project.
2) Vetting and, if necessary, modifying the sampling design to ensure that the number and distribution of sampling sites is sufficient to answer the study questions and meet objectives with statistical certainty.
3) More fully address the Standard Operating Procedures and data management components of the temperature data. (The *Alaska Regional Framework Protocol for Water Temperature Monitoring* should be used as a starting place.)
4) The need for collecting water quality and discharge data should be reviewed. (This is partially addressed in the *Draft 2014 Stream Study Protocols* document and can be used as a starting point.)

Water Resources Branch biologist Meg Perdue suggested options to address the issue of logger loss to bears:

1) Switching to metal conduit for the logger housing instead of the PVC pipe. (This might lessen bears interest in chewing on them. PVC pipe may have a more distinctive odor; anecdotal evidence suggests bears may be attracted to petroleum-based products.) The downside of metal conduit is that they are heavier to transport and would likely require pipe wrenches to open them due to rusting threads. There could also be a slightly longer lag time for the temperature to stabilize in metal conduit.
2) Using a screw link rather than a clip to attach the housing to the anchor cable to avoid detachment of the housing. This would require more time and tools to switch out loggers because the screw link would likely rust over a year's time.
3) Moving water monitoring sites away from high bear traffic areas (based on the numbers of bear trails), if potential lower traffic areas could be located.

Baseline data for lake and stream water temperature, flow parameters and water quality is important for documenting climate effects on Izembek NWR and will continue to be collected.

Eelgrass Abundance and Productivity Monitoring

Beginning in the 1960s, scientists began doing research on eelgrass in Izembek Lagoon because of its importance to migrating waterfowl. Izembek NWR staff today continue to conduct surveys on the eelgrass in Izembek Lagoon in collaboration with USGS scientists. When possible, surveys are conducted monthly at Grant's Point in Izembek Lagoon to provide information on seasonal changes in eelgrass productivity, abundance, and trends relative to environmental factors such as water temperature, sea level, light, salinity, and turbidity.

Izembek NWR, the Region 7 FWS Inventory and Monitoring program, and USGS partners have been developing a formal study protocol to refine the current survey methods to better document and quantify the trends in health and productivity of the eelgrass habitat in Izembek Lagoon over the past ten years. The revised monitoring effort will incorporate a multi-scale design to assess eelgrass health and distribution trends annually over the next

30 years. Level 1 of the survey will entail collecting and classifying satellite imagery every 5-10 years to document changes in the spatial extent of eelgrass across the lagoon. Abundance and standing crop estimates are measured annually using an extensive point sampling design that covers a grid pattern of 120 points across the lagoon (Level 2). The monthly productivity and abundance surveys at Grant's Point (Level 3) will continue to be part of the overall survey design, as well. The three levels will be combined to assess overall health and changes in distribution of eelgrass throughout the lagoon over time.

Eelgrass Pathogen Research

In the spring of 2016, a study was initiated that uses an environmental DNA (eDNA) approach to assess the presence of pathogenic organisms known to cause disease in eelgrass. Specifically, *Labyrinthula zosterae*, a pathogenic strain of protist that is believed to have caused an eelgrass die-off along Atlantic coast in the 1930s, and Phytophthora/Halophytopthera, a newly identified pathogen on eelgrass in Europe that reduces seed germination six-fold, is suspected. With collaboration from scientists in the Netherlands USGS biologists have identified the presence of Phytophthora/Halophytopthera on eelgrass leaves and from seeds recovered from the digestive tracts of pintails sampled from Izembek Lagoon. This is a USGS funded project led up by Sandra Talbot, Damian Menning, and David Ward.

Marine Mammal Surveys

Izembek NWR began monitoring haul-out areas used by Steller's sea lions in 2013 and walrus in 2014 on Unimak Island and the barrier islands of Izembek NWR using aerial survey techniques and remote cameras. These species were previously not known to haul-out

Aerial survey along the coast of Unimak Island, August 2017. (Photo: Charlie Musser)

within the area managed by Izembek NWR. Izembek NWR currently has ten remote cameras deployed on Unimak Island (Oksenof Point, Cape Sarichef, Urilia Bay, Scotch Cap) and Izembek Lagoon (Cape Glazenap, Operl Island). Approximately 50,000 photographs documenting sea lion and walrus use of haul-outs began in 2013 and 2014, respectively. The greatest number of sea lions documented so far (n = ~250) occurred at Cape Sarichef on Unimak Island in 2014. In 2015, as many as 2,000 walrus were seen hauled-out in Urilia Bay on Unimak Island from July through November.

Walrus hauled-out in Urilia Bay on Unimak Island, August 2017. (Photo: Charlie Musser)

Other interesting observations of note have been made recently, as well. For instance, in August 2017, a group of five National Oceanic and Atmospheric Association (NOAA) Marine Mammal biologists monitoring seal populations noted that sea lions displaced harbor seals from some of their traditional haul-out sites. During the stormy and windy week of the survey, sea lions took over Amak Island off the coast of Izembek Lagoon, which is a traditional haul-out site for a large number of seals, and climbed approximately 30 feet up into the rocks above the sea.

Photos were retrieved from the remote trail cameras this year in late August 2017. Unfortunately, with both wildlife biologist positions currently vacant, only a portion of the photos from previous years have been analyzed so far. As time permits and staffing allows, photographs will be analyzed and individuals counted to document important haul-out areas, determine timing of the use of haul-out sites, generate a population index and estimate trends.

EDUCATION AND OUTREACH ACTIVITIES
Charlie Musser

Sand Point Culture Camp
Upon my arrival in Sand Point, the Culture Camp was already in progress and the work preparing wood for carving traditional Unangan visors was the first task at hand. Peter Devine, who was full of local traditional knowledge, was on hand to teach wood carving and to boil the wood in order to bend the visors. The traditional Unangan visors were carved from driftwood that would wash up on Aleutian beaches, but in this case we were using cottonwood. Throughout the ten days, many of the older kids were able to carve, bend, and paint beautiful traditional visors that could be worn.

I was slated to work primarily with the older groups of kids from 6th grade to high school age, but I spent the second day first helping and observing the 3rd and 4th graders who were learning about the parts of flowers. We went outside and helped the children identify the stem, root, and leaves of different wildflowers and then pasted them into their camp journals. I witnessed, and began learning, my first Unangan song, "Chugix" (which means halibut) that the children were preparing to perform at the closing banquet. (The "x" sound in the Unangan language is not pronounced like in English, but instead like the "k" in kite, but the tongue does not stop the air from flowing.) In this regard, the Unangan language was highlighted throughout the camp. Liza Mack from APIA was on hand to teach basic Unangan to the children during the day and to adults in the evenings.


Learning to make ukla—a way to cut and preserve salmon. (Photo: Charlie Musser)

When working with the older kids, I focused on teaching the differing aspects of the salmon cycle. I taught two activities outdoors to multiple groups of kids. First, we created salmon redds, or nests, using orange Playdo for the eggs, and rocks and jugs of water to imitate a streambed. Each participant was given the chance to experiment with covering and

uncovering their nests and then imitating pecking birds using toothpicks. After a short overview of the steps in the cycle they then played a highly energetic game acting as spawning salmon. Using a trail, to imitate a streambed, surrounded by alder bushes, some kids acted as spawning salmon moving up the stream while others acted as bears, birds, waves, and fishermen that may impede their progress. They came away with a greater understanding of the difficulty of the salmon's journey and the importance of protecting the spawning streams that sustained the entire species.

Peter Devine and I took groups of kids tide pooling at low tide two separate days. Using identification guides, I assisted the kids with identifying different species of marine invertebrates and other living plants and creatures within the tide pools. By the end of the second day many of them were pointing out the differences between blood stars and sunflower stars and coming away with a greater understanding of the depth of life within the tide pools. Peter also taught how to find and catch octopus and how to harvest bidarkis which were brought back and served at the evening meal. Back at camp, Peter also taught the kids how to make ukla, a specific way to cut and dry salmon, and at the same time I led an impromptu fish dissection, teaching the kids the various parts that make up the inside of the pink salmon.

Tide-pooling for octopus and bidarki near Sand Point. (Photo: Charlie Musser)

Andrew Abyo, an Alutiiq woodcarver based out of Anchorage, was also on hand to teach and assist kids and adults with making traditional visors and masks. This was an intense and intricate process that turned out very well, as many participants came away with impressive pieces. Along with assisting with carving, woodcutting, etc., I was also able to create my own Aleut mask complete with imitation sea lion whiskers. In the evenings I also learned the art of beading, using fishing line, to adorn glass floats that are found throughout

the Aleutian region. With the mentorship of Marcy de Costa, I was given the skills to teach others this decorative skill.

The final day was highlighted by traditional dances with singing and drumming that the camp participants had been practicing. Along with a large feast, where the entire town was invited, the Sand Point Culture Camp came to an impressive close.

King Cove Culture Camp

Although our travel was delayed an extra day by weather, two members of the Izembek staff, myself and the biological technician Angelina Perez, were able to arrive only one day after the start of the King Cove Culture Camp. Our first day and many subsequent days after were spent assisting the camp staff with environmental themed art projects including making octopuses and wind chimes out of plastic water bottles and decorating sea shells with paint.

We led two separate interpretive programs, one being the salmon cycle activity that was taught in Sand Point for the 3rd through 5th graders. The second activity, taught to kindergarten through 2nd graders consisted of a small lesson about sea otters that mainly consisted of the kids feeling the fur and handling the skulls of sea and river otters. Then the children made their own sea otters out of paper plates and construction paper.

Uncle Simeon teaching the game Kaadax. (Photo: Charlie Musser)

Once again language and dancing were highlighted, as Liza Mack led daily language lessons to both age groups and all ages participated in large group dances that were later performed at the Eddie Mack Memorial Fundraiser the following Saturday.

In the evenings some adults focused on making traditional visors, this time working with Dusty “Pooh Bear,” who was originally from King Cove. I was able to construct my own visor and was fascinated by the conversations I was witness to during our work, covering many aspects of Unangan history, traditions, and culture. Other adults participated in making beaded medicine bags using rabbit fur and wolf skin.

I was also appreciative to meet “Uncle” Simeon, one of the last fluent speakers of the Unangan language who was born in the now abandoned village of Belkofski. Simeon was on hand to aid the language lessons and as a source for how to properly pronounce the numerous sounds unfamiliar to English speakers. Simeon also spent time teaching and playing the game of Kadaax with the kids. Kadaax is a traditional game using multiple sticks and involved sleight of hand techniques to distract the opposing player from knowing which hand you may have sticks in. The kids were also part of the game, as each player has multiple “team members” that chant songs and try to distract the opposing player.

Horned puffins in Cold Bay. (Photo: Greg Risdahl)

Literature Cited

Crowley, D., Personal Communication, September 6, 2017

Fischer, J. B., A. R. Williams, and R.A. Stehn. 2017. Nest population size and potential production of geese and spectacled eiders on the Yukon-Kuskokwim Delta, Alaska, 1985-2016. Unpublished Report, U. S. Fish and Wildlife Service, Anchorage, Alaska.

Olsen, S. M. Compiler. 2016. Pacific Flyway Data Book, 2016. U. S. Department of Interior, U. S. Fish and Wildlife Service, Division of Migratory Bird Management, Vancouver, Washington.

Pacific Flyway Council. 2002. Pacific Flyway Management plan for Pacific brant. Pacific Flyway Study Comm. [c/o USFWS, DMBM] Portland, OR. Unpublished Report, 40 pp + appendices.

Ramey, A. M., A. B. Reeves, J. L. TeSlaa, S. Nashold, T. Donnelly, J. Bahl, and J. S. Hall. 2016. Evidence for common ancestry among viruses isolated form wild birds in Beringia and highly pathogenic intercontinental reassortant H5N1 and H5N2 influenza A viruses. Infection, Genetics and Evolution 40: 176-185.

Reed, A. D., D. V. Ward and J. S. Sedinger. 1998. Brant (*Branta bernicla*). In: The Birds of North America no. 337 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Shults, B. S. and D. K. Marks. 2016. Emperor goose (*Chen canagica*) photographic age-ratio survey, 2016. Unpublished Report, U. S. Fish and Wildlife Service, Anchorage, Alaska.

Ward, D. H., A. D. Reed, J. S. Sedinger, J. M. Black, D. V. Derksen, and P. M. Castelli. 2005. North American Brant: Effects of changes in habitat and climate on population dynamics. Global Change biology 11:869-880.

Williams, A. R., T. D. bowman, and B. S. Shults. 2016. Molting Pacific Steller's Eider Survey in Southwest Alaska, 2016. Unpublished Report, U. S. Fish and Wildlife Service, Anchorage, Alaska.

Wilson, H. M. 2017a. Aerial survey of wintering Pacific brant and other species at the Izembek Lagoon Complex and the Sanak islands, Alaska, January 2017. Unpublished Report, U. S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska.

Wilson, H. M. 2017b. Fall Izembek brant survey 2016. Unpublished Report, U. S. Fish and Wildlife Service, Anchorage, Alaska.

Wilson, H. M. and D. M. Marks. 2017. Aerial survey of emperor geese and other water birds in southwestern Alaska, spring 2016. Unpublished Report, U. S. Fish and Wildlife Service, Anchorage, Alaska.