



Inventory and Monitoring Plan for Kodiak National Wildlife Refuge



Mara Weisenberger/USFWS

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Kodiak National Wildlife Refuge Inventory and Monitoring Plan

I. Signatures

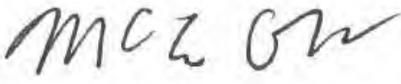
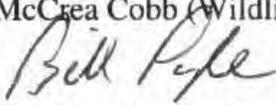
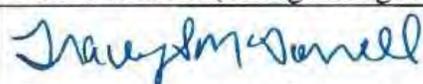
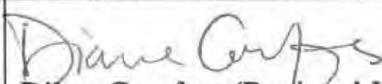
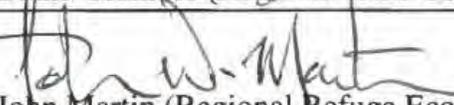
Inventory and Monitoring Plan		
For: <u>Kodiak National Wildlife Refuge</u>		
<i>Action</i>	<i>Signature /Printed Name</i>	<i>Date</i>
Prepared By:	 McCrea Cobb (Wildlife Biologist)	12/5/13
	 Bill Pyle (Supervisory Wildlife Biologist)	12/5/13
Submitted By:	 Kent Sundseth (acting Refuge Manager)	5 December 2013
Reviewed By:	 Tracey McDonnell (Refuge Supervisor)	12/16/13
Reviewed By:	 Diane Granfors (Regional I&M Coordinator)	10 Dec 2013
Reviewed By:	 John Martin (Regional Refuge Ecologist)	10 DEC 2013
Approved By:	 Mitch Ellis (Regional Chief of Refuges)	2/14/2014

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II. Plan

A. Introduction

Kodiak National Wildlife Refuge was established in 1941 by Executive Order 8857 “...for the purpose of protecting the natural feeding and breeding ranges of the brown bear and other wildlife on Uganik and Kodiak Islands, Alaska...”. This purpose was further defined under the Alaska National Interest Lands Conservation Act (ANILCA):

- i. to conserve fish and wildlife populations and their habitats in their natural diversity, including, but not limited to, Kodiak brown bears, salmonids, sea otters, sea lions and other marine mammals and migratory birds;
- ii. to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;
- iii. to provide...the opportunity for continued subsistence uses by local residents; and
- iv. to ensure, to the maximum extent practicable...water quality and necessary water quantity within the refuge.

To meet these and other purposes, Kodiak Refuge biologists inventory, monitor, and research aspects of the Refuge’s natural resources. Due to budget and personnel constraints, it is necessary for Refuge management to prioritize survey and research efforts in light of their relative importance for informing management decisions, addressing treaty and policy obligations, and achieving Refuge objectives and purposes.

This plan documents and prioritizes inventory and monitoring surveys and research currently conducted, and proposed to be conducted, at the Kodiak Wildlife from 2013 to 2022. This document was developed in collaboration with the Service’s Inventory and Monitoring Initiative, and in accordance with revised Service policy 701 FW 2.

Kodiak Refuge’s surveys address biological objectives identified in the Refuge’s Comprehensive Conservation Plan (CCP), other Refuge guiding documents, regional and national programs, and large-scale monitoring efforts. The CCP objectives direct acquisition and application of information to increase knowledge and support decisions regarding wildlife and habitat resource management. Resource information needs identified in the CCP objectives encompass a wide range of resource types, management questions, and spatial scales. To address these needs, the CCP calls for a corresponding diversity of inventory, monitoring, and research surveys. Most of the surveys listed in this Inventory and Management Plan (IMP) correspond to CCP objectives. Additional interim objectives were recently established to address management issues or information gaps identified since CCP publication (Pyle et al. 2013). For example, climate change was not addressed by the CCP because completion of that plan predated identification of this topic as a priority concern of the Service (USFWS 2008).

Other Refuge-specific references used as guidance for evaluating and prioritizing survey efforts include: the Refuge’s 2013 Inventory and Monitoring Needs Assessment, a report on climate change and the Karluk River watershed (Beever 2012), the Conceptual Ecological Model for

Kodiak Refuge (Pyle 2011), the Environmental Assessment of Integrated Pest Management of Invasive Plants on Kodiak Refuge (Kodiak NWR 2010), the framework for ecological monitoring on lands of the Alaska National Wildlife Refuges and their partners (Woodward and Beaver 2010), the Proceedings of the Kodiak Introduced Species Workshop (Clough 2000), and Kodiak Refuge's Public Use Management Plan (USFWS 1993).

This IMP calls for continuation of current, locally developed surveys to improve management through increased understanding of long-term trends in resources. Additionally, several surveys feature Refuge cooperation in regional (e.g., Landscape Conservation Cooperatives) and national survey efforts (e.g., Breeding Bird Survey). Proposed inventory and monitoring, and research surveys also are included in this plan.

B. Methods

In February 2013, the biological staff of Kodiak Refuge (Supervisory Biologist Bill Pyle, Wildlife Biologist McCrea Cobb, Ornithologist Robin Corcoran, and Bear Biologist Bill Leacock) reviewed existing and historical surveys and research projects ("surveys") within their respective fields and entered these into the database for Planning and Reporting of Inventory and Monitoring on Refuges (PRIMR).

In March 2013, Kodiak Refuge biological staff, the acting Refuge Manager (Kent Sundseth), Region 7 (Alaska) Inventory and Monitoring (I&M) Coordinator (Diane Granfors), Lead I&M Biologist (Peter Dratch), and Region 7 Refuge Ecologist (John Martin) met at Kodiak Refuge headquarters for three days to discuss the IMP process and the Refuge biological activities, resources of concern, and information needs. During the first day, the team completed a Needs Assessment, which laid a foundation for developing the IMP and informed Regional Office staff of the Refuge's data management and support needs.

Refuge biologists evaluated the biological and management utility of existing and proposed surveys using a draft of an assessment tool devised by biologists of the NWRS I&M Program. This Simple Multi-Attribute Ranking Tool (SMART) tool entailed evaluation of the extent to which each survey met 17 criteria based on assignment of pre-defined scores for each criteria. Since criteria differed in scope and effect, each was assigned a weight (0-100) using a direct rating process (Goodwin and Wright 2011) that collectively reflected the Refuge's interpretation of priority of importance. Following preliminary application of the tool, Refuge staff concluded that revision of the SMART criteria was warranted primarily to reduce redundancy. Refuge staff subsequently revised the SMART criteria primarily by combining some of the original criteria and excluding others, yielding a list of 13 criteria (Appendix A).

During April 2013, Refuge biologists created a list of proposed surveys to address gaps in addressing CCP objectives. These were entered into PRIMR following review and approval by Kodiak Refuge management. Each biologist then reevaluated their respective existing and proposed surveys using the customized SMART tool criteria and documented, in brief, their rationale for rank score selection. A subsequent review of selection rationales by Pyle and Cobb led to minor adjustments in survey rankings (Appendix A). Following these steps, Refuge

biologists and management assigned new ratings and weights to the SMART tool criteria, and produced a prioritized list of Refuge surveys.

The priority list generated with the revised SMART tool criteria generally corresponded with management priorities. However, some final adjustment was necessary to increase consistency with the priorities expressed in the Refuge's CCP. We therefore evaluated the priority ranking generated with the SMART tool against a suite of factors that dictated priority during CCP development and implementation. The following factors were considered:

1. Management of Kodiak brown bear (*Ursus arctos middendorffii*) is the top priority. Monitoring surveys that pertain to the brown bear population and its habitat should receive highest priority.
2. Monitoring introduced non-native ungulates is a recognized priority need, as generally reflected by the scores assigned with the SMART tool. However, the actual information need is currently greatest for mountain goat to support harvest management decisions that could minimize the extent to which the population exceeds habitat capacity.
3. Monitoring surveys generally have higher information value to management compared to inventory surveys. This difference should be reflected in priorities unless inventory results are needed to directly support management, as is the case with invasive plant inventory.
4. Decisions regarding allocation of Refuge base funds for support of monitoring surveys should reflect the priorities set in this plan. Specifically, high priority survey should take precedent over low priority surveys, and established priority monitoring should take precedent over proposed monitoring or research.

The final priority ranking reflects consistency with existing management plans and expected information needs. The following discussion summarizes the primary differences between rankings assigned using the SMART tool and priorities assigned with the combination of the SMART tool and evaluation of the factors listed above. Priority of four of the 14 surveys that ranked highest with the SMART tool was revised. Surveys pertaining to brown bear received the highest priority, and the mountain goat population survey was considered more important than the deer population survey. We also revised the priority of several surveys that ranked moderate to low importance with the SMART tool. A combination of factors contributed to these decisions, especially the known or estimated relative contribution of existing or proposed surveys to knowledge and management of the Refuge's native and non-native species and their habitats. In summary, the final analyses yielded minor but important revisions in survey priority. However, in most cases, we maintained consistency with the rank order of importance assigned with the SMART tool.

The final prioritized list of surveys was then divided into the following tiers:

1) *Selected*

- a. "Current" surveys that could be completed based on a 3-year average (FY 2010 – 2012) of the Refuge's biological program budget (\$125 K). We were confident that the Refuge could complete these surveys over the time span of

the IMP with this level of funding adjusted annually to account for cost increases due to inflation.

- b. “*Expected*” surveys that could be completed over the timespan of the IMP, but required continued and/or expanded support (financial and logistic) of the Refuge and its partners.

2) *Non-selected*

- a. “*Future*” surveys that were proposed, ranked low priority, and would require additional collaborative support of the Refuge’s partners for completion.
- b. “*Historic*” surveys recently completed or discontinued, and therefore dropped from future consideration.

Refuge biologists estimated non-personnel costs (\$), personnel requirements (FTEs), and salary costs (\$) for each candidate survey. Using a modified version of the budget calculator from the PRIMR database, we categorized costs into equipment, contracts, and travel/flight costs. Personnel requirements were categorized into the specific personnel involved in the survey, which consisted of a Service biologist and often included a Service pilot, seasonal Biological Technicians and volunteers. Costs and personnel requirements were calculated separately for primary survey components. These included: design/planning, coordination, training, field work/data collection, data entry, archive/data management, analysis, reporting, and other. For each survey, we derived annual FTEs based on multiplication of time required for completion of a survey component by annual salary rate for the responsible staff position (FY 2013 cost to the Refuge). We considered volunteers to have no cost, even though volunteers at Kodiak typically receive a modest daily subsistence stipend.

For current surveys, annual costs and personnel requirements were estimated by reviewing the most recent budgets and personnel requirements. For future surveys, Refuge biologists estimated costs and personnel requirements by reviewing costs for similar surveys, researching equipment costs and needs, and discussing survey costs with peers that have completed similar surveys. For surveys that did not take place every year, annual costs and personnel requirements were quantified by dividing the cost and personnel needed to complete the survey by the time interval between each survey (i.e., a survey conducted every other year at a cost of \$10,000 per survey would have an annual survey cost of \$5,000). Cost estimates were based on FY 2013 and did not take into account inflation. Final costs estimates and the cost calculator spreadsheets for each survey are available in PRIMR.

Refuge biologists estimated annual schedules for Selected Surveys. Activities for each survey were divided into six primary components (planning, training, field work, data entry, analysis, and reporting) and reported for each month (Appendix D).

C. Results

Selected Surveys

The prioritization process identified 27 Selected Surveys to be completed during the duration of this IMP (Table 1a, Appendix B). Of these, 18 surveys were prioritized as “Current Surveys”

that could be completed with Kodiak Refuge's recent capacity (FY 2010 – 2012 average of Kodiak Refuge's biological program resources) if additional funds were to be provided to account for increased costs due to inflation. Nine additional surveys were ranked as "Expected Surveys" that were likely to be completed over the time span of the IMP. Whereas implementation of I&M surveys will require new and sustained investments by the Refuge, implementation of research surveys will require new investment by the Refuge and its partners.

Table 1a. Summary of Selected Surveys for Kodiak National Wildlife Refuge.

Survey Priority ¹	Survey ID Number ²	Survey Name/ Type ³	Survey Status ⁴	Mgmt. Obj. ID ⁵	Survey Area ⁶	Staff Time (FTE) ⁷	Annual Cost (OPR) ⁸	Survey Timing ⁹	Survey Length ¹⁰	Survey Coordinator ¹¹	Protocol Citation ¹²	Protocol Status ¹³
1.01	FF07RKDK00-032	Bear Abundance Monitoring (CM)	Current	CCP / Objective 02.0.03, Objective 02.0.02, Objective 02.0.01	Multiple management units: Survey units (ADF&G bear management subunit): Terror (northeast), Spiridon (northeast), Sturgeon (southwest), Karluk (southwest), Aliulik (Aliulik Peninsula), Kiliuda-Shearwater (east)	FWS: 0.09	\$12,240.00	May 21 - June 1/ Recurring - every year	1987-Indefinite	William Leacock, Wildlife Biologist	(none)	Initial Survey Instructions
1.02	FF07RKDK00-012	Bear Mortality Assessment (CM)	Current	CCP / Objective 02.0.01	Entire station	FWS: 0.02	\$0.00	November/ Recurring -- every year	1961-Indefinite	William Leacock, Wildlife Biologist	(none)	Initial Survey Instructions
1.03	FF07RKDK00-009	Bear Composition Monitoring (M)	Current	CCP / Objective 02.0.05, Objective 02.0.01	Multiple management units: The survey consists of three areas. The primary survey area includes six streams: Pinnell, Southeast, Connecticut, Red Lake, Main Sturgeon, and East Sturgeon.	FWS: 0.08	\$12,600.00	July-August/ Recurring -- every year	1982-Indefinite	William Leacock, Wildlife Biologist	(none)	Initial Survey Instructions

Survey Priority ¹	Survey ID Number ²	Survey Name/ Type ³	Survey Status ⁴	Mgmt. Obj. ID ⁵	Survey Area ⁶	Staff Time (FTE) ⁷	Annual Cost (OPR) ⁸	Survey Timing ⁹	Survey Length ¹⁰	Survey Coordinator ¹¹	Protocol Citation ¹²	Protocol Status ¹³
					Secondary area includes three streams: Thumb, O'Malley, and Upper Dog Salmon							
1.04	FF07RKDK00-027	Nearshore Marine Bird Monitoring (M)	Current	CCP / Objective 05.0.01, Objective 05.0.05	Regional	FWS: 0.31, Other: 0.42	\$30,390.00	June (breeding population abundance) and August (productivity)/ Recurring -- every year	2011- Indefinite	Robin Corcoran, Ornithologist	(none)	Initial Survey Instructions
1.05	FF07RKDK00-011	Seabird Colony Survey (CM)	Current	CCP / Objective 05.0.01	Multiple stations	FWS: 0.17, Other: 0.16	\$13,240.00	June/ Sporadic or Ad Hoc	2001- Indefinite	Robin Corcoran, Wildlife Biologist	(none)	Initial Survey Instructions
1.06	FF07RKDK00-025	Mountain Goat Population Monitoring (CM)	Current	CCP / Objective 01.0.02, Objective 03.0.01	Entire station	FWS: 0.02	\$6,400.00	July-August/ Recurring -- every year	1994- Indefinite	McCrea Cobb, Wildlife Biologist	(none)	Initial Survey Instructions
1.07	FF07RKDK00-037	Deer Population Monitoring (M)	Current	CCP / Objective 03.0.03	Single management unit: Non-forested areas of Kodiak Refuge	FWS: 0.08	\$6,800.00	May/ Recurring -- every year	2012- Indefinite	McCrea Cobb, Wildlife Biologist	(none)	Initial Survey Instructions
1.08	FF07RKDK00-006	Deer Harvest Survey (CM)	Current	CCP / Objective 01.0.02, Objective 03.0.03, Objective 01.0.03	Entire station	FWS: 0.01	\$0.00	February-April following August-January hunting season/ Recurring -- every year	1987- Indefinite	McCrea Cobb, Wildlife Biologist	(none)	Initial Survey Instructions
1.09	FF07RKDK00-014	Invasive Plant Survey (I)	Current	CCP / Objective 06.0.01	Entire station	FWS: 0.1, Other: 0.38	\$11,700.00	May - September/ Occurs one time only	2003- Indefinite	Bill Pyle, Supervisory Wildlife Biologist	(none)	Initial Survey Instructions

Survey Priority ¹	Survey ID Number ²	Survey Name/ Type ³	Survey Status ⁴	Mgmt. Obj. ID ⁵	Survey Area ⁶	Staff Time (FTE) ⁷	Annual Cost (OPR) ⁸	Survey Timing ⁹	Survey Length ¹⁰	Survey Coordinator ¹¹	Protocol Citation ¹²	Protocol Status ¹³
1.10	FF07RKDK00-017	Invasive Plant Monitoring (M)	Current	CCP / Objective 06.0.01	Multiple management units: (1) Vicinity of Camp Island, Karluk Lake; (2) Garden Island, Uganik Bay; and (3) Refuge Headquarters vicinity in Kodiak; (4) Akalura Cannery vicinity, Olga Bay	FWS: 0.05, Other: 0.02	\$2,637.00	Late May through September/ Recurring -- every year	2003- Indefinite	Bill Pyle, Supervisory Wildlife Biologist	(none)	Initial Survey Instructions
1.11	FF07RKDK00-039	Sea Otter Population Monitoring (CM)	Current	CCP / Objective 14.0.01	Regional	FWS: 0.13	\$12,500.00	August/ Recurring -- every three years	2004- Indefinite	McCrea Cobb, Wildlife Biologist	(none)	Initial Survey Instructions
1.12	FF07RKDK00-013	Migratory Bird Subsistence Harvest Survey (CM)	Current	CCP / Objective 08.0.02	Statewide	FWS: 0.21	\$2,412.00	August through March/ Recurring -- every five years	2001- Indefinite	Tonya Lee, Refuge Information Technician	(none)	Initial Survey Instructions
1.13	FF07RKDK00-048	Aquatic Invasive Species Monitoring (M)	Current	CCP / Objective 01.0.05	Single management unit: Kodiak Island	FWS: 0.09, Other: 0.03	\$7,684.00	August/ Recurring -- every decade	2012- Indefinite	Bill Pyle, Supervisory Wildlife Biologist	(none)	Initial Survey Instructions
1.14	FF07RKDK00-065	Bald Eagle Coastal Breeding Population Survey (CM)	Current	CCP / Objective 05.0.01, Objective 05.0.03, Objective 05.0.05	Statewide	FWS: 0.03	\$8,400.00	Late April to early May/ Sporadic or Ad Hoc	1983- Indefinite	Robin Corcoran, Ornithologist	(none)	Initial Survey Instructions
1.15	FF07RKDK00-005	Wintering Steller's Eider Aerial	Current	CCP / Objective 05.0.06	Multiple management units: East-	FWS: 0.04	\$6,300.00	February/ Recurring -- every five	1993- Indefinite	Robin Corcoran, Ornithologist	(none)	Initial Survey Instructions

Survey Priority ¹	Survey ID Number ²	Survey Name/ Type ³	Survey Status ⁴	Mgmt. Obj. ID ⁵	Survey Area ⁶	Staff Time (FTE) ⁷	Annual Cost (OPR) ⁸	Survey Timing ⁹	Survey Length ¹⁰	Survey Coordinator ¹¹	Protocol Citation ¹²	Protocol Status ¹³
		Survey (CM)			side of Kodiak Island - Chiniak & Marmot Bays south to Alitak Bay & Trinity Islands			years				
1.16	FF07RKDK00-033	Moored All-season Temperature Arrays (CM)	Current	CCP / Objective 09.0.03	Multiple stations	FWS: 0.04, Other: 0.02	\$6,433.00	Data is automatically collected on an hourly basis throughout the year/ Recurring -- every year	2011- Indefinite	Bill Pyle, Supervisory Wildlife Biologist	(none)	Initial Survey Instructions
1.17	FF07RKDK00-008	Sea Duck Banding (M)	Current	CCP / Objective 05.0.01, Objective 05.0.04, Objective 05.0.02	Entire station	FWS: 0.07, Other: 0.07	\$3,840.00	August/ Recurring -- every year	1996- Indefinite	Robin Corcoran, Ornithologist	(none)	Initial Survey Instructions
1.18	FF07RKDK00-036	Reindeer Population Monitoring (M)	Current	Interim Plan / Objective 03.0.07	Single management unit: Southern Kodiak Island	FWS: 0.02	\$3,300.00	June/ Recurring -- every year	2011- Indefinite	McCrea Cobb, Wildlife Biologist	(none)	Initial Survey Instructions
2.01	FF07RKDK00-049	River Temperature Monitoring (CM)	Expected	CCP / Objective 09.0.03	Multiple management units: total of three sites of 3 rivers (Ayakulik, Dog Salmon and Karluk River drainages)	FWS: 90.6	\$109,550.00	Recurring -- every year	2015- Indefinite	Bill Pyle, Supervisory Wildlife Biologist	(none)	(none)
2.02	FF07RKDK00-053	Weather Station Vegetation Monitoring	Expected	CCP / Objective 06.0.03	Single management unit: Kodiak Island unit of KNWR	FWS: 0.03 Other: 0.01	\$4,348	July/ Reoccurring every 10 years	2015- Indefinite	Bill Pyle, Supervisory Wildlife Biologist	(none)	(none)

Survey Priority ¹	Survey ID Number ²	Survey Name/ Type ³	Survey Status ⁴	Mgmt. Obj. ID ⁵	Survey Area ⁶	Staff Time (FTE) ⁷	Annual Cost (OPR) ⁸	Survey Timing ⁹	Survey Length ¹⁰	Survey Coordinator ¹¹	Protocol Citation ¹²	Protocol Status ¹³
2.03	FF07RKDK00-022	Plant Survey (CI)	Expected	CCP / Objective 06.0.02	Entire station	FWS: 0.05, Other: 0.22	\$0.00	June-August/ Occurs one time only	2005- Indefinite	Bill Pyle, Supervisory Wildlife Biologist	(none)	Initial Survey Instructions
2.04	FF07RKDK00-066	Barrow's Goldeneye Nest Box Study (CB)	Expected	CCP / Objective 05.0.01, Objective 05.0.04	Multiple management units: On-refuge - Karluk Lake; off-refuge - five lakes along the Kodiak road system and Hidden Basin (boat access only).	FWS: 0.0, Other: 0.04	\$70.00	May to August/ Recurring -- every year	2010- Indefinite	Robin Corcoran, Wildlife Biologist	(none)	Initial Survey Instructions
2.05	FF07RKDK00-047	Bison Distribution Monitoring (CM)	Expected	Interim Plan / Objective 03.0.07	Single management unit: Herd currently (2013) can be found in the Hidden Basin Region, adjacent to Refuge lands, during the winter.	FWS: 0.01	\$600.00	Sporadic or Ad Hoc	2011- Indefinite	McCrea Cobb, Wildlife Biologist	(none)	Initial Survey Instructions
2.06	FF07RKDK00-030	Breeding Bird Survey (CM)	Expected	Interim Plan / Objective 05.0.08	National	FWS: 0.0, Other: 0.03	\$100.00	June/ Recurring -- every year	1985- Indefinite	Robin Corcoran, Ornithologist	(none)	Initial Survey Instructions
2.07	FF07RKDK00-018	Monitoring Avian Productivity and Survivorship (MAPS) (CM)	Expected	Interim Plan / Objective 05.0.08	National	FWS: 0.04, Other: 0.14	\$450.00	June and July/ Recurring -- every year	2010- Indefinite	Robin Corcoran, Ornithologist	(none)	Initial Survey Instructions
2.08	FF07RKDK00-019	Alaska Landbird Monitoring Survey	Expected	Interim Plan / Objective 05.0.08	Regional	FWS: 0.01, Other: 0.03	\$790.00	June/ Occurs one time only	2010- Indefinite	Robin Corcoran, Ornithologist	(none)	Initial Survey Instructions

Survey Priority ¹	Survey ID Number ²	Survey Name/ Type ³	Survey Status ⁴	Mgmt. Obj. ID ⁵	Survey Area ⁶	Staff Time (FTE) ⁷	Annual Cost (OPR) ⁸	Survey Timing ⁹	Survey Length ¹⁰	Survey Coordinator ¹¹	Protocol Citation ¹²	Protocol Status ¹³
		(ALMS) (CM)										
2.09	FF07RKDK00-XXX	Christmas Bird Count	Expected	Interim Plan / Objective 05.0.08	National	FWS: 0.02	\$1,627	Mid-December to early January	1982-indefinite	Robin Corcoran, Ornithologist	(none)	Initial Survey Instructions

¹ The rank for each survey listed in order of priority (e.g., numeric, tiered, alpha-numeric, or combination of these).

² A unique identification number consisting of station organization code-sequential number-survey type code-start year.

³ Short titles for the survey name, preferably the same names in station work plans.

⁴ Surveys planned for the lifespan of this IMP (Current or Expected).

⁵ The management plan and objectives that justify the described survey; includes the Refuge's CCP (USFWS 2007) and recently established interim objectives.

⁶ Station management unit names, entire station, or names of other landscape units included in survey.

⁷ Estimates of Service (FWS) and non-Service (Other) staff time needed to complete the survey (1 work year = 2080 hours = 1 FTE).

⁸ Average annual operations costs for conducting the survey (e.g., equipment, contracts, travel) not including staff time.

⁹ Timing and frequency of survey field activities.

¹⁰ The years during which the survey has been or will be conducted.

¹¹ Name and title of the Survey Coordinator for each survey.

¹² Title, author, and version of the survey protocol (if there is no protocol to cite, enter None).

¹³ Stage of approval of the survey protocol (Initial Survey Instructions, In Development, In Review, or Approved)

Selected Surveys That Can Be Conducted With Current Refuge Capacity

1.01 Bear Abundance Monitoring (FF07RKDK00-032)

1) What is the population or attribute of interest, what will be measured, and when?

This is an aerial survey of brown bears (*Ursus arctos middendorffi*) that produces estimates of bear densities within seven survey units on Kodiak Island: Terror, Spiridon Peninsula, Sturgeon River basin, Karluk River basin, Aliulik Peninsula, SW Kodiak, and Kiliuda/Shearwater. Landcover in these areas, most of which are encompassed within the Refuge, consists of a mixture of deciduous shrub/tree, alpine, tundra, and wetland. One of seven areas has been surveyed annually between 21-31 May, and the survey usually has rotated sequentially among areas over a seven-year period.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

CCP objectives 2.01, 2.02, and 2.03. These objectives were derived, in part, from recommendations generated by a Citizen Advisory Panel in the Kodiak Archipelago Bear Conservation and Management Plan (ADF&G 2002).

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Alaska Department of Fish and Game (ADF&G), in cooperation with the Refuge, has established objectives for management of brown bear subpopulations on Kodiak Island (e.g., 175 – 263 independent bears/1,000 km² for southwest Kodiak Island). Results from this survey are used to evaluate whether these objectives are being met. Estimated increases and decreases ($P > 0.05$) may trigger management action. Specifically, it may trigger expansion of allowable harvest if a sub-population increases. Alternatively, it may trigger a combination of actions if a sub-population decreases, such as a re-survey (to confirm result), a contraction of allowable harvest, and research to assess causes for population change. This survey is required by, and works in conjunction with, two other selected surveys (“Bear Mortality Assessment” and “Bear Composition Monitoring”) and a selected research project (“Bear-Salmon Interactions”) to provide a more complete picture of the overall health of the bear population on Kodiak. This survey received a relatively high SMART-tool prioritization score, but was deemed more important than other higher scoring surveys because maintaining a viable population of brown bears is the founding purpose of Kodiak Refuge and a primary goal identified in the CCP (Goal 2).

4) Is this a cooperative survey? If so, what partners are involved in the survey?

The survey is primarily a collaborative effort between the Refuge and ADF&G. However, this is the highest level priority survey for the Refuge and therefore could be entirely supported by the Refuge, if necessary. There is a potential to link results from this survey to other surveys of coastal brown bear population in coastal Alaska. Results from this survey will be incorporated into inventory and monitoring of salmon escapement and berry production in the Karluk basin of

Kodiak to determine the influence of berry crops and salmon abundance on the bear population and their landscape use patterns.

5) Protocol status?

A site-specific narrative and standard operating procedures are published in a peer-reviewed scientific journal (Barnes and Smith 1999). The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.02 Bear Mortality Assessment (FF07RKDK00-012)

1) What is the population or attribute of interest, what will be measured, and when?

This survey assesses annual mortality levels and trends of brown bear (*Ursus arctos middendorffi*) due to hunter harvests (sport and subsistence) and Defense of Life and Property actions (DLPs) within the Refuge. It is a legal requirement that mortalities from hunter harvests and DLPs be reported to biologists at ADF&G's Kodiak office; a unique seal number is affixed to the hide and skull, and standardized data is recorded on gender, age, skull dimensions, and location of kill. The Refuge acquires a digital copy of mortality records from ADF&G at the end of each regulatory year. The Refuge uses these records to identify mortalities that occurred within Refuge boundaries and appends those to its master dataset.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

CCP objective 2.01. This objective was derived, in part, from recommendations generated by a Citizen Advisory Panel in the Kodiak Archipelago Bear Conservation and Management Plan (ADF&G 2002).

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

The effectiveness of bear conservation requires accurate estimates of bear mortality, consistent with CCP Goal 2. These data are especially important because harvest, especially selective harvest of large adult males, has been a primary source of bear mortality on the Kodiak Archipelago, including Kodiak Refuge (Van Daele 2007). Presently, no explicit management triggers and thresholds have been identified for alteration in harvest based exclusively on mortality data. Moreover, harvest and mortality have been adjusted primarily in response to documented significant changes in population density, as addressed by the cooperative survey of bear abundance. To date, there has been no indication that abundance of trophy males has been diminished by the recent level of selective harvest (ADF&G 2010). However, we acknowledge this potential and plan to work with ADF&G to establish management triggers based on evaluation and comparison of expected standards with observed trends for age distribution and skull size of harvested male bears. This survey works in conjunction with two other selected surveys ("Bear Abundance Monitoring" and "Bear Composition Monitoring") and a selected research project ("Bear-Salmon Interactions") to provide a more complete picture of the overall health of the bear population on Kodiak. This survey received a relatively high SMART-tool prioritization score, but was deemed more important than other higher scoring surveys because maintaining a viable population of Kodiak brown bear is a founding Refuge purpose and understanding rates and sources of mortality are crucial ensuring conservation effectiveness.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

ADF&G maintains records of reported mortality through its sealing process. The Refuge reviews, extracts Refuge specific records, and produces reports.

5) Protocol status?

ADF&G acquires mortality data via its standard statewide protocol. The Refuge has instructions explaining processing and analysis of the subset of records for bear mortality within its legislative boundary. The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.03 Bear Composition Monitoring (FF07RKDK00-009)

(1) What is the population or attribute of interest, what will be measured, and when?

Conducted annually in July and August, this aerial survey quantifies brown bear (*Ursus arctos middendorffi*) attendance, bear composition classes, and family group sizes and cub age along sections of eight anadromous streams in southwestern Kodiak. These data are used to estimate annual trends in the social and age compositions (percentage of singles, maternal females, and dependent cubs), and density and productivity of bears of southern Kodiak Island.

(2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

CCP objectives 2.01 and 2.05. Interim sub-objective 2.5.1: (In accordance with standard protocol, annually assess status and trend in brown bear use (composition and site usage) of selected stream areas during July-August.) These objectives were derived, in part, from recommendations generated by a Citizen Advisory Panel in the Kodiak Archipelago Bear Conservation and Management Plan (ADF&G 2002).

(3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Results are primarily used to evaluate whether the bear population is maintaining a level of productivity (e.g., ratio of singles versus family groups), cub survival rates (proportion of cubs), and stream use patterns within the range of locally and empirically derived standards. Observation of multi-year trends of substantially decreased ratios of maternal females, cubs, and/or stream attendance may trigger management responses including: the need for a complementary area-specific survey of bear abundance; research into potential causal factors for the apparent decline; and/or decreases in the level of sport harvest of bears. This survey works in conjunction with two other selected Refuge surveys (“Bear Abundance Monitoring” and “Mortality Assessment”) and a selected Refuge research project (“Bear-salmon Interactions”) to provide a more complete picture of the overall health of the bear population on Kodiak. This survey received a relatively high SMART-tool prioritization score, but was deemed more important than other higher scoring surveys because maintaining a viable population of brown bears is a founding Refuge purpose and primary goal identified in the CCP (Goal 2). An understanding of trends in the social and age compositions of bears is required to meet this goal.

(4) Is this a cooperative survey? If so, what partners are involved in the survey?

No, but there is a potential to link results to other surveys of coastal brown bear population in coastal Alaska. Results will be incorporated into inventory and monitoring of salmon escapement and berry production in the Karluk basin of Kodiak to determine the influence of berry crops and salmon abundances on bear population sizes and patterns of landscape use.

Protocol status: The Refuge has produced a narrative, standard operating procedures (SOPs), and an initial draft of site-specific survey protocols. The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.04. Nearshore Marine Bird Monitoring (FF07RKDK00-027)

1) What is the population or attribute of interest, what will be measured, and when?

This survey provides estimates of the annual abundances, distributions, productivity, and habitat associations of nearshore marine birds of the Kodiak Archipelago. June surveys are used to estimate breeding population abundances, and August surveys are used to estimate productivity.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

This survey supports accomplishment of objective 5.1 and 5.5 of the Refuge's CCP.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Migratory birds are a trust resource of the Service. Their conservation is a primary goal of the Kodiak Refuge (CCP Goal 5), and goals of the state of Alaska and the Service's Division of Migratory Bird Management. Results of this survey provide Refuge and migratory bird managers with an understanding of trends in coastal bird population abundances and distributions, including species important to Kodiak-based subsistence and recreational sport harvests, and others whose populations have been locally impacted by commercial fisheries and silviculture operations. Many of the species targeted in the survey rely on terrestrial nesting habitats administered by Kodiak Refuge and Alaska Maritime Refuge. Assessment of breeding populations and productivity for these species provides bases for habitat management and understanding factors that may influence the quality and availability of these habitats. Seabird mortality related to fishing gear is a globally recognized conservation issue that is believed to be responsible for declines in many populations. The Kodiak Archipelago is home to one of the largest commercial fisheries in the world and bycatch has been documented within the survey area of several species targeted in this survey. Results of this survey also can provide essential bases for estimation of mitigation costs and restoration needs following oil-spill incidents, as demonstrated in the aftermath of the 1989 Exxon Valdez incident. Results from this survey work in conjunction with the Refuge's "Seabird Colony Survey" and the "Migratory Subsistence Harvest Survey" to provide a more complete picture of the status of seabird population in the Kodiak area. This survey received the highest prioritization score using the SMART tool.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

There are no partners contributing to survey implementation, but this survey is part of a large-scale, interagency survey of multiple bird species performed within the region delineated by the National Park Service for its Southwest Alaska Network. The survey methods are consistent with those used at Katmai (2006 – 2010) and Kenai Fjords National Parks (2007 – 2010) and are comparable to those used to monitor nearshore bird communities in Prince William Sound for over two decades.

5) Protocol status?

The Refuge has produced a narrative, standard operating procedures (SOPs), and an initial draft of site-specific survey protocols. The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.05. Seabird Colony Survey (FF07RKDK00-011)

1) What is the population or attribute of interest, what will be measured, and when?

This survey estimates the sizes and spatial distributions of diurnally active seabird colonies, by species, around the Kodiak Archipelago every five to 10 years. Following completion of a re-survey, data are summarized and compared with data collected in historic surveys.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

This survey supports accomplishment of objective 5.1 of the Refuge's CCP.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

This survey contributes data to a multi-Refuge, cross-programmatic and interagency effort to re-survey the majority of seabird colonies in the North Pacific Seabird Colony Database and to document new colonies along the coastline of the Kodiak Archipelago. Results of the survey are broadly applicable since the scope encompasses nesting colonies throughout the archipelago, including most of the colony sites administered by Kodiak and Alaska Maritime NWRs. Surveying seabird colonies is important because data may be needed to support mitigation and restoration actions in case of oil spills, such as occurred in the Exxon Valdez incident. Information from this survey is needed by the Alaska Co-migratory Bird Management Council to successfully manage and conserve subsistence harvest of seabird species and their eggs. Results from this survey work in conjunction with the "Nearshore Marine Bird Survey" to provide a more complete picture of the status of seabird population around Kodiak. This survey was selected over others because monitoring populations of resident and migratory birds as indicators of ecosystem health is a goal of the Kodiak Refuge (CCP Goal 5), Alaska Maritime Refuge, and the Service's Division of Migratory Bird Management. This survey received the second highest SMART-tool prioritization score for surveys.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

The survey has been supported by the Service's Division of Migratory Bird Management (MBM) and Alaska Maritime National Wildlife Refuge.

5) Protocol status?

The Refuge, in cooperation with MBM, has produced a narrative, standard operating procedures and an initial draft of site-specific survey protocols. The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.06. Mountain Goat Population Monitoring (FF07RKDK00-025)

1) What is the population or attribute of interest, what will be measured, and when?

This survey quantifies abundances, distributions, and productivity (kids per 100 adults) of introduced non-native mountain goats (*Oreamnus americanus*) on Kodiak Island. The survey is conducted annually between mid-July and late August.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

CCP objectives 1.2 and 3.1.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

The mountain goat population on Kodiak Island has continued to increase dramatically in number and range since its introduction in 1952. If this population exceeds carrying capacity, the irruptive growth model predicts that it will over-utilize available forage resources and crash to a new lower carrying capacity. This outcome would adversely impact natural resources of the Refuge, potentially reduce forage resources for bears, and reduce goat hunter harvest opportunities. This survey has become increasingly important because quantifying mountain goat abundances and distributions is a fundamental requirement for effective, empirically-based harvest management aimed at avoiding an irruptive growth pattern. Without data from this survey, it would be difficult for the Refuge and ADF&G to achieve their shared long-term management goal for mountain goats: maintaining abundances at levels that satisfy hunter harvest expectations while avoiding irreversible resource damage. Regulations governing recreational sport harvest of mountain goats have been meaningfully adjusted over the past six years in response to results of this survey. Data from this survey work in conjunction with results from a Refuge Selected Research Project, "Mountain Goat Resource Selection," and are needed meet the Refuge's goal of developing a nutritional carrying capacity model for mountain goats on Kodiak (Cobb 2012). This survey received a mid/high SMART tool score. Priority was elevated, however, because results generated by the survey have important and immediate management utility, consistent with goal 3 and objective 3.1 of the Refuge's CCP.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

This survey is conducted in partnership with the Alaska Department of Fish and Game.

5) Protocol status?

The Refuge has produced a narrative, standard operating procedures (SOPs), and an initial draft of site-specific survey protocols. The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.07. Deer Population Monitoring (FF07RKDK00-037)

1) What is the population or attribute of interest, what will be measured, and when?

This aerial survey estimates abundances and distributions of Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) in non-forested habitats of southern Kodiak Island in May.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

CCP objective 3.3.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

These data are required to estimate trends in non-native deer abundances, which is critical to support management decisions related to hunter harvest under federal and state regulations. Deer were initially introduced to the Kodiak Archipelago in 1924 to provide additional hunting opportunities. Their population rapidly increased, peaked in abundance in the 1980s, and has since varied widely in response to winter severity. The deer population now plays a central economic and cultural role by providing a critical source of protein for rural residents of the Kodiak Archipelago. Harvest levels for subsistence and sport hunting were estimated at 8,000 deer in 2005 – 2006, which is greater than any other game species in Kodiak area and represented 35 – 40% of deer harvest in Alaska (Van Daele and Crye 2009). As a Federally-designated subsistence species, maintaining deer harvest opportunities is a Refuge goal (CCP goal 8) and is mandated under the Alaska Natural Interest Lands Conservation Act (ANILCA). However, as an introduced non-native ungulate, a high-density introduced deer population has the potential to profoundly affect native flora and fauna. Monitoring and minimizing impacts from non-native species is mandated under the Refuge Improvement Act and Executive Order 13112, and is a Refuge goal (CCP Goal 3). More specifically, a quantitative estimate of deer population trends is a Refuge objective (CCP objective 3.3), a high priority for the Refuge’s conservation partner ADF&G, and a requirement to facilitate harvest and habitat management. This survey was tied for the fourth highest SMART tool score, which further underscores its importance to the Refuge.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

No; however cooperation with ADF&G will be encouraged since the agency has a mandate to acquire data that supports management of the population, and deer are the most widely sought quarry of sport hunters in the Kodiak area.

5) Protocol status?

The Refuge has produced a narrative, standard operating procedures (SOPs), and an initial draft of site-specific survey protocols (Cobb 2012). The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.08. Deer Harvest Survey (FF07RKDK00-006)

1) What is the population or attribute of interest, what will be measured, and when?

This survey produces an annual estimate of the general distributions, levels, and success rates of Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) harvests in the Kodiak Archipelago.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

CCP goals 3 (manage nonnative species to minimize impacts on native resources, while continuing to provide opportunities for harvest) and 8 (Provide the opportunity for local residents to continue their subsistence uses on the Refuge, consistent with the subsistence priority and with other refuge purposes) and CCP objectives 1.2 (Collaborate with ADF&G when monitoring and conducting research on state trust species within the Refuge), 1.3 (curate wildlife study records using professional database standards and methods) and 3.3 (develop method, in partnership with ADF&G, to monitor deer population trends on Kodiak Island to facilitate harvest and habitat management).

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Deer were initially introduced to the Kodiak Archipelago in 1924 to provide additional hunting opportunities. Their population rapidly increased, peaked in the 1980s, and has since varied widely in response to winter severity. The deer population now plays a central economic and cultural role by providing a critical source of protein for rural residents of the Kodiak Archipelago. Harvest levels for subsistence and sport hunting on Kodiak were estimated at 8,000 deer in 2005 – 2006, which greater than any other game species on Kodiak and represented 35 – 40% of deer harvest in Alaska (Van Daele and Crye 2009). As a Federally-designated subsistence species, maintaining deer harvest opportunities is a Refuge goal (CCP goal 8) and is mandated under the Alaska Natural Interest Lands Conservation Act (ANILCA). However, as an introduced non-native ungulate, a high-density introduced deer population has the potential to profoundly affect native flora and fauna. Management, including monitoring, to minimize potential impacts is mandated under the Refuge Improvement Act and Executive Order 13112, and is a Refuge goal (CCP goal 3). Understanding harvest success, particularly on Refuge lands, is critical for empirically-driven harvest and habitat management.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Data are acquired by ADF&G, which provides a summary to the Refuge. Historically, the Refuge provided partial funding support to ADF&G for survey operation to support assessment of deer harvest on federal lands. Although this assessment was not included in the recently established web-based survey, it will be resumed once the online system is fully functional (circa. 2014 – 2015).

5) Protocol status?

ADF&G manages protocols governing reporting of harvest by hunters of deer in the Kodiak Archipelago, including those that hunt under federal subsistence. Specific protocols are not available.

1.09 Invasive Plant Survey (FF07RKDK00-014)

1) What is the population or attribute of interest, what will be measured, and when?

This extensive survey assesses the identity, abundance, and distribution of highly invasive plants in and adjacent to Kodiak Refuge and Alaska Maritime Refuge. Annual surveys, performed intermittently during the growing season between May and September, focus primarily in coastal, riverine, and lacustrine areas of historic and current human use. Secondly, we cooperatively survey critical control points in the vicinity of Kodiak and outlying communities. In any given year, the area surveyed is small (e.g., 4-8 km²) due to the large size of the potentially affected archipelago area, high costs of transportation, and limited funds for survey support. We conduct outreach where the survey operates in and adjacent to human habitations and at popular recreational sites visited by public. We quantify outreach by categorizing the type of contact and enumerating groups and individuals contacted.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

CCP objective 6.1. Additionally, an Environmental Assessment and associated Finding of No Significant Impact provide extensive programmatic guidance for the Refuge's management of invasive plants including this survey (USFWS 2010a, 2010b).

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Data collected in this survey provides the primary basis for targeting restoration of areas infested by highly invasive plants in and adjacent to Refuge lands, as well as critical control points in Kodiak and outlying communities. Surveys supported by the Refuge since 2003 have documented numerous infestations of highly invasive plants, which are disallowed on Refuge lands (USFWS 2010a), and which have triggered integrated pest management (IPM) to control and eradicate infestations via mechanical and chemical methods. Additionally, we routinely provided outreach and thereby informed the public and residents of threats and management options regarding highly invasive plants. Success of Service-supported control actions is evaluated by a companion survey (invasive plant monitoring), and by the combination of results from monitoring of control actions as well as follow-up extensive surveys. This survey tied for fifth highest SMART tool score.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Surveys are usually conducted in partnership with Kodiak Soil and Water Conservation District and/or locally-based Service volunteers. Kodiak Archipelago Cooperative Weed Management Area. CWMA includes federal and state agencies, Native Corporations, non-profit organizations, and individual citizens.

5) Protocol status?

The Refuge has produced survey instructions and plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.10 Invasive Plant Monitoring (FF07RKDK00-017)

1) What is the population or attribute of interest, what will be measured, and when?

At selected areas infested by highly invasive plant species, we quantify plant responses to integrated pest management (IPM). Specifically, the population of interest is the discrete geographic area (i.e., infestation area) selected for IMP including herbicide use of one or more species of highly invasive plant such as orange hawkweed (*Hieracium aurianticum*), oxeye daisy (*Leucanthemum vulgare*), and Canada thistle (*Cirsium vulgare*). Frequency, cover, and density have variously served as parameters for assessment of response of highly invasive species in different infestation areas. Additionally, we use repeat photography to visually assess response of invasive species, and associated native vegetation, at all infestation areas subject to IPM including herbicide use.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

CCP objective 6.1. Integrated Pest Management of Invasive Plants on Kodiak National Wildlife Refuge and Vicinity (Environmental Assessment 2010). Additionally, an approved Environmental Assessment and associated Finding of No Significant Impact provide extensive programmatic guidance for the Refuge's management of invasive plants including this survey (USFWS 2010a, 2010b).

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

This survey determines the response of highly invasive plant species to integrated pest management (IPM) where IPM actions involve herbicide use. IPM methods are adjusted, as appropriate, where monitoring results suggest that modification of IPM methods could increase effectiveness (e.g., adaptive management framework). Monitoring methods and thresholds differ among infestation areas subject to IPM including herbicide use. On sites where response to treatment is quantified, the threshold for management response (i.e., adjustment of IPM methods) is dually based on evaluation of response trends of the invasive plant and herbicide usage. On sites where response to treatment is subjectively assessed (photopoints), the threshold for management response is based primarily on the trend in herbicide usage. Highly invasive species, such as orange hawkweed, are considered a primary impediment to meeting this goal. The importance and role of monitoring response of invasive plants to IPM actions are specifically addressed in an Environmental Assessment (USFWS 2010a). Results of this survey work, in conjunction with the Refuge's "Invasive Plant Survey", provide primary bases for identification and effective management of infestations of highly invasive plants. This survey tied for the fifth highest SMART tool score.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Surveys are usually conducted in partnership with Kodiak Soil and Water Conservation District and/or locally-based Service volunteers.

5) Protocol status?

The Refuge has produced survey instructions and plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.11 Sea Otter Population Monitoring (FF07RKDK00-039)

1) What is the population or attribute of interest, what will be measured, and when?

This survey produces an estimate, with statistical confidence, of the size of the federally threatened northern sea otter (*Enhydra lutris*) population of the Kodiak Archipelago. Developed and managed by the Division of Marine Mammals Management (MMM), the survey has been conducted at five to 10 year intervals between June and August.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Conservation of sea otter is explicitly listed as a Refuge purpose. The need for this survey is addressed in objective 4.1 of the Refuge's CCP. Additionally, MMM calls for routine operation of this survey in its monitoring plan for Alaskan populations of sea otters (USFWS 2010).

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Since the mid-1980s, sea otter abundances have declined by over 90% throughout much of southwestern Alaska. Results from population surveys prompted designation of the Southwest Alaska Distinct Population Segment as threatened under the Endangered Species Act. However, the population in the Kodiak area is one of the few in the southwest stock's range which did not decline substantially. Consistent monitoring of populations within the southwest stock's range is required to evaluate a potential change in designation. Additionally, monitoring results provide primary information required for evaluation of the relative ecological and economic interactions of sea otter populations with nearshore marine habitat (e.g., influence on abundance of sea urchin, Dungeness crab, and large kelp). This survey received the sixth highest SMART tool score, which reaffirms its importance to the Refuge.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Historically, MMM led the survey and Kodiak Refuge supported it (e.g., observer, data entry). In 2014, the Refuge, in cooperation with MMM and the Service's I&M Initiative, will investigate options for improving survey frequency and safety.

5) Protocol status?

The Refuge has produced survey instructions and plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.12 Migratory Bird Subsistence Harvest Survey (FF07RKDK00-013)

1) What is the population or attribute of interest, what will be measured, and when?

This survey, a questionnaire, quantifies the distribution, species diversity, and abundance of subsistence harvest of migratory birds in the Kodiak Archipelago. The survey targets selected communities every three years and it is part of a standardized state-wide effort to monitor birds harvested under federal subsistence regulations in Alaska.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Refuge CCP objective 8.2 calls for assisting the Service's Division of Migratory Bird Management (MBM) program in completion of this survey in the Kodiak Archipelago.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

The Migratory Bird Treaty Act Protocol Amendment provides for customary and traditional use of migratory birds and their eggs for subsistence use by rural residents of Alaska. MBM is mandated to complete periodic surveys of migratory birds harvested under federal subsistence regulations, and to provide survey results to the Alaska Migratory Bird Subsistence Co-management Council (AMBCC). Harvest survey data help ensure that customary and traditional use of migratory birds and their eggs is satisfied but does not significantly decrease the size of continental populations. Monitoring harvest trends enables tracking of any major changes in the composition and intensity of migratory subsistence harvest. Major changes in harvest levels and patterns may serve as bases for AMBCC discussion and decisions regarding harvest regulations.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Historically, MBM led the survey and Kodiak Refuge supported it (e.g., surveyor, coordination with ADF&G contractor and Tribally-affiliated surveyors).

5) Protocol status?

The Alaska Migratory Bird Co-Management Council produced a narrative, standard operating procedures (SOPs), and state-wide survey protocols (Naves 2010). A new survey protocol is in development. The Refuge plans to submit a draft site-specific protocol for this survey following adoption of revised protocol by the Service and Alaska Migratory Bird Co-management Council.

1.13 Aquatic Invasive Species Monitoring (FF07RKDK00-048)

1) What is the population or attribute of interest, what will be measured, and when?

This survey quantifies the occurrence, abundance, and distribution of selected species of aquatic organisms regarded as highly invasive. It includes species whose introduction would substantially damage freshwater ecology and fisheries in the Kodiak area, such as New Zealand mudsnail (*Potamopyrgus antipodarum*), as well native species, such as the diatomaceous alga *Didymosphenia geminata*, which is known to substantially damage temperate freshwater systems following inadvertent introduction outside of its native range. The spatial scope of the survey is initially restricted to segments of five rivers (Ayakulik, lower Buskin, Dog Salmon, Karluk, lower Uganik) that receive the most public use, and are therefore at greatest risk of import and export of highly invasive species. The survey is conducted during the annual baseflow period, typically late July to mid-August, every 10 years.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

This survey addresses the freshwater component referenced in objective 1.5 of the Refuge's CCP.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Kodiak Refuge harbors highly productive stream, river, and lake ecosystems that support exceptional salmonid fisheries. Collectively these fisheries support a high density of brown bears; serve as a primary source of subsistence to local residents; afford world-class opportunities for recreational angling; and provide for multi-million dollar commercial harvests. The continued health of salmonid habitats in the Refuge and other archipelago areas requires periodic monitoring to assess the occurrence and extent of aquatic invasive species. Detection of any invasive species would serve as a basis for development of a collaborative interagency prevention and mitigation strategies. To raise awareness and to prompt prevention, public outreach has been concurrently conducted by Wildlife Forever and the Kodiak Soil and Water Conservation District (KSWCD), in cooperation with the Refuge.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Partnered with the Alaska Department of Fish and Game on assessment of the whirling disease pathogen (*Mxyobolus cerebralis*), and with the Anchorage Fisheries Resource Office and Kodiak Soil and Water Conservation District on assessment and outreach related to of aquatic invasive species.

5) Protocol status?

The Refuge has produced survey instructions plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.14 Bald Eagle Coastal Breeding Population Survey (FF07RKDK00-065)

1) What is the population or attribute of interest, what will be measured, and when?

The population of interest consists of adult bald eagles (*Haliaeetus leucocephalus*) that reside along the coast of the Kodiak Archipelago during late April-early May. The attribute of interest is long-term trends of this population component at five to 10 year intervals. Data acquired from Kodiak comprise a subset of data acquired for the north Pacific coast of Alaska by the Division of Migratory Bird Management (MBM), Alaska Region.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

This survey partially addresses Refuge CCP objective 5.3 (monitor trend in size and distribution of the Refuge's populations of bald eagle) and 5.5 (identify important areas on Refuge for birds of conservation concern, including bald eagles). It also addresses CCP objective 5.1 (monitor the distribution and trends of coastal populations of environmentally sensitive resident birds as indicators of marine and coastal resource health)

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Sustained accomplishment of this survey will facilitate relevant interpretation of trend in the size of the population because results from the Kodiak survey will be compared to results elsewhere along the Alaska coast. Results will provide land and migratory bird managers a firm basis for evaluating population status. Management thresholds and responses have yet to be identified for this survey, at local and regional levels. However, in the event surveyors measure a significant decline in the Kodiak population, it is likely the Refuge would partner with MBM to increase survey frequency to validate the precision of the result; and if validated, initiate investigation of potential causal factors such as change in food supply, reproductive success, and recruitment. Identification of causal factors would serve as a basis for development and implementation of mitigation and recovery strategies.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

The Service's Division of Migratory Bird Management's Raptor Management Office.

5) Protocol status?

Hodges (2011) described protocol and results of statewide surveys. MBM's Raptor Management Office developed and implemented an SOP for the survey of the Kodiak area in 2013. The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.15 Wintering Steller's Eider Aerial Survey (FF07RKDK00-005)

1) What is the population or attribute of interest, what will be measured, and when?

This aerial survey estimates the abundance of wintering Steller's eiders (*Polysticta stelleri*) in the vicinity of Kodiak Island, every five to 10 years.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Partly accomplishes objective 5.6 of the Refuge's CCP.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

In 1997, the Alaska breeding population of Steller's eider was listed as threatened under the Endangered Species Act. Although Kodiak is not within the species' breeding range, the Archipelago is host to approximately 4,000 – 5,000 wintering eiders. Data from this survey will be used to establish trends in eider abundances at Kodiak. Results from periodic monitoring of the Alaska population are used to assess extent of recovery towards population objectives established in the species' recovery plan. In cases of marine mishaps such as oil spills, results of this survey would likely facilitate impact analyses and mitigation plans since some of the species' distribution in the Kodiak area overlaps an area of concentrated activity by commercial marine vessels (e.g., Chiniak Bay).

4) Is this a cooperative survey? If so, what partners are involved in the survey?

The survey is jointly operated by the Refuge and the Service's Division of Migratory Bird Management.

5) Protocol status?

The Refuge has produced a narrative, standard operating procedures (SOPs), and an initial draft of site-specific survey protocols (Corcoran 2010b). The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.16 Moored All-season Temperature Arrays (FF07RKDK00-033)

1) What is the population or attribute of interest, what will be measured, and when?

This survey monitors temporal and spatial variation in water temperature of Karluk Lake and Red Lake, Kodiak Island. Data is recorded on an hourly basis, year-round, at 5-10 m depth increments to a maximum of 110 m. An additional thermistor is deployed between May-October to monitor near-surface (1 m) temperature.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Operation of this survey partly accomplishes an objective of the Refuge's CCP (9.3), which calls for initiating study of limnology of lakes regarded as important fish and wildlife habitat. One of the purposes of the Refuge is to "...maintain sufficient water quality and quantity..." for support of fishes, wildlife, and dependent human uses.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Results from this survey work in conjunction with concurrent monitoring performed by Togiak Refuge, Alaska Peninsula/Becharof Refuges, and the National Park Service's Southwest Alaska Network (SWAN) to provide a comprehensive basis for anticipating and managing impacts of global warming on the quality of sockeye salmon (*Oncorhynchus nerka*) nursery habitat in southwest Alaska. Karluk and Red Lakes support the largest, most productive stocks of sockeye salmon in the Kodiak Archipelago, and salmon reared in these lakes provide subsistence to village communities and support a multi-million dollar commercial harvest. Evaluation of trend in lake temperature variation is important because projected warming of air and water may eventually compromise fitness and performance of juvenile sockeye salmon, potentially reducing abundance and leading to collateral impacts to the ecosystem and economy. The comparative nature of the survey will facilitate interpretation of trend, which may be used to forecast future climate-driven impacts to salmon habitat, and which can facilitate development of mitigation strategy in the event of impact forecast. A newly released 2013 initiative of the Western Alaska Land Conservation Cooperative seeks to identify existing knowledge and gaps pertaining to temperature thresholds of salmon. Pending funding availability, a companion survey will assess trend in temperature of river mainstems and tributaries in the Karluk and Ayakulik River Basins.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Primary partners include Togiak Refuge, Alaska Peninsula/Becharof Refuges, the SWAN, and ADF&G. Data acquired by Kodiak Refuge complement limnological data acquired by ADF&G on biophysical conditions of a large network of lakes utilized as nursery habitat of sockeye salmon.

5) Protocol status?

Partnered Refuges implemented station-specific protocols (survey instructions) based on standard protocol developed by the SWAN (Shearer and Moore 2011). Kodiak Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.17 Sea Duck Banding (FF07RKDK00-008)

1) What is the population or attribute of interest, what will be measured, and when?

This survey estimates of survival rates, and examines movement patterns of the harlequin duck (*Histrionicus histrionicus*) populations in Uyak Bay and Uganik Bay, adjacent to Kodiak Island, and Barrow's goldeneye (*Bucephala islandica* and *B. clangula*) population in Blue Fox Bay, adjacent to Afognak Island.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Objective 5.2 of the Refuge's CCP calls for monitoring wintering waterfowl. Objectives 5.4 of the Refuge's CCP calls for monitoring trends in survival and productivity of sea duck species that make up most of the local waterfowl harvest, such as harlequin duck and goldeneye.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Many sea duck populations in Alaska have declined dramatically during the past 20 years, and the causes of these declines are poorly understood. Abundance of harlequin duck in Uyak Bay fell by 80% between 1994 and 2010, which appears related to heavy hunting pressure and high site fidelity, based on band return results. Harlequin duck is the most sought quarry of trophy seaduck hunters, and goldeneye is a subsistence resource. Blue Fox Bay is a critical molting habitat for Barrow's goldeneye in the Kodiak Archipelago, and is the only known marine molting site for this species on the west coast of North America. This site is also one of the few where molting females are amenable to capture and banding, which is the most common and least costly approach to quantifying their survival and movement patterns. Results of this survey have been used, in conjunction with results from nearshore marine birds, to request voluntary restriction of harlequin duck harvest of residents and waterfowl hunting guides of the village community of Larsen Bay.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Data and results are shared with the Service's Division of Migratory Bird Management.

5) Protocol status?

The survey has been operated in accordance with initial instructions. The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

1.18 Reindeer Population Monitoring (FF07RKDK00-036)

1) What is the population or attribute of interest, what will be measured, and when?

The survey assesses the distribution, abundance, and productivity of feral reindeer (*Rangifer tarandus*) on Kodiak Island during summer at three- to five-year intervals.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Reindeer are an introduced species. CCP goal 3 states the need to "manage nonnative species to minimize impacts on native resources...". Survey results support interim objective 3.7 (Pyle et al. 2013): "To facilitate population and habitat management; monitor trends in summer distribution, size, and productivity of the reindeer population on the Refuge." Managing nonnative species, such as reindeer, to minimize impacts on native resources is a Refuge goal (CCP goal 3).

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

This aerial survey produces a minimum population estimate for reindeer on Kodiak Island. Secondly, the survey estimates summer distribution and productivity (calves per 100 adults). These data are used to index trends in the reindeer population sizes over time. Reindeer is a feral non-native species to Kodiak, with the potential to negatively impact native flora and fauna when at high population densities. In response to concerns over a perceived decline in reindeer on Kodiak, the Alaska Board of Game reinstated a ban on "same-day airborne" hunts, instigated a six-month hunting season, and limited annual take to one reindeer per person. The impacts of these regulatory changes to reindeer abundances are unknown; however, concerns that these changes may increase reindeer abundances and lead to associated degradation in fragile tundra habitat prompted the need for abundance data. Moreover, an understanding of changes in abundance is a fundamental step toward determining the impacts of population limiting factors on annual changes in reindeer abundance; such as predation, disease, and forage limitations. To quantify the effect of harvest management on reindeer abundances, the Refuge initiated annual surveys of reindeer abundance.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

No. The Refuge provides ADF&G with survey results, which can be used to manage harvests.

5) Protocol status?

No written protocol is currently available. Previous surveys have focused on known historical reindeer ranges in southern Kodiak Island, and flown straight-line aerial transects separated by approximately 1 km in flat terrain, and contour transects in mountainous terrain (Cobb 2011b). The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

Selected Surveys That Can be Conducted with Additional Expected Capacity

2.01 River Temperature Monitoring (FF07RKDK00-049)

1) What is the population or attribute of interest, what will be measured, and when?

This survey will monitor temporal and spatial variation in maximum daily mean temperature of the mainstem river and a primary lake tributary in each of three watersheds (Ayakulik, Dog Salmon, Karluk) between May and September. Data will be recorded on an hourly basis between May and September in river systems with the greatest historic abundances of pink salmon (*Oncorhynchus gorbuscha*), sockeye salmon (*O. nerka*), and Chinook salmon (*O. tshawytscha*).

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Operation of this survey partly accomplishes an objective of the Refuge's CCP (9.3), which calls for initiating study of limnology of lakes regarded as important fish and wildlife habitat. One of the purposes of the Refuge is to "...maintain sufficient water quality and quantity..." for support of fish, wildlife, and dependent human uses.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Kodiak Refuge supports exceptional salmonid fisheries that serve as a primary source of subsistence to rural residents, attract anglers from around the world, and provide for a multi-million dollar commercial harvest. Results of this survey will provide a basis for anticipating and managing impacts of global warming on quality of riverine habitat used by salmon at different stages of the freshwater life cycle (e.g., migration, spawning, egg-development, juvenile rearing). Our approach will involve networking with local and regional partners who share concerns about the need to monitor potential thermal influences of climate change on salmon habitat. In the Kodiak area, we propose to establish paired monitoring sites (mainstem and headwater tributaries) in each of three watersheds collectively regarded as most important to salmonid management. Implementation of this study is supported by the Refuge's CCP (2007), as well as recommendations of a regional interagency workshop on stream and lake temperature (USFWS 2012) and a Kodiak-based climate change workshop (Beever 2012). Establishment of a network of river temperature monitoring sites is a focal topic of the Service's Water Resource Program, I&M Initiative, and Western Alaska LCC.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Partners of a local monitoring network may include the Alaska Department of Fish and Game, Koniag, Inc., Larsen Bay Tribal Council, Old Harbor Tribal Council, Sun'aq Tribe of Kodiak, and the Kodiak Regional Aquaculture Association.

5) Protocol status?

None currently; however, the one we develop will be patterned after existing standards applied by the Cook Inletkeeper (Mauger 2008). The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

2.02 Weather Station Vegetation Monitoring (FF07RKDK00-053)

1) What is the population or attribute of interest, what will be measured, and when?

The population will consist of selected plant communities in the vicinity of Remote Automated Weather Stations (RAWS) on Kodiak Refuge, Kodiak Island. We will evaluate the status and trend in selected community attributes regarded as relatively insensitive to variation due to differences in time of sampling, such as frequency of occurrence by species and vegetation (shrub) structure based on assessment of stem density by size class. It is likely that vegetation will be sampled at decadal intervals, at a minimum, during the peak of growing season between mid- to late July.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Refuge CCP objective 6.3.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

The purpose of the survey is to monitor response of selected attributes of plant communities to climate change in the vicinity of RAWS stations. Locally-based decisions regarding mitigation and adaptation to climate change, a form of management response, will require results from long-term monitoring of climate change influence on Refuge resources including vegetation, a foundation to terrestrial wildlife habitat. Consistent with the approach of the National Park Service's I&M Networks, we will use a multi-scale approach including landscape-scale evaluation based on periodic interpretation of archipelago landcover (see landcover monitoring survey) coupled with fine-scale ground-based evaluation (this survey). Weather stations required for comparative evaluation of plot-based climate-vegetation relationships have been purchased and installed (1995 -1; 2000 - 3). Establishment of an additional weather station has been approved by NOAA (climate reference station). Vegetation monitoring will be initiated following approval of a referred protocol, which will include requisite power analyses for establishing threshold values for detection of significant temporal changes in vegetation attributes targeted for assessment.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

We will seek appropriate expertise and assistance from staff affiliated with USGS Alaska Science Center and the botanist affiliated with the Service's Alaska Region I&M Initiative.

5) Protocol status?

Survey instructions and protocols have yet to be formulated.

2.03 Plant Survey (FF07RKDK00-022)

1) What is the population or attribute of interest, what will be measured, and when?

This survey documents the occurrence, diversity, and distribution of plant species in Kodiak Refuge and vicinity. Fieldwork is focused in the vicinity of floatplane accessible lakes and coastal sites during June-August, the primary period of plant growth. The survey is frequently coupled with the survey of invasive plant species.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Partially accomplishes Refuge CCP objective 6.2.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

The Refuge Improvement Act of 1997 (Public Law 105-57) directs the Service to (a) conserve plants and their habitats on National Wildlife Refuges; and (b) to maintain biological diversity and integrity of plant communities. Among other purposes, the Service's Biological Integrity Policy (601 FW 3) directs Refuges to assess biological diversity and integrity through baseline vegetation surveys and studies. A goal and accompanying objective of Kodiak Refuge's CCP (USFWS 2007) direct management to "Maintain and restore native plant populations, communities, and habitats" and "...describe species composition of plant communities for selected areas of the Refuge..." This survey provides an initial basis for addressing these mandates by producing a baseline inventory of plant species occurrence, distribution, and community composition. One of the primary surveyors produced a highly popular and comprehensive field guide based in large part on results of this survey (Studebaker 2010).

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Locally-based volunteer botanists and botanists affiliated with the University of Alaska, Museum of the North.

5) Protocol status?

The Refuge has produced survey instructions. The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

2.04 Barrow's Goldeneye Nest Box Study (FF07RKDK00-066)

1) What is the population or attribute of interest, what will be measured, and when?

This survey estimates the annual abundance and reproductive success (e.g., eggs/clutch, hatch and fledging rates) of breeding Barrow's goldeneye (*Bucephala islandica*) along the northern road system, and surrounding Karluk Lake, of Kodiak Island. The survey is conducted annually during mid-summer following fledging.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Monitoring Barrow's goldeneye is a Refuge objective (CCP objectives 5.1 and 5.2) and data that used by the State of Alaska and the Alaska Migratory Bird Co-Management Council (AMBCC) to support sound harvest management.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

The Refuge supports both an extensive resident Barrow's goldeneye breeding population and a large migrant wintering population. This survey provides information on how the local breeding population contributed to Kodiak's wintering goldeneye population. Results are used to facilitate sustainable hunter harvest rates in the Kodiak area, especially for goldeneyes that largely breed on Refuge lands, and are regarded as a preferred quarry of subsistence and recreational sport hunters. We have yet to identify thresholds of significant change in trends of survey parameters that may warrant management response.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

This project is a cooperative effort of the Alaska Department of Fish and Game (John Crye), Kodiak National Wildlife Refuge (volunteer Denny Zwiefelhofer), Lesnoi Corporation, U.S. Coast Guard - Integrated Support Command Kodiak, and various private individuals. Results are used by ADF&G and the AMBCC.

5) Protocol status?

Initial survey instructions (Zwiefelhofer and Crye 2013). The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

2.05 Bison Distribution Monitoring (FF07RKDK00-047)

1) What is the population or attribute of interest, what will be measured, and when?

This semi-annual survey determines the locations and abundances of a domestic bison (*Bison bison*) that routinely stray (trespass) onto state land between the state-leased grazing allotment and the Refuge.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Survey results support interim objective 3.8 (Pyle et al. 2013): “To gauge the potential for their spread on to Refuge lands, periodically monitor, in cooperation with ADF&G, the distribution and abundance of bison outside designated state-leased lands and near Refuge lands.” Managing nonnative species, such as reindeer, to minimize impacts on native resources is a Refuge goal (CCP goal 3).

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

This survey determines the locations and abundances of domestic bison, which have expanded beyond a prescribed grazing allotment and are approaching Refuge lands near Hidden Basin, Kodiak Island. The permittee has refused to cooperate with ADF&G and Alaska Department of Natural Resources (DNR) requests to maintain the herd on state-leased lands, a violation of the lease agreement. Left unmanaged, the herd will likely increase, expand in distribution, and eventually could colonize Refuge lands. Establishment of bison on the Refuge would constitute a breach of the Refuge Improvement Act of 1997 and an associated refuge policy (Biological Integrity, Diversity, and Environmental Health; 601 FW3, 2001). To prevent potential establishment on the Refuge, bison in the Hidden Basin area should be returned to the lease area, monitored by the permittee to prevent egress beyond the lease area, or removed by hunter harvest (if designated as feral by ADF&G). Surveying the herd, via fixed-wing aircraft, determines whether bison are continuing to approach Refuge lands and helps determine the course of further management actions, as required.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Survey data are shared with ADF&G and Alaska Department of Natural Resources (DNR), the state agencies responsible for managing wildlife and administering grazing allotments on state lands.

5) Protocol status?

No protocol is currently available. Dedicated bison surveys have occurred (Pyle 2009), but in general, surveys are conducted opportunistically in conjunction with other Refuge activities (i.e., other aerial surveys or law enforcement patrols). The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

2.06 Breeding Bird Survey (FF07RKDK00-030)

1) What is the population or attribute of interest, what will be measured, and when?

This single-sample annual survey estimates the relative abundance of bird species observed along two separate routes, each consisting of 25 stops systematically spaced at 0.4 km intervals, during June. Data from the two Kodiak counts is submitted to the USGS, which selectively pools it with data from other sites, then analyzes the time-series datasets for purposes of evaluating trends in bird populations at regional and continental scales.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

This survey addresses one of four components of interim objective 5.8 (Pyle et al. 2013), which calls for facilitation and participation, as appropriate, in citizen avian science programs. Results from this survey address ADF&G's Comprehensive Wildlife Conservation Strategy, which emphasizes the extremely limited information on the status and trends of most of the 135 species of landbirds that breed in Alaska.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

This survey is part of a large-scale effort geared to inform biologically sound conservation and management actions based on analysis of trend in bird populations at regional and continental scales. Determining population trends, relative abundance, and distributions of North American avifauna is critical for identifying conservation actions, determining conservation priorities, and evaluating the effect of these actions. The survey program, jointly coordinated by the USGS and Environment Canada's Canadian Wildlife Service, provides the US and Canadian Federal governments, state and provincial agencies, and the general public with science-based avian population trend estimates and other information for regional and national species' population assessments. These agencies have the primary responsibility for data analyses and interpretation of results including thresholds of significance that may warrant consideration of management response. This survey operates in conjunction with the Refuge's Breeding Bird Survey (ALMS – Remote Sites) to provide a more complete understanding of the long-term population trends, abundances by habitat type, and distributions of landbirds across Alaska.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

USGS Biological Resources Division, Environment Canada's Canadian Wildlife Service, and the Service's Division of Migratory Bird Management. Appropriately trained Service volunteers have routinely and instrumentally assisted with survey operation.

5) Protocol status?

The USGS produced a narrative, standard operating procedures (SOPs), and national survey protocols (Sauer 2012). The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

2.07 Monitoring Avian Productivity and Survivorship (MAPS) (FF07RKDK00-018)

1) What is the population or attribute of interest, what will be measured, and when?

The survey provides data used to estimate the productivity and adult survival rates of small to medium sized migratory and resident landbird species. Replicate surveys are operated during June and July at a site adjacent to Kodiak Refuge headquarters.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

This survey addresses one of four components of interim objective 5.8 (Pyle et al. 2013), which calls for facilitation and participation, as appropriate, in citizen avian science programs. ADF&G's Comprehensive Wildlife Conservation Strategy emphasizes the extremely limited information on the status and trends of most of the 135 species of landbirds that breed in Alaska, including several that are regularly monitored by this survey. This survey also addresses CCP Objective 12.8, which calls for expanding opportunities for individuals, organized groups, and families to learn about Kodiak Refuge through on and off-headquarters programs, environmental education, nature walks and interpretive programs.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

This survey is a locally-operated component of a national program for monitoring spatial and temporal patterns of productivity and adult survival rates of migratory and resident landbirds while communicating science and conservation to the public through bird banding. The MAPS program currently consists of nearly 500 monitoring stations sampled annually and provides estimates of adult apparent survival and recruitment rates and indices of productivity for about 150 landbird species. The Institute for Bird Populations, the program leader, has primary responsibility for data analyses and interpretation of results including thresholds of significance that may warrant consideration of management response.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

The MAPS program, managed by the Institute for Bird Populations, comprises a continental-wide network of hundreds of constant-effort mist netting stations. Locally-based professional and amateur ornithologists, as well as interested members of the lay public, have routinely assisted with station operation.

5) Protocol status?

The Institute for Bird Populations produced a narrative, standard operating procedures (SOPs), and national survey protocols (DeSante et al. 2013). The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

2.08 Alaska Landbird Monitoring Survey (ALMS) (FF07RKDK00-019)

1) What is the population or attribute of interest, what will be measured, and when?

Operated biennially during June, this single-sample survey produces estimates of distribution, relative abundance, and habitat affinities of breeding species of landbirds in Alaska. Each of the Alaskan survey sites, including the one operated by the Refuge on Uganik Island, consists of a systematically arrayed 25-point grid where bird observations are recorded for 10 minutes within a fixed distance surrounding each point.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

This survey addresses one of four components of interim objective 5.8 (Pyle et al. 2013), which calls for facilitation and participation in citizen avian science programs. Results from Kodiak and other statewide survey sites facilitate estimation of population status and trends of Alaska's breeding landbirds, an information priority identified in ADF&G's Comprehensive Wildlife Conservation Strategy. This survey also addresses Refuge CCP objective 5.5, which calls for identifying important habitat areas on the Refuge for bird species of conservation concern.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

This survey is the local component of a statewide survey effort (ALMS) to monitor long-term population trends, determine abundance by habitat type, and model distributions of landbirds across Alaska. ALMS works in conjunction with the Refuge's "Breeding Bird Survey (Road-based)" by providing complimentary data on population trends of Alaskan landbirds that are largely not adjacent to roads. The Refuge submits data to the USGS Alaska Science Center, the agency vested with primary responsibility for data analyses and interpretation of results including thresholds of significance that may warrant consideration of management response.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

USGS Alaska Science Center and the Service's Division of Migratory Bird Management. Appropriately trained Service volunteers have routinely and instrumentally assisted with survey operation.

5) Protocol status?

The Boreal Partners in Flight sponsored the USGS Alaska Science Center to produce a narrative, standard operating procedures (SOPs), and state-wide survey protocols (Handel and Cady 2004). The statewide survey protocol framework will be peer-reviewed in 2014. The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

2.09 Christmas Bird Count (FF07RKDK00-064)

1) What is the population or attribute of interest, what will be measured, and when?

This single-sample annual survey, sponsored by the National Audubon Society, documents the occurrence and distribution of terrestrial and marine bird species within two systematically-set count areas in northeastern Kodiak Island between mid-December and early January.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

This survey addresses one of four components of interim objective 5.8 (Pyle et al. 2013), which calls for facilitation and participation, as appropriate, in citizen avian science programs.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

The Service has actively supported Christmas Bird Counts (CBC) for many years, especially through establishment, operation, and coordination of CBCs that encompass lands in the Refuge System. Results from the two Kodiak CBCs contribute to survey datasets for Alaska and the US. Time-series data acquired at Kodiak and other North American CBC sites has facilitated analyses of regional and national trends in bird populations during early winter. Additionally, the CBCs in Kodiak, as elsewhere, have attracted interest and direct involvement of the public in a relevant and long-term conservation science study.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Kodiak Audubon and the National Audubon Society.

5) Protocol status?

Standard protocol described in the count compiler's manual (NAS 2013). The Refuge plans to submit a draft site-specific protocol for this survey for an I&M-sponsored review.

Non-selected Surveys

Eight surveys were not selected for implementation. Of these, three surveys were classified as “Future” because they would require additional collaborative support of the Refuge’s partners for completion. Five additional surveys were classified as “Historic” and were dropped from future consideration because they were completed or were no longer considered a Refuge priority, as detailed in a recent analysis of existing and proposed survey needs (Pyle et al. 2013).

Future (in order of priority)

- Beaver Population Monitoring
- River Otter Harvest Survey
- River Otter Population Monitoring

Historic

- Fall Bear Use of the Upper Karluk River
- Winter Seabird Survey
- Soil-ecological Site Survey
- Over-winter Deer Mortality Survey
- Bald Eagle Occupancy and Productivity

Selected Research

Seventeen research projects were prioritized (Appendix C). All of these projects have required, and will continue to require, resources beyond the current capacity of Kodiak Refuge (2010 – 2012 average of Kodiak Refuge’s biological program resources) and, therefore, none were classified as Current. Four multi-year research projects were prioritized as Expected because we anticipate continued support by the Refuge and its research partners through project completion. (Table 1b).

Table 1b. Summary of Selected Research (Expected) at Kodiak National Wildlife Refuge.

Survey Priority ¹	Survey ID Number ²	Survey Name ³	Survey Status ⁴	Mgmt. Obj. ID ⁵	Survey Area ⁶	Staff Time (FTE) ⁷	Annual Cost (OPR) ⁸	Survey Timing ⁹	Survey Length ¹⁰	Survey Coord. ¹¹	Protocol Citation ¹²	Protocol Status ¹³
1	FF07RKDK00-058	Bear-Salmon Interactions	Expected	N/A	Multiple management units: Focal area encompasses the Red Lake, Frazer Lake, and Karluk Lake Basins of SW Kodiak Island including lands owned by the Service and Koniag, Inc., a Native Corporation.	FWS: 0.17, Other: 1.02	\$45,420	May-October/ Sporadic or Ad Hoc	2012-Indefinite	William Leacock, Wildlife Biologist	(none)	Initial Survey Instructions
2	FF07RKDK00-034	Mountain Goat Resource Selection	Expected	CCP / Objective 03.0.01, Objective 03.0.04	Multiple management units: Hepburn Peninsula, Uyak Bay area, Hidden Basin / Terror Lake areas (Kodiak Island), and other sites.	FWS: 0.13, Other: 0.04	\$58,000	Year-round/ Recurring -- every year	2011-2016	McCrea Cobb, Wildlife Biologist	(none)	Initial Survey Instructions
3	FF07RKDK00-028	Nesting Ecology of Kittlitz's Murrelet	Expected	CCP / Objective 05.0.05	Multiple management units: Kodiak Glacial Refugium, western Kodiak Island	FWS: 0.46, Other: 1.15	\$35,195	June through mid August/ Recurring -- every year	2008-Indefinite	Robin Corcoran, Wildlife Biologist	(none)	Initial Survey Instructions

Survey Priority ¹	Survey ID Number ²	Survey Name ³	Survey Status ⁴	Mgmt. Obj. ID ⁵	Survey Area ⁶	Staff Time (FTE) ⁷	Annual Cost (OPR) ⁸	Survey Timing ⁹	Survey Length ¹⁰	Survey Coord. ¹¹	Protocol Citation ¹²	Protocol Status ¹³
4	FF07RKDK00-038	Baseline Contaminants in Sea Ducks	Expected	CCP / Objective 05.0.07	Multiple management units: On-refuge - Blue Fox Bay, Afognak and Uganik Island; Off-refuge - Chiniak Bay.	FWS: 0.08, Other: 0.06	\$50,376	August/Recurring -- every year	2012-2013	Robin Corcoran, Wildlife Biologist	(none)	Initial Survey Instructions

¹ The rank for each survey listed in order of priority (e.g., numeric, tiered, alpha-numeric, or combination of these).

² A unique identification number consisting of station organization code-sequential number-survey type code-start year.

³ Short titles for the survey name, preferably the same names in station work plans.

⁴ Surveys planned for the lifespan of this IMP (Current or Expected).

⁵ The management plan and objectives that justify the described survey.

⁶ Station management unit names, entire station, or names of other landscape units included in survey.

⁷ Estimates of Service (FWS) and non-Service (Other) staff time needed to complete the survey (1 work year = 2080 hours = 1 FTE).

⁸ Average annual operations costs for conducting the survey (e.g., equipment, contracts, travel) not including staff time.

⁹ Timing and frequency of survey field activities.

¹⁰ The years during which the survey has been or will be conducted.

¹¹ Name and position of the Survey Coordinator for each survey.

¹² Title, author, and version of the survey protocol (if there is no protocol to cite, enter None).

¹³ Stage of approval of the survey protocol (Initial Survey Instructions, In Development, In Review, or Approved).

Selected Research That Can be Conducted with Expected Additional Capacity

1. Bear-Salmon Interaction (FF07RKDK00-058)

1) What is the population or attribute of interest, what will be measured, and when?

This research will assess: (a) timing and abundance of sockeye salmon (*Oncorhynchus nerka*) runs on anadromous tributary streams and lake shoal spawning areas; and (b) movements, habitat use, and reproductive consequences of sockeye salmon utilization by female brown bear (*Ursus arctos middendorffii*). Fieldwork will be conducted during late spring-early fall in three watersheds of southwest Kodiak Island (Ayakulik, Frazer, Karluk).

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Survey results will support interim objectives: objective 2.9 (Assess brown bear-habitat relationships to increase understanding of habitat requirements and to improve capacity to manage bear habitat); subobjective 2.9.3 (Pyle et al. 2013): (Assess the relationship of variability of salmon spawning streams and lake shoal areas to bear movement, habitat use, and reproductive output); and subobjective 7.2 (Monitor salmon escapement in streams on the Refuge that are key seasonal feeding areas for brown bears and bald eagles and work collaboratively with ADF&G to maintain escapement levels that reflect wildlife needs).

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Maintaining a viable population of coastal brown bears is the primary founding purpose of Kodiak Refuge and a central Refuge goal (USFWS 2007). Coastal brown bear and sockeye salmon are designated “priority species” by the Service’s Alaska Region in the region encompassed by the Western Alaska LCC. The long-term viability of the Refuge bear population hinges upon its ability to consistently meet its requirements for primary food sources such as sockeye salmon. Wildlife managers with the Refuge and ADF&G have concluded that the recent declines in bear densities and productivity around Karluk Lake by up to 48% since 2003 were related mainly to the concurrent declines in escapement of sockeye salmon and production of elderberry and salmonberry. Results from this study will be used to assess the bear-sockeye salmon relationship, and to model the sockeye salmon requirement of the brown bear subpopulation that utilizes river basins of southwestern Kodiak Island.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Survey partners include University of Montana’s Flathead Lake Biological Research Station; University of Washington’s School of Aquatic and Fishery Science; and the University of Wyoming.

5) Protocol status?

The University of Montana, in cooperation with the Refuge, has produced two refereed research plans including site-specific research protocols (Deacy 2012, 2013).

2. Mountain Goat Resource Selection Patterns (FF07RKDK00-034)

1) What is the population or attribute of interest, what will be measured, and when?

This project will quantify multi-scale resource selection patterns of the introduced mountain goat (*Oreamnus americanus*) population on Kodiak Island. Specific components include: (a) dietary composition, food selection, and feeding site selection of nursery bands during late spring to mid-summer; and (b) movement and selection of habitats within seasonal home ranges.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Research results will specifically support accomplishment of objective 3.4 of the Refuge CCP. Research of goat resource selection directly addresses a range of Refuge goals including: increasing knowledge of fish and wildlife populations, their habitats, and their interrelationships (CCP goal 1); evaluating and reporting habitat use and preferences of mountain goats to improve understanding of goat influence on habitat conditions (CCP objective 3.4); and maintaining native plant populations, communities, and habitats (CCP goal 6). These goals, objectives, and concerns are additionally supported by the USFWS's overarching Biological Integrity, Diversity and Environmental Health policy.

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

Research results will be used to: (a) facilitate design and implementation of systematic monitoring of habitat condition and trend in selectively used foraging habitats; and (b) formulate and promote mitigation strategies to minimize impacts of non-native mountain goats on native flora. Eighteen mountain goats were introduced to Kodiak Island from the Kenai Peninsula, Alaska in 1952 and 1953, and the population has since followed an irruptive, exponential growth pattern typified by an ungulate population introduced to suitable habitat coupled with probable limited influences of severe weather and non-human predators in population regulation. Without proper, science-based management, the impacts of a high density population of introduced mountain goats on the vegetation of Kodiak are potentially significant.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

ADF&G and the USFWS Invasive Species program.

5) Protocol status?

The Refuge has approved a research plan that includes narrative, standard operating procedures, and an initial draft of site-specific research protocols (Cobb 2011).

3. Nesting Ecology of Kittlitz's Murrelet (FF07RKDK00-028)

1) What is the population or attribute of interest, what will be measured, and when?

This project quantifies the reproductive biology and nesting habitat selection of Kittlitz's murrelet (*Brachyramphus brevirostris*) between early June and late August in the Late-glacial Refugium area of southwestern Kodiak Island.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

Project results will facilitate accomplishment of objective 5.5 of the Refuge's CCP. Additionally, interim objective 5.3.1 was established to specifically address historic and continued monitoring of nesting ecology and reproductive success (Pyle et al 2013).

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

The Kittlitz's murrelet was classified as a candidate for federal listing under the Endangered Species Act due to its small worldwide population (<60,000 birds) coupled with evidence of recent (>1990) major declines in the size of subpopulations in the core of the species' range. Nesting ecology was one of three priority research needs identified by the Service's Endangered Species Division in 2008. However, most aspects of nesting ecology are undetermined because the species is rare, it nests solitarily in inaccessible terrain, and few nests have been found and studied. This project is one of only three studies in North America to collect nesting data on Kittlitz's murrelets, and it is the only one currently monitoring reproductive success. Results will provide information on adult behavior and habitat characteristics at successful and unsuccessful nests, which will help identify factors that may influence reproductive success, such as adult attendance patterns, chick feeding rates, composition of prey fed to chicks, and sources of nest failure. Additionally, results provide bases for modeling requirements for terrestrial nesting and marine foraging habitats. This study has been coordinated with companion studies of nesting ecology on Agattu Island (2008-2010), ongoing work on population genetics, ongoing surveys of pelagic distribution and abundance, and newly initiated studies of at-sea movements and migrations.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

The study is a collaborative effort involving the Service's Anchorage Fish and Wildlife Field Office (Ellen Lance), the USGS Alaska Science Center (John Piatt), the USGS Oregon Cooperative Fish and Wildlife Research Unit (Dan Roby), and the University of Southern Illinois's Department of Zoology (Jim Loworn). The study has supported two MS graduate students.

5) Protocol status?

The project has operated in accordance to study plans and protocols approved by the USGS (Byrd et al. 2008), the Service (Lance and Paitt 2009), and Oregon State University (Lawonn 2012). Additional protocol may be included in the future pending review and approval by the Service and its cooperators.

4. Baseline Contaminants in Sea Ducks (FF07RKDK00-038)

1) What is the population or attribute of interest, what will be measured, and when?

Resident populations of harlequin duck (*Histrionicus histrionicus*) and Barrow's goldeneye (*Bucephala islandica*). Selected contaminants such as mercury will be assayed from blood samples taken from molting adults caught in August 2012-13.

2) Which refuge management objective does the survey support? Is the objective derived from the CCP, interim objectives, an HMP, or other?

This project supports accomplishment of the Refuge's CCP objective 5.7. The Sea Duck Joint Venture Strategic Plan 2008-2012 lists documentation of the biological impact of contaminants as a major initiative (Sea Duck Joint Venture Management Board 2008).

3) Why is it important to conduct the survey? Describe how survey results will be used to make better informed refuge management decisions. If survey results are used to trigger a management response, identify the management response and threshold value for comparison to survey results.

This study provides baseline data on contaminant levels in selected, widely distributed, resident species of sea ducks of the Kodiak Archipelago. A long military history on Kodiak has resulted in a high number of contaminated sites, and heavy maritime traffic and seafood processing present a pollution risk from point-source discharges and spills. Addressing the lack of information about levels of contaminant exposure in sea ducks in North America is viewed as a primary need for conserving these species, according to the Sea Duck Joint Venture, a collective of individuals, corporations, conservation organizations, and government agencies. This study will provide baseline knowledge of contaminant levels, including spatial variation in levels, of harlequin duck and Barrow's goldeneye of the Kodiak Archipelago.

4) Is this a cooperative survey? If so, what partners are involved in the survey?

Funding for contaminants analysis provided by USFWS Region 7 Avian Health & Disease Program (2012) and Wildlife Management Institute (2013). Expertise and personnel for blood sampling provided by USFWS Fairbanks Fish & Wildlife Field Office Contaminants Branch (Chris Latty & Micah Miller).

5) Protocol status?

The Refuge has produced a narrative, standard operating procedures (SOPs), and site-specific research protocols (Taylor et al. 2012).

Non-selected Research

Fifteen research projects were not selected for implementation. Among these, 13 research projects were classified as “Future” because they will require additional Refuge and non-Refuge resources for completion. Any of these projects could be executed following establishment of the appropriate commitments and approvals, including approved amendments to this IMP. Two of the listed research projects were classified as “Historic” because they were recently completed.

Future (in order of priority)

- Bear-Habitat Interactions
- Photo-based Monitoring of Bear Viewing Sites
- Black Oystercatcher Nest Success and Winter Survival
- Berry Production Monitoring
- Marbled Murrelet Nesting Ecology
- Deer Resource Selection
- Deer Population Dynamics
- Seabirds as Indicators of Forage Fish Stocks
- Effects of Non-native Herbivores on Shrub and Sapling Trees
- Mountain Goat Winter Spatial Use Patterns
- Karluk Vegetation History
- Emperor Goose Winter Habitat Requirements and Mortality Factors
- Landcover Monitoring

Historic

- Bear Diet Assessment
- Bear Contaminants Assessment

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2. Appendices

Appendix A. SMART Tool Survey Prioritization Criteria

Thirteen criteria were selected and weighted by Kodiak Refuge staff, and then used to rank surveys through the SMART tool. Relative weights for each criterion are listed in parentheses after the bolded criteria names. Weights (in parenthesis) sum to 1.0 across all criteria. Higher value weights represent criteria that were considered more important.

Criteria	Station-specific Weight
Refuge purpose	0.14
Refuge priority	0.12
Threats and controversy	0.10
Relationship to management plan	0.07
Management utility (decision support) for Refuge	0.11
ESA species	0.05
Non-refuge FWS programs	0.03
FWS partners	0.05
Survey coverage	0.03
Survey extent	0.03
Protocol development	0.07
Survey breadth	0.08
Ecological role	0.12

- 1) **Refuge purpose and other legal mandates (0.135):** Does the survey provide information to evaluate if the station is achieving its purpose(s) or the purposes on the NWRS such as Biological Integrity, Diversity, and Environmental Health (BIDEH); NWR Resources of Concern (e.g., migratory birds, anadromous fishes, marine mammals); maintaining water rights; and compatibility of refuge uses especially wildlife-dependent recreation?

Note: In Alaska, Refuge purposes are generally those defined under ANILCA. A survey addressing wilderness character addresses purpose for a station with proposed or designed wilderness. Federally listed species are addressed under criterion #6 so they should not be considered as a NWR Resources of Concern under this criterion. For BIDEH, only consider surveys addressing the highest measure of biological integrity, which is viewed as those intact and self-sustaining habitats and wildlife populations existing during historic conditions (see 601 FW 3.10). Example 1: Because 80% of North American seabirds nest on Alaska Maritime NWR, they are a high priority resource for the refuge [ANILCA 303 (1)(B)(i)], the NWRS [NWRSIA Sec. 2. (3)], and the FWS. Example 2: Floristic surveys for community classification and measures of plant species diversity.

1. No
2. Other legal mandate
3. Refuge purpose
4. Refuge purpose and other legal mandate(s)

- 2) **Refuge priority (0.108):** Refuge priorities may include species, habitats, and species assemblages and are often addressed by high priority goals in the Refuge CCP.
Note: Alaska Refuges have recently spent a good deal of time identifying and documenting their priorities which can be used to identify the answers to this question.
1. No
 2. Yes
- 3) **Threats and controversy (0.095):** Does the survey support decision making to assess a suspected or known threat to refuge resources or a controversial refuge management action or refuge use?
Note: Examples of known or suspected threats and known controversial refuge management actions include mammalian predator control and use of pesticides. Examples of suspected or known controversial refuge uses (recreational and economic) can include closing or opening areas to sport hunting or livestock grazing. Threats may include invasive species and climate change; often these are tied to controversial actions.
1. No existing or potential threat or controversy
 2. Suspected threat and non-controversial
 3. Suspected threat and controversial
 4. Known threat and non-controversial
 5. Known threat and controversial
- 4) **Relationship to management plans (0.074):** How many station CCP or other management plan objectives can be evaluated by the survey?
Example 1: A survey of staff gauge readings for water levels in representative units can be used to evaluate a range of wetland habitat objectives including seasonal, emergent, and permanent types. Example 2: An Early Detection Rapid Response survey can be used to discover the presence of highly invasive plant species in multiple refuge habitats.
1. Does not address an objective
 2. Addresses 1 objective
 3. Addresses 2 objectives
 4. Addresses 3 or more objectives
- 5) **Management utility (decision support) for the refuge (0.122):** Does the survey provide data for recurring management decisions, especially as part of an existing decision framework that is implemented on a regular basis?
1. No set application for the refuge
 2. May have management implications, but they are not explicitly defined
 3. Have management implications, but no current decision framework
 4. Part of an existing management decision framework
- 6) **ESA (0.054):** Is the objective of the survey to assess status, trend, or requirements of a federally listed or candidate species under the ESA?
1. No

2. Yes, but off refuge lands
 3. Yes, on refuge lands
- 7) **Non-Refuge FWS programs (0.034):** Does the survey provide information that directly contributes to evaluating the status and trends of resources that are a priority for the NWRS or other Service regional or national program (e.g., Migratory Birds, Fisheries, Water Resources/Hydrology *other than ESA species*) or the Refuge I&M initiative (e.g., phenology, baseline inventories, water quality)?
- Example 1: North American Breeding Bird Survey, North American Amphibian Monitoring Program, Mid-Winter Waterfowl Survey, and Circumpolar Biodiversity Monitoring Network are priority surveys for regional or national FWS programs.*
1. Does not address a management priority identified by a FWS regional or national program or initiative
 2. Addresses a management priority identified by 1 FWS regional or national program or initiative
 3. Addresses a management priority identified by 2 FWS regional or national programs or initiatives
 4. Addresses a management priority identified by ≥ 3 FWS regional or national programs or initiatives
- 8) **FWS partners (0.047):** Does the survey address an identified priority of your Landscape Conservation Cooperative(s) (LCC), or an identified information need of state agencies, or other conservation partners?
1. Does not focus a management priority identified by FWS partners (e.g., LCC, state agency).
 2. Focus on a management priority identified by 1 FWS partner (e.g., LCC, state agency).
 3. Focus on a management priority identified by 2 FWS partners (e.g., LCC, state agency).
 4. Focus on a management priority identified by ≥ 3 FWS partners (e.g., LCC, state agency)
- 9) **Survey coverage (0.034):** What proportion (%) of the species' or subspecies' population or vegetation communities' geographic range under U.S. jurisdiction will be covered by the survey on the station?
- Example 1: 75% of Laysan Albatross population nest on Midway NWR. Conducting a survey to monitor the breeding population size on the refuge would cover >10% of the entire species' population and score 3.*
- Note: Surveys of abiotic factors affecting these species or vegetation communities should also be considered for this criterion. Example 2: 60% of the wintering waterfowl in the Pacific Flyway use wetlands in the Central Valley of California including the San Luis NWRC. Monitoring water levels by reading staff gauges weekly from October to March in managed wetlands is an important abiotic survey to indicate if there are sufficient acres of suitable foraging habitat to support 60% of the wintering waterfowl. Because water is essential to maintain refuge wetlands for wintering waterfowl, "survey coverage" would equate to waterfowl population surveys and score 3.*

1. Low: Survey covers <1% of the species' or communities' population/range
2. Medium: Survey covers 1-10% of the species' or communities' population/range
3. High: Survey covers ≥10% of the species' or communities' population/range

10) **Survey extent (0.034):** At what scale does the survey most benefit the science information needs required for resource management?

Note: Only surveys with a standard protocol and established systems of data management and analysis are scored higher than a 1. This criterion is applicable to surveys covering areas on and adjacent to the station. Example: If a refuge participates and contributes to a regional survey involving neighboring US Forest Service lands, then this criterion would apply.

1. Small scale: Applicable to only 1 refuge.
2. Medium scale: Applicable to a few refuges, a refuge complex, or includes the refuge and a small area beyond the refuge boundary.
3. Large scale: Applicable to multiple refuges/complexes across an entire ecoregion, LCC, or region.
4. Continental scale: Component of a large landscape level survey (e.g., North American Breeding Bird Survey, North American Amphibian Monitoring Program, and Circumpolar Biodiversity Monitoring Network).

11) **Protocol development (0.068):** At what stage of development is the survey protocol?

Note: The following The I&M initiative has a standardized format for survey protocols that contain 8 critical elements. A survey protocol that has the 8 elements and has been peer reviewed meet these criteria.

1. Survey has no written protocol or only initial survey instructions
2. The protocol is in development (draft)
3. The protocol is in formal review
4. There is an approved protocol, or published record of the protocol

12) **Survey breadth (0.081):**

1. single species or abiotic parameter
2. multi-species or multi-abiotic parameters
3. community – multi-trophic level or biotic and abiotic

13) **Ecological role? (0.115)** Does the survey address a key component of the ecosystem, such as a critical species or abiotic driver, such that alterations or fluctuations would have large effects on the system?

1. No
2. Yes

Appendix B. SMART Tool Prioritization Scores, Rankings, and Survey Selection

The following table lists values used to prioritize and select inventory and monitoring surveys likely to be conducted at Kodiak Refuge during the life of the IMP. Prioritization scores were generated for 30 candidate surveys by Refuge staff using 13 SMART tool criteria for each survey. Scores were then used as a starting reference to assign final priority and operation status of surveys. Current surveys could be completed if future program funding meets the average level received between 2010 and 2012, as nominally adjusted for inflation. One or more expected surveys could be completed if program funding exceeds the average level of funding received between 2010 and 2012. Future projects are least likely to be conducted because non-Refuge partners and support commitments have yet to be identified. Selected surveys (those with a status of “Current” or “Expected”) are shaded blue.

No.	Survey Name	SMART Tool Score	Survey Status ¹
1	Nearshore Marine Bird Survey	0.88	Current
2	Seabird Colony Survey	0.76	Current
3	Deer Harvest Survey	0.74	Current
4	Deer Population Monitoring	0.74	Current
5	Bear Abundance Monitoring	0.72	Current
6	Invasive Plant Survey	0.71	Current
7	Invasive Plant Monitoring	0.71	Current
8	Sea Otter Population Monitoring	0.68	Current
9	Bear Mortality Assessment	0.65	Current
10	Bear Composition Monitoring	0.65	Current
11	Migratory Bird Subsistence Harvest Survey	0.59	Current
12	Aquatic Invasive Species Monitoring	0.58	Current
13	Bald Eagle Coastal Breeding Population Survey	0.57	Current
14	Mountain Goat Population Monitoring	0.55	Current
15	Wintering Steller's Eider Aerial Survey	0.55	Current
16	Moored All-season Temperature Arrays	0.53	Current
17	River Temperature Monitoring	0.47	Expected
18	Sea Duck Banding/Survival	0.46	Current
19	Breeding Bird Survey	0.45	Expected
20	Monitoring Avian Productivity and Survivorship (MAPS)	0.45	Expected
21	Alaska Landbird Monitoring Survey (ALMS)	0.44	Expected
22	Reindeer Population Monitoring	0.38	Current
23	Christmas Bird Count	0.36	Expected

No.	Survey Name	SMART Tool Score	Survey Status¹
24	Barrow's Goldeneye Nest Box Study	0.35	Expected
25	Bison Distribution Monitoring	0.30	Expected
26	Weather Station Vegetation Monitoring	0.24	Expected
27	Beaver Population Monitoring	0.23	Future
28	Plant Survey	0.19	Expected
29	River Otter Harvest Survey	0.12	Future
30	River Otter Population Monitoring	0.12	Future

¹*Current*: High priority surveys that could be accomplished if future funding corresponds to the 3-year average (2010 – 2012) Kodiak Refuge biological program budget.

Expected: Surveys that are anticipated to be completed over the timespan of the IMP, but require the continued collaborative support of the Refuge's partners.

Future: Existing and new surveys that generally ranked as a lower priority and would require additional support of the Refuge's partners for completion.

Appendix C. SMART Tool Prioritization, Scores, and Research Project Selection

The following table lists values used to prioritize and select research projects likely to be conducted at Kodiak Refuge during the life of the IMP. Prioritization scores were generated for 17 projects and by Refuge staff using 13 SMART tool criteria for each research project. Scores were then used as a starting reference to assign the surveys into one of three status classes. Current projects could be completed primarily with Refuge funding over the course of this IMP. Expected projects were likely to be conducted because there is a reasonably high chance that non-Refuge partners will maintain and/or expand their (personnel and funding) support commitments. Future projects were those least likely to be conducted because non-Refuge partners and support commitments have yet to be identified. Selected research projects (those with a status of “Expected”) are shaded blue.

No.	Research Project Name	SMART Tool	
		Score	Status ¹
1	Bear-Habitat Interactions	0.76	Future
2	Bear-Salmon Interactions	0.74	Expected
3	Photo-based Monitoring of Bear Viewing Sites	0.67	Future
4	Black Oystercatcher Nest Success and Winter Survival	0.66	Future
5	Berry Production Monitoring	0.65	Future
6	Marbled Murrelet Nesting Ecology Study	0.64	Future
7	Deer Population Dynamics	0.62	Future
8	Deer Resource Selection	0.62	Future
9	Seabirds as Indicators of Forage Fish Stocks	0.61	Future
10	Nesting Ecology of Kittlitz's Murrelets	0.61	Expected
11	Mountain Goat Resource Selection Patterns	0.55	Expected
12	Effects of Non-native Herbivores on Shrub and Sampling Trees	0.52	Future
13	Karluk Vegetation History	0.50	Future
14	Mountain Goat Winter Spatial Use Patterns	0.50	Future
15	Emperor Goose Winter Habitat Requirements and Mortality Factors	0.49	Future
16	Baseline Contaminants in Sea Ducks	0.42	Expected
17	Landcover Monitoring	0.35	Future

¹*Expected*: Research that is anticipated to be completed over the timespan of the IMP, but requires the continued collaborative support of the Refuge’s partners.

Future: Existing and new research that ranked as a lower priority and would require additional collaborative support of the Refuge’s partners for completion.

Appendix D. Estimated Monthly Schedule for Selected Current and Expected Inventory and Monitoring Surveys.

Survey Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Bear Abundance Monitoring		P	P	P	FW, DE	A, R						
Bear Mortality Assessment	DE, A, R			DE	DE					DE	DE	DE, A, R
Bear Composition Monitoring	P, A, R	P	P	P	P		FW, DE	FW, DE	FW, DE		A, R	A, R
Nearshore Marine Bird Monitoring	P	P	P	P	P, T	T, FW	A	FW	A, R	A, R	A, R	A, R
Seabird Colony Survey ¹	P	P	P	P	P, T	T, FW	A	FW	A, R	A, R	A, R	A, R
Mountain Goat Population Monitoring					P	P	P	FW	DE, A, R			
Deer Population Monitoring			P	P	FW, DE	A	A	A	R			
Deer Harvest Survey	DE	DE	A, R							DE	DE	DE
Invasive Plant Survey	P			P	P	FW	FW	FW	DE	A	R	
Invasive Plant Monitoring	P			P	P	FW	FW	FW	DE	A	R	
Sea Otter Population Monitoring	P	P	P	P	P	P	P	T, FW	FW, DE	A	A, R	R
Migratory Bird Subsistence Harvest Survey ¹	P	P	FW	FW			FW		FW	FW		P
Aquatic Invasive Species Monitoring ¹	P					P	FW	FW	FW	DE, A	A	R
Bald Eagle Coastal Breeding Population Survey	P		P	FW, DE							A	R
Wintering Steller's Eider Aerial Survey ¹		FW	DE, A	A, R								P

Appendix D. (Continued)

Survey Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Moored All-season Temperature Arrays	P			P	FW, DE				P	FW, DE	A	R
Sea Duck Banding							P	FW	DE		A	A, R
Reindeer Population Monitoring					P	FW, DE	A	R				
River Temperature Monitoring	P			P	FW, DE			P	FW, DE	A, R	R	
Weather Station Vegetation Monitoring	P	P				P	FW, DE	FW, DE	DE, A, R	A, R	R	
Plant Survey	P					P	FW	FW	DE	A	A, R	R
Barrow's Goldeneye Nest Box Study				P, FW			P, FW	FW, DE		A	R	
Bison Distribution Monitoring	FW, DE	FW, DE	FW, DE	FW, DE								FW, DE
Breeding Bird Survey					P	FW, DE						
Monitoring Avian Productivity and Survivorship (MAPS)					P	FW, DE	FW, DE	FW, DE				
Alaska Landbird Monitoring Survey (ALMS)					P	FW, DE						
Christmas Bird Count												P, FW, DE

P=Planning, T=Training, FW=Field Work, DE=Data Entry, A=Analysis, R=Reporting

¹Periodic (i.e., every 5-10 years)

Appendix E. Estimated Annual Survey Costs.**(A) Current Surveys**

Survey Name	Survey Priority	Staff Time, FWS (hrs) ¹	FWS Staff Total (\$) ²	Volunteer Time (hrs)	Operations Cost (\$) ³	Total Cost
Bear Abundance Monitoring	1.01	188	\$9,099	0	\$12,240	\$21,339
Bear Mortality Assessment	1.02	40	\$1,853	0	\$0	\$1,853
Bear Composition Monitoring	1.03	174	\$8,510	0	\$12,600	\$21,110
Nearshore Marine Bird Monitoring	1.04	650	\$24,299	866	\$30,390	\$54,689
Seabird Colony Survey	1.05	348	\$13,060	336	\$13,240	\$26,300
Mountain Goat Population Monitoring	1.06	80	\$3,366	0	\$6,400	\$9,766
Deer Population Monitoring	1.07	172	\$6,556	0	\$6,800	\$13,356
Deer Harvest Survey	1.08	18	\$616	0	\$616	\$1,232
Invasive Plant Survey	1.09	205	\$9,357	780	\$11,700	\$21,057
Invasive Plant Monitoring	1.10	102	\$4,857	32	\$2,637	\$7,494
Sea Otter Population Monitoring	1.11	280	\$10,763	0	\$12,500	\$23,263
Migratory Bird Subsistence Harvest Survey ⁴	1.12	428	\$10,554	0	\$2,412	\$12,966
Aquatic Invasive Species Monitoring ⁴	1.13	179.2	\$9,163	68	\$7,684	\$16,847
Bald Eagle Coastal Breeding Population Survey	1.14	54	\$2,424	0	\$8,400	\$10,824
Wintering Steller's Eider Aerial Survey	1.15	88	\$3,699	0	\$6,300	\$9,999
Moored All-season Temperature Arrays	1.16	87.2	\$4,574	32	\$6,433	\$11,007
Sea Duck Banding	1.17	148	\$5,611	150	\$3,840	\$9,451
Reindeer Population Monitoring	1.18	46	\$1,889	0	\$3,300	\$5,189

¹ Includes permanent and seasonal Service (FWS) staff time² Computed by dividing annual salary costs by 2080 (hrs worked/year)³ Includes transportation costs (Husky = \$200/hr; Beaver = \$420/hr), field equipment and any other estimated costs⁴ Periodic (i.e., every 5-10 years)

Appendix E (cont.)

(B) Expected Surveys

Survey Name	Survey Priority	Staff Time, FWS (hrs) ¹	FWS Staff Total (\$) ²	Volunteer Time (hrs)	Operations Cost (\$) ³	Total Cost
River Temperature Monitoring	2.01	90.6	\$4,772	24	\$2,381	\$7,153
Weather Station Vegetation Monitoring	2.02	74	\$3,871	0	\$4,349	\$8,220
Plant Survey	2.03	113	\$5,877	0	\$0	\$5,877
Barrow's Goldeneye Nest Box Study	2.04	4	\$158	80	\$70	\$228
Bison Distribution Monitoring	2.05	13	\$504	0	\$600	\$1,104
Breeding Bird Survey	2.06	6	\$238	64	\$100	\$338
Monitoring Avian Productivity and Survivorship (MAPS)	2.07	90	\$3,565	300	\$450	\$4,015
Alaska Landbird Monitoring Survey (ALMS)	2.08	11.5	\$477	64	\$790	\$1,267
Christmas Bird Count	2.09	32	\$1,427	0	\$200	\$1,627

¹ Includes permanent and seasonal Service (FWS) staff time

² Computed by dividing annual salary costs by 2080 (hrs worked/year)

³ Includes transportation costs (Husky = \$200/hr; Beaver = \$420/hr), field equipment and any other estimated costs

Appendix E (cont.).

(C) Expected Research

Survey Name	Survey Priority	Staff Time, FWS (hrs) ¹	FWS Staff Total (\$) ²	Staff Time, Other (hrs) ³	Other Staff Total (\$) ²	Volunteer Time (hrs)	Operations Cost (\$) ⁴	Total Cost
Bear-Salmon Interactions	1.01	350	\$16,663	640	\$11,122	1,480	\$45,420	\$73,205
Mountain Goat Resource Selection	1.02	262	\$10,147	0	\$0	80	\$58,000	\$68,147
Nesting Ecology of Kittlitz's Murrelet	1.03	948	\$20,399	0	\$0	2,400	\$35,195	\$55,594
Baseline Contaminants in Sea Ducks	1.05	170	\$7,302	0	\$0	124	\$43,074	\$50,376

¹ Includes permanent and seasonal FWS staff time

² Computed by dividing annual salary costs by 2080 (hrs worked/year)

³ Partners, including university graduate students and state employees

⁴ Includes transportation costs (Husky = \$200/hr; Beaver = \$420/hr), field equipment and any other estimated costs

Appendix E (cont.).

(D) Future Research

Survey Name	Survey Priority	Staff Time, FWS (hrs) ¹	FWS Staff Total (\$) ²	Staff Time, Other (hrs) ³	Other Staff Total (\$) ²	Volunteer Time (hrs)	Operations Cost (\$) ⁴	Total Cost
Bear-Habitat Interactions	2.01	320	\$15,048	0	\$0	300	\$60,000	\$75,048
Photo-based Monitoring of Bear Viewing Sites	2.02	87	\$4,105	77	\$3,465	0	\$6,500	\$14,070
Black Oystercatcher Nest Success and Winter Survival	2.03	1,174	\$30,546	1,600	\$0	0	\$40,790	\$71,336
Berry Production Monitoring	2.04	94	\$4,429	520	\$13,560	640	\$39,600	\$57,589
Marbled Murrelet Nesting Ecology	2.05	478	\$15,453	0	\$0	900	\$47,210	\$62,663
Deer Resource Selection	2.06	338	\$12,357	0	\$0	80	\$43,200	\$55,557
Deer Population Dynamics	2.07	406	\$14,097	0	\$0	304	\$17,160	\$31,257
Seabirds as Indicators of Forage Fish Stocks	2.08	178	\$6,800	0	\$0	100	\$4,650	\$11,450
Effects of Non-native Herbivores on Shrub and Sapling Trees	2.09	420	\$14,577	0	\$0	120	\$14,200	\$28,777
Mountain Goat Winter Spatial Use Patterns	2.10	240	\$8,218	0	\$0	540	\$19,000	\$27,218
Karluk Vegetation History	2.11	24	\$1,248	0	\$0	0	\$5,906	\$7,154
Emperor Goose Winter Habitat Requirements and Mortality Factors	2.12	477	\$18,748	0	\$0	100	\$28,800	\$47,548
Landcover Monitoring	2.13	64	\$3,329	0	\$0	0	\$50,000	\$53,329

¹ Includes permanent and seasonal Service (FWS) staff time

² Computed by dividing annual salary costs by 2080 (hrs worked/year)

³ Partners, including university graduate students and state employees

⁴ Includes transportation costs (Husky = \$200/hr; Beaver = \$420/hr), field equipment and any other estimated costs

Appendix F. Data Management.

Overview

Although currently lacking, there is a recognized need for a coordinated system and framework for biological data management at the refuge, region, and national levels. Various actions have and will be taken by the National Office requiring systematic establishment and maintenance of coordinated system and frameworks for management of Refuge biological data. Two factors compelling these changes include Executive Order 13642 of 2013, which requires improved data accessibility to the public, and efforts by the Service's Inventory and Monitoring Initiative geared to develop policies and frameworks to address the Executive Order and organizational needs.

Current system

In the meantime, the Refuge uses the following ad-hoc approach for management of biological data. Each of the four wildlife biologists is responsible for management of an array of current and historical surveys within their respective subprogram area. Surveys dating from the late-1990s contain a combination of paper and electronic data forms, paper and digital data, and digital relational databases. Responsibilities include: data record storage, management, security, and archiving. Paper records are organized and stored within file cabinets in biologists' offices. Correspondingly electronic data and databases are primarily stored on PC hard drives in biologists' offices. To facilitate security, data are copied from PC hard drives to external hard drives on a monthly or more frequent basis. External drives are stored in cabinet or drawer (but not fireproof) in each of the offices. With few exceptions, data are archived in external drives. Data generated by historical surveys are archived on appropriately labeled PC hard drives or external drives, and stored in a cabinet or drawer in each of the offices. Some data, databases and additional archival records have been copied to a hard drive on the Refuge's intranet server. Records housed in the server drive are automatically backed-up on a weekly basis.

Databases

Most current and historic Refuge survey data are stored as MS Excel tables. For several recently initiated biological monitoring and research projects, biologists have established MS Access databases and R projects. In other cases, biologists sought technical support from data managers affiliated with the Service's Inventory and Monitoring Initiative (for surveys) and from graduate research assistants (for research projects) to create MS Access databases.

GIS

Most Refuge biological projects produce spatial data and rely on additional spatial datasets such as orthoimagery, habitat cover, and land ownership status. These data are managed independently by biologists consistent with their other electronic data records. In 2001, the Refuge established an ad hoc spatial data management structure on the Refuge's server drive to store spatial data and standardize its organization and accessibility. This structure has become outdated over time (i.e., minimal conversion to geodatabases), which has increasingly impeded users' abilities to organize and access Refuge spatial data. A primary factor that has limited data accessibility is the absence of sufficient server capacity, either separated from the Refuge server or integrated within the main Refuge server, to centrally store and rapidly transfer data among

users. Consequently, biologists currently store individual copies of relevant spatial data on their office computers and backup drives.

Action Items

Refuge staff will take the following steps to improve data management:

1. Ensure that all data (or at least a class of similar data sets) have documentation that comply with a minimum metadata standard.

A key component of any data management system is good documentation of data and procedures. In order to enable compliance with the open data policies, all data sets will be using the parameters described in our basic metadata form (http://ifw7fair-web/im/fw7_metadata_form.pdf). This will ensure compliance with the "Common Core Metadata" (<http://project-open-data.github.io/schema/>) requirements of the open data policy.

2. Ensure all backups and working file system structures are documented.

In addition to regularly backing up data, Refuge biologists will also document how the file structures are organized. This will include a description of the projects that are on each hard drive, where the drives are located, and a description of the data that have been collected by each project. The goal is to generate a document that would allow any new or existing Refuge staff to know exactly where to find historic data and its associated metadata.