Species Management Report and Plan ADF&G/DWC/SMR&P–2020–6

Deer Management Report and Plan, Game Management Unit 8:

Report Period 1 July 2011–30 June 2016, and

Plan Period 1 July 2016–30 June 2021

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Alaska Department of Fish and Game Division of Wildlife Conservation

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Species management reports and plans provide information about species that are hunted or trapped and management actions, goals, recommendations for those species, and plans for data collection. Detailed information is prepared for each species every 5 years by the area management biologist for game management units in their areas, who also develops a plan for data collection and species management for the next 5 years. This type of report is not produced for species that are not managed for hunting or trapping or for areas where there is no current or anticipated activity. Unit reports are reviewed and approved for publication by regional management coordinators and are available to the public via the Alaska Department of Fish and Game's public website.

This species management report and plan was reviewed and approved for publication by Cynthia Wardlow, Management Coordinator for Region II for the Division of Wildlife Conservation.

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Purpose of this Report

This report provides a record of survey and inventory management activities for Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) in Unit 8 for the 5 regulatory years 2011–2015 and plans for survey and inventory management activities in the following 5 regulatory years, 2016–2020. A regulatory year (RY) begins 1 July and ends 30 June (e.g., RY11 = 1 July 2011–30 June 2012). This report is produced primarily to provide agency staff with data and analysis to help guide and record the agency's own efforts; it is also provided to the public to inform it of wildlife management activities. The Alaska Department of Fish and Game, (ADF&G) Division of Wildlife Conservation (DWC) launched this type of 5-year report in 2016 to more efficiently report on trends and describe potential changes in data collection activities. It replaces the Sitka black-tailed deer management report of survey and inventory activities that was previously produced every 2 years.

I. RY11–RY15 Management Report

Management Area

Game Management Unit 8 (GMU 8; 5,097 mi^2, Fig. 1) is located in the Kodiak Archipelago in the Gulf of Alaska. It comprises all islands southeast of the centerline of Shelikof Strait, including Kodiak, Afognak, Whale, Raspberry, Shuyak, Spruce, Marmot, Sitkalidak, Amook, Uganik and Chirikof islands, the Trinity Islands, the Semidi Islands, the Barren Islands, and other adjacent islands and all seaward waters and lands within 3 miles of these coastlines. The archipelago is approximately 177 miles long and 50 miles wide consisting of a rugged, fjord-carved landscape with elevations ranging from sea level to approximately 4,500'. The archipelago has a wet maritime climate with little seasonal temperature variation and abundant precipitation. Vegetation composition varies throughout the archipelago and is highly influenced by past glaciation (Barnes 2005).

There are 3 primary ecological regions comprising the archipelago: the Sitka spruce region, the central ecological region, and the southern ecological region (Fleming and Spencer 2006). The Sitka spruce region encompasses northeastern Kodiak Island and includes Afognak and Shuyak Islands. The lower elevations in this region are comprised primarily of Sitka spruce (*Picea stichensis*) with a dominant understory consisting of salmonberry (*Rubus spectabilis*), devils club (*Echinopanax horridum*), cow parsnip (*Heracleum lanatum*), ferns (*Athrium* spp.) and high-bush blueberry (*Vaccinium ovalifolium*) with dispersed pockets of elderberry (*Sambucus racemosa*). Other plant communities in this region include forb-grass meadows containing willow (*Salix* spp.), birch (*Betula kenaica*), and alder (*Alnus crispa sinuata*). Much of Kodiak Island is classified as the central ecological region and is dominated by rugged, mountainous topography with steep ravines, deep valleys, and fast-moving glacial streams and rivers. Bands of deciduous forests comprised of willow, birch, cottonwood, and alder can be found in lowland areas along rivers and streams. Similar to the Sitka spruce region, salmonberry, ferns, cow parsnip, blueberry, and fireweed (*Epilobium angustifolium*) along with various grass and forb assemblages cover much of the landscape. At the higher elevations, plant communities include alpine forb meadows and alpine tundra. Alpine forb meadows consist of sedges (*Carex* spp.), lupine (*Lupinus nootkatensis*), and Indian paintbrush (*Caltilleja unalalaschensis*), while the alpine tundra is comprised of crowberry (*Empetrum nigrum*), partridgefoot (*Luetkea pectinata*), alpine blueberry (*Vaccinium uliginosum*), various lichens (*Cladina* spp., *Cetraria* spp.) and dwarf shrubs. The southern ecological region encompasses the glacial refugium and sub-arctic heath lands (Fleming and Spencer 2006) and consists of crowberry, dwarf willow (*Salix* spp.), fireweed. blueberry, cranberry (*Vaccinium vitis-idaea*), goldenrod (*Solidago lepida*), Labrador tea (*Ledum palustre*), kinnikinnik (*Arctostaphyos uva-ursi*) and various forbs and mosses (Fleming and Spencer 2006).

The Kodiak Road System Management Area is contained within GMU 8 and only includes portions of the main island comprising that portion of Kodiak Island north of a line from the head of Settlers Cove (including Peregrebni Point) to Crescent Lake (57°52′N, 152°08′W) and east of a line from the outlet of Crescent Lake to Mount Ellison Peak and from Mount Ellison Peak to Pokati Point at Whale Passage, and that portion of Kodiak Island east of a line from the mouth of Saltery Creek to the mouth of Elbow Creek and adjacent small islands in Chiniak Bay.

Summary of Status, Trend, Management Activities, and History of Deer in Unit 8

The Sitka black-tailed deer population in Unit 8 likely originated from 3 transplants between 1924 and 1934, totaling 25 deer (Paul 2009). In May 1923, the U.S. Secretary of Agriculture authorized the first transplant of deer to Kodiak and the project commenced the following year when 14 animals were captured near Sitka and released on Long Island just east of what is now the city of Kodiak. Soon after the Alaska Game Commission was established in 1925 it endorsed the project and adopted regulations to protect the newly established population. In 1930, 2 additional deer were captured from Prince of Wales Island and released on Long Island. There was, however, little movement from Long Island to Kodiak, as noted in a March 1931 report from the Alaska Game Commission to the legislature stating only 3 does and 2 bucks had been observed on Kodiak Island (Burris and McKnight 1973). Due to the lack of movement of deer from Long Island to Kodiak Island, transplant efforts were renewed in 1934 and 9 deer were captured in the Rocky Pass area near Petersburg and released on Kodiak.

Other evidence, however, suggests deer have been on the archipelago since at least the beginning of the twentieth century. A letter dated 15 March 1919 (ADF&G files, Kodiak Area Office) from the Office of the U.S. Marshal to the Alaska Territorial Governor states, "The Alaska Commercial Company planted some deer on Kodiak Island some 20 years ago, and up to the time of the Katmai eruption [1912] they were increasing very nicely…" The correspondence noted that ash from the eruption had decimated the deer population on Kodiak, and hunters had killed all the deer on Long Island. A note from the U.S. Department of Agriculture to the governor on 26 April 1919 states "I note your request that protection be continued on deer on Kodiak and Long Islands and will reinsert this in the regulations." We have not found any further information on the date, source, or size of this "original" transplant of deer to Kodiak.

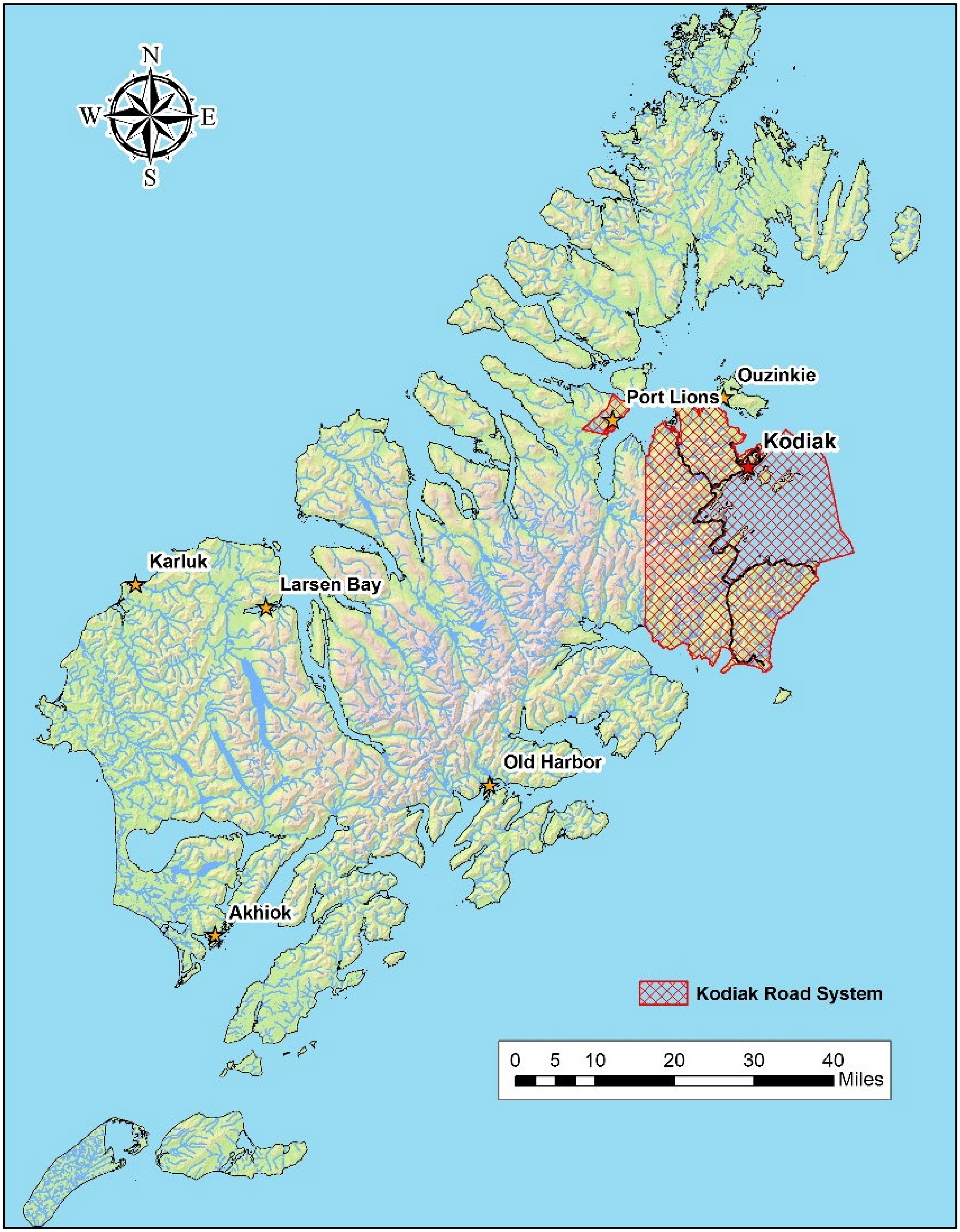

Figure 1. A map showing most of Game Management Unit 8, Kodiak Archipelago, Alaska.

By the early 1940s deer were abundant on Long Island and occupied northeastern Kodiak Island (Van Daele et al. 2013). In 1950 they were a common sight near Kodiak city, and the first officially sanctioned hunt was held in 1953 (Burris and McKnight 1973). The deer population continued to expand into unoccupied habitats, and by the late 1960s, deer had dispersed throughout Kodiak, Afognak, and adjacent islands (Smith 1979). The expansion of deer on the southern part of Kodiak Island continued for the next several decades, eventually allowing population expansion to Sitkinak and Tugidak islands in the early 1980s.

Winter mortality proved to be the most significant factor limiting the deer population. Deer herds suffered high mortality during the 1968–1969 and 1970–1971 winters, causing declines in harvests and hunter success (Alexander 1970, 1973). The population rebounded from 1972 to the mid-1980s, when it reached peak numbers, exceeding 100,000 animals unitwide (Smith 1989). Severe winter conditions prevailed from 1987 through 1992, and deer in the northern part of the archipelago were hit especially hard. There was a short reprieve from 1993 to 1996, but populations declined again in 1997. During the winter of 1998–1999 the Unit 8 deer population declined precipitously (Van Daele 2003). The 5 successive winters, 1999–2000 through 2005–2006, were relatively mild. Harsh winter weather returned in 2006–2007 and 2008–2009, along with increased deer mortality. Mild winters were observed during 2009–2010 through 2010–2011. The winter of 2011–2012 was again harsh and an estimated 40% of the deer herd perished, due in part to record snowfall conditions. Temperate winters continued for the next 3 years (2012–2013 through 2014–2015), allowing the deer population to recover. Not until the winter of 2015–2016 was the deer population again negatively impacted by severe winter conditions.

Deer have become an important resource for residents of and visitors to the Kodiak Archipelago. Venison has surpassed marine mammals as a primary source of mammalian protein for villagers, and income generated from services provided to deer hunters is a major factor in the local economy. Despite the significance of this resource, we have not yet developed an objective method of measuring the population size or density. Annual hunter harvest surveys have been used to assess trends in the deer population since 1989. We assessed winter mortality by searching for and examining deer carcasses in selected coastal wintering areas and periodically used aerial surveys to assess winter conditions and physical appearance of deer. From 1990 through 1998 the U.S. Fish and Wildlife Service (USFWS) experimented with various aerial and ground surveys to monitor deer population trends on the Kodiak National Wildlife Refuge (NWR; Zwiefelhofer and Stovall 1992). Refuge staff also experimented with browse transects, Forward Looking Infrared Radar (FLIR), and range exclosures to investigate deer population trends. Most recently, NWR staff has attempted to obtain a population estimate for deer in non-forested habitats of the island, specifically in the Olga flats and Ayakulik areas and along the Aliulik Peninsula, using aerial mark-recapture distance sampling techniques (Cobb 2014).

Seasons and bag limits were liberal during the past 3 decades. Seasons ranged from 153 to 184 days, and bag limits ranged from 3 bucks to 7 deer. Most regulatory changes were initiated in response to perceived population trends and hunting effort. The unit typically has been divided into 2 or 3 hunt areas. The road systems emanating from Kodiak city and Port Lions have had the most restrictive regulations, while more remote areas have been more liberal. Gender restrictions are usually predicated on protecting maternal does while their fawns are still dependent on them or restricting doe harvests during times when the population is recovering from declines. Because of the subjective nature of much of the data used in deer management, close cooperation between the Alaska Department of Fish and Game (ADF&G), USFWS, the Kodiak Fish and Game Advisory Committee, and the general public is critical.

Management Direction

Existing Wildlife Management Plans

Unit 8 deer were not addressed in the 1976 Southcentral Alaska wildlife management plans developed by the department and adopted by the Alaska Board of Game (ADF&G 1976), and no other specific and separate formal plan has previously been developed. However, management direction and objectives for the Unit 8 deer population have been informed and revised based on public input and Alaska Board of Game action; these have been reported in previous management reports.

Goals

No goals specific to Unit 8 deer had been formally reported prior to this report. However, management of deer statewide, including in Unit 8, has always been based on Article 8 of Alaska's state constitution, which directs that wildlife will be utilized, developed, and maintained on the sustained yield principle. Deer in Unit 8 have been managed to maintain a population of 70,000–75,000 deer with an annual harvest of 8,000 – 8,500 deer as outlined in 5 AAC 92.108.

Codified Objectives

Amounts Reasonably Necessary for Subsistence Uses

In January 1993 the Alaska Board of Game made a positive customary use determination for deer in Unit and set the amounts reasonably necessary for subsistence uses at 3,600–4,100 deer unitwide.

Intensive Management

At its March 1999 meeting, the Board of Game identified the Sitka black-tailed deer population on Kodiak Archipelago as being important for providing high levels of harvest for human consumptive use under 5 AAC 92.106 and established deer in Unit 8 as an intensive management species. Intensive management objectives established by the Alaska Board of Game (5 AAC 92.108) were set as follows:

- Population objective: 70,000–75,000
- Harvest objective: 8,000–8,500

Management Objectives

The current management objectives are the codified objectives listed above.

MANAGEMENT ACTIVITIES

Methods for data collection and results for all activities during RY10–RY12 are explained in Van Daele, Svoboda, and Crye (2013), and for RY13–RY15 in Svoboda and Crye (2015).

1. Population Status and Trend

No activities to assess or monitor deer population status or trend were undertaken during RY11–RY15.

Data Needs

Reliable methods are needed to determine the current population status and assess fluctuations in population trends and demographics. Obtaining consistent monitoring methods will ensure management goals are being obtained and managers can set sustainable harvest levels to maintain a healthy, viable deer population that meets the subsistence needs of the community.

Recommendations

Design and implementation of a reliable technique to determine deer population status is essential. A robust method for gathering information on population demographics, including gender, age structure and survival would be useful and provide ADF&G a tool to monitor population fluctuations and annual survival.

2. Mortality–Harvest Monitoring and Regulations

ACTIVITY 2.1. Conduct deer coastal mortality surveys each spring.

Data Needs

Sitka black-tailed deer are considered an Intensive Management (IM) species necessary for subsistence purposes; therefore, it is necessary to determine annual and seasonal mortality throughout the archipelago to assess whether a sufficient population exists to support subsistence harvest. Coastal mortality surveys provide a relative index of deer mortality on different sections of the archipelago. However, current methods to determine archipelago-wide mortality are not sufficient to provide conclusive findings, so alternative methods are currently being explored.

Methods

Coastal deer mortality transects were established in 1992 in areas having increased deer concentration during the winter and early spring months. Transects comprise the area from the high tide line to approximately 200 meters inland from the high tide mark, and extend distances ranging 1.6–7.8 km (1.0–4.8 miles) in length depending on habitat type and terrain. The 3 primary index areas include Chief Cove (CCN/CCS), North Sitkalidak Strait (NSS), and West Olga Bay (OGB); however, beginning in RY12 only Chief Cove (CCN/CCS) was surveyed and reported. Observers were transported to survey sites by local air taxi operators.

Mortality survey routes were walked by a 2-person observer team. Both observers walked parallel transects while searching for deer carcasses. Observer 1 navigated the predetermined route traveling parallel to the shoreline and maintaining a distance of 30 m (~100 ft) from the high-water line. The second observer walked parallel to Observer 1, approximately 30 m (100 ft) inland although vegetation and terrain often resulted in variations in the distance separating observers. When observers reached the end of each transect, they turned around, readjusted their positioning to cover a new area within the transect boundary, and returned toward the initial starting point, making sure to cover a new portion of transect on their return. A carcass determined to have died the previous winter or in early spring was enumerated and a GPS waypoint was recorded. Deer carcasses were identified using remains including bones, hair, and tissue. A carcass determined to be older than one year was not included in mortality estimates and was visually differentiated from recent carcasses using various physical and environmental characteristics (e.g., moss growth, bleached bones, leaf litter).

Information on each carcass was collected and included: GPS coordinates, distance from beach, general appearance, sex and age when possible, and bone marrow coloration and consistency. Bone marrow condition was indexed to estimate the nutritional condition prior to death (Cheatum 1949). The overall size of the pelvic girdle was used to differentiate between fawn and adult age classes. When possible, a yearling age class was estimated from lower jawbone tooth eruption and wear (Severinghaus 1949).

Weather data recorded for each survey and summarized by year (Figs. 2 and 3) were compiled from the National Weather Service weather station at the Kodiak State Airport.

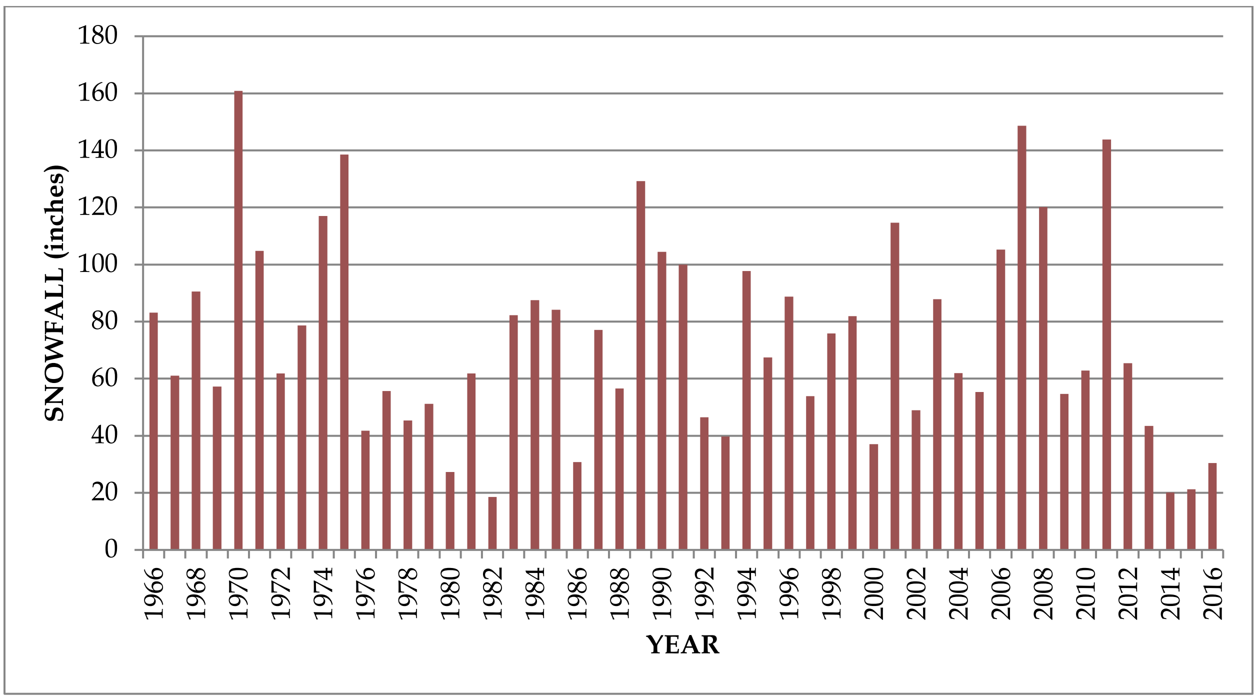

Figure 2. Total annual snowfall 1966–2016 for Kodiak Island, Alaska.

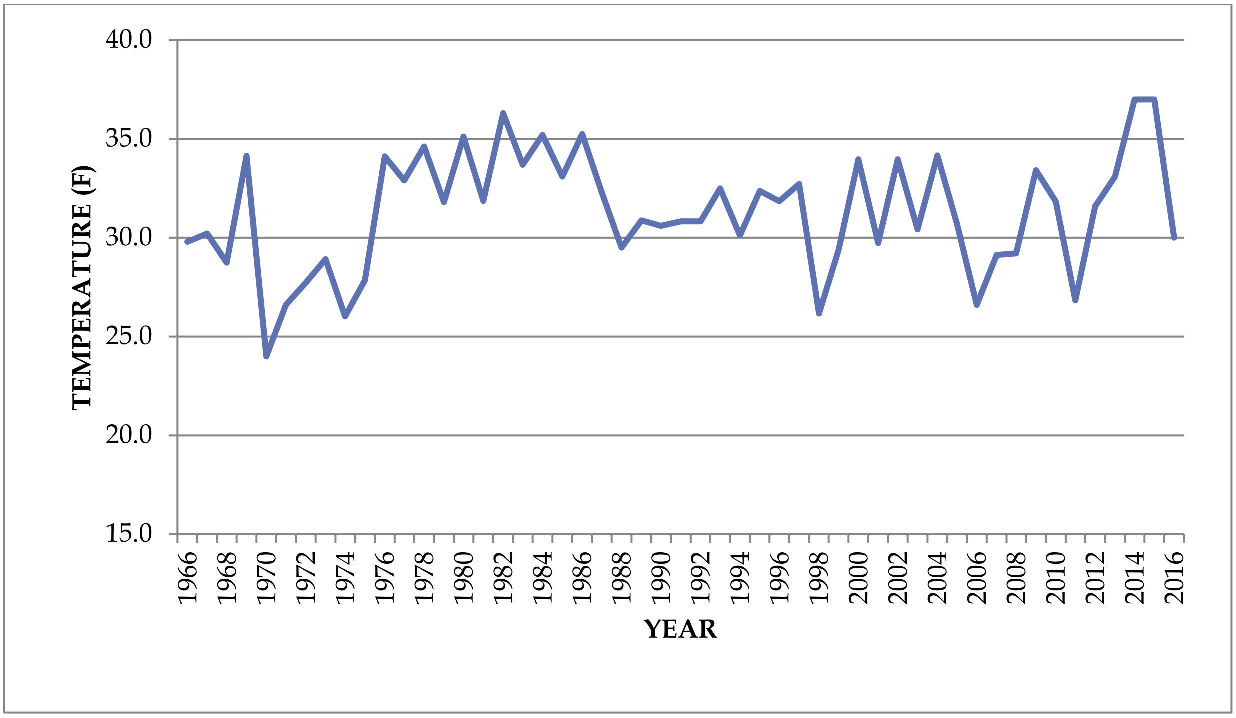

Figure 3. Mean winter (December–March) temperature 1966–2016 for Kodiak Island, Alaska.

Results and Discussion

Results for coastal deer mortality surveys during regulatory year 2010, regulatory years 2011 and 2012, and regulatory year 2013 are included in Van Daele and Crye (2011); Van Daele, Svoboda, and Crye (2013); and Svoboda and Crye (2015), respectively, as well as in Table 1.

Deer mortality estimates were generally higher following colder winters with increased snowfall (Table 1, Figures 2 and 3). The harsh winter of RY11 was intensified by high winds, abundant snow at high elevations, and extended periods of cold temperatures. Results suggest deer mortality was higher in RY11 than previous more mild winters. Adult deer mortality increased following the severe winter of RY11 and again in RY12. Previous research suggests heavy snowfall can increase winter mortality rates of ungulates by limiting access to forage (DelGiudice et al. 2002). However, the maritime climate of the Kodiak Archipelago may reduce the impacts of heavy snowfall on forage accessibility by providing access to alternate marine derived nutrients (i.e. kelp). Although, this phenomenon has been observed anecdotally in deer on Kodiak Island, additional work is needed to fully understand this relationship.

Juvenile deer mortality counts were greater the year after a severe winter compared to immediately following a severe winter indicating a possible lag time in response to harsh winter conditions. Counts of juvenile deer carcasses immediately following the severe winters of RY08 and RY11 were 18 and 21, respectively with total counts of adult and juvenile carcasses (including mortalities of unknown age and gender) totaling 21 and 29, respectively. However, counts of juvenile deer carcasses one year after the severe winters of RY08 and RY11 were 28 and 21, respectively with total counts of adults and juveniles totaling 29 and 31. This apparent lag in juvenile mortality may be attributed to reduced maternal nutritional condition following a severe winter. Greater winter severity preceding fawn parturition reduces maternal nutritional condition, resulting in decreased fawn body mass at birth (Duquette et al. 2014). Nutritional carryover effects are common in ungulates (Parker et al. 2009) and can increase mortality in neonates as previously reported (Duquette et al. 2014). Therefore, juvenile mortality may have been exacerbated in fawns born immediately following a severe winter due to reduced body condition at birth thereby making them more susceptible to mortality (Liley and Creel 2008).

Recommendations for Activity 2.1

Discontinue, or modify current mortality survey protocols by increasing distribution and frequency of surveys. Unfortunately, current methods to estimate deer mortality are not sufficient to provide conclusive findings, so alternative methods are currently being explored.

ACTIVITY 2.2. Quantify and analyze harvest data.

Data Needs

Sitka black-tailed deer have a positive customary and traditional use finding and are considered an intensive management (IM) species necessary for subsistence purposes; therefore, it is necessary to assess annual harvest to ensure harvest objectives are met. However, it is important to note that annual harvest is not an appropriate trigger mechanism for corrective action on estimated abundance. Sitka black-tailed deer populations in the Kodiak Archipelago are driven primarily by winter severity and fluctuate predominantly in response to winter and spring weather patterns. Annual harvest appears to have little impact on annual survival or perceived abundance.

Methods

Harvest data are summarized by regulatory year (RY). From RY89 to RY10 questionnaires were mailed to hunters annually to assess trends in hunting effort and harvest. Questionnaires were sent to a random sample of deer harvest ticket holders and harvest estimates were derived from data collected from returned questionnaires. Because response rates were low, harvest estimates were expanded to account for nonresponse. In RY11, a statewide deer harvest ticket system was implemented and all individuals obtaining deer harvest tickets were required to report their harvest and a summary of hunting effort. Harvest information was summarized by regulatory year for total harvest, hunter residency and success, transportation method, and harvest chronology. In addition, guides and transporters frequently submitted voluntary summaries of hunting activities which served as anecdotal information for biologists assessing hunting and deer population trends.

Table 1. Unit 8 Gender and age composition of Sitka black-tailed deer identified during coastal mortality surveys on Kodiak Island, Alaska, regulatory years 1995–2015.

Regulatory	Adult				Juvenile[a]				UNK	Total[b]					
Year	Male	Female	Unk	Total	Male	Female	Unk	Total		Male	%	Female	%	Unk	Total
1995	0	0	1	1	4	2	28	34	1	4	66.7	2	33.3	30	36
1996[c]	5	4	2	11	17	5	47	69	1	22	71.0	9	29.0	50	81
1997[c]	1	0	2	3	8	5	15	28	1	9	64.3	5	35.7	18	32
1998[c]	9	18	23	50	12	24	61	97	3	21	33.3	42	66.7	87	150
1999[c]	0	1	0	1	1	2	6	9	0	1	25.0	3	75.0	6	10
2000[c]	0	0	0	0	0	0	0	0	0	0	0.0	0	0.0	0	0
2001[c]	0	0	0	0	0	0	0	0	0	0	0.0	0	0.0	0	0
2002[c]	0	0	0	0	0	0	0	0	0	0	0.0	0	0.0	0	0
2003[c]	2	7	5	14	1	1	9	11	4	3	27.3	8	72.7	18	29
2004[c]	0	1	2	3	0	0	5	5	0	0	0.0	1	100.0	7	8
2005[c]	3	7	3	13	7	4	22	33	1	10	47.6	11	52.4	26	47
2006	0	2	1	3	4	1	36	41	1	4	57.1	3	42.9	38	45
2007	0	1	3	4	8	0	35	43	3	8	88.9	1	11.1	41	50
2008	1	0	0	1	1	3	14	18	2	2	40.0	3	60.0	16	21
2009	0	0	0	0	7	4	17	28	1	7	63.6	4	36.4	18	29
2010	0	1	3	4	0	1	12	13	1	0	0.0	2	100.0	16	18
2011	2	4	2	8	6	4	11	21	0	8	50.0	8	50.0	13	29
2012[d]	3	5	2	10	6	5	10	21	0	9	47.4	10	52.6	12	31
2013[d]	2	0	6	8	2	0	3	5	2	4	100.0	0	0.0	11	15
2014[d]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2015[d]	0	1	0	1	0	0	2	2	5	0	0.0	1	100.0	7	8

[a] Includes fawns and yearlings.
[b] Percentages represent deer identified of known gender
[c] Data obtained from Kodiak National Wildlife Refuge files.
[d] Surveys conducted RY12–RY15 covered only Chief Cove.
ND indicates No Data was collected for that regulatory year.

Season and Bag Limit

The open season for resident, nonresident, and federal subsistence hunters was 1 August–31 October along the Kodiak Road System Management Area. The bag limit was 1 buck. A special weapons hunt (archery and muzzleloaders) was open in this area 1–14 November with a bag limit of 1 deer (either sex). Hunters were required to successfully complete a special weapons hunter education course before participating in the hunt. In the fall of 2011, a special-weapons youth hunt was opened within the 1 deer bag limit area along the Kodiak road system. From November 15 through December 31 youth hunters aged 10–17 who had successfully completed a basic hunter education course and an archery/muzzleloader course were able to participate in the hunt. The bag limit was one deer of either sex.

The open season for resident, nonresident, and federal subsistence hunters in the remainder of Unit 8 was 1 August–31 December. The bag limit was 3 deer. Hunters could harvest only bucks 1 August–30 September and deer of either sex could be taken October through December.

Federal subsistence hunting regulations mirrored state regulations, except that residents of Unit 8 could continue to hunt on the Kodiak National Wildlife Refuge throughout January. On Kodiak NWR lands, hunters could harvest deer for other qualified subsistence users if they first obtained a designated hunter permit. Proxy hunting on other lands was restricted to resident hunters who were hunting for other Alaska residents who were ≥65 years old, legally blind, or ≥70% disabled and had obtained the necessary state permit to do so.

Results and Discussion

<u>Harvest by Hunters</u>

Harvest during RY11 (5,068) was markedly higher than during the 2 preceding regulatory years (RY09 = 4,087; RY10 = 4,046) as the deer population continued to recover from the harsh winter of RY08 (Figs. 2 and 3). The RY11 harvest exceeded the previous 5-year recorded annual average of 4,112 deer (Fig. 4) and was the highest harvest since RY06. Historical data suggest hunter effort, hunter participation, and hunter success increase gradually as deer numbers rebound in the years following a severe winter. The high harvest in RY11 can likely be attributed to increased snow accumulation at higher elevations forcing deer to lower elevations in search of food. As deer concentrate in areas with increased food accessibility (i.e., beaches) they become more vulnerable to harvest. In contrast, harvest during RY12 and RY13 was the lowest harvest in a decade, presumably due to the severe winter in RY11 and the resulting reduction in deer density, coupled with reduced hunter effort. Hunter effort and the number of hunters participating in deer hunts often declines immediately following a harsh winter as reports of increased winter deer mortality and reduced densities discourage hunters from going afield. As the deer population gradually rebounded, harvest numbers increased. In RY14 the total reported harvest was estimated at 4,418 and increased to 6,124 in RY15, the highest harvest recorded in a decade. During the previous 5 years of reported harvest (RY10–RY14) the mean annual harvest was 3,928 deer, indicating an increase in both the deer population and hunters on the Kodiak Archipelago.

The percentage of males in the harvest exceeded 75% each year of this reporting period. The highest percentage of males was in RY15 (88%) and the lowest in RY12 (76.0%). The 5-year (RY11–RY15) average was 81% male harvest (Fig. 4).

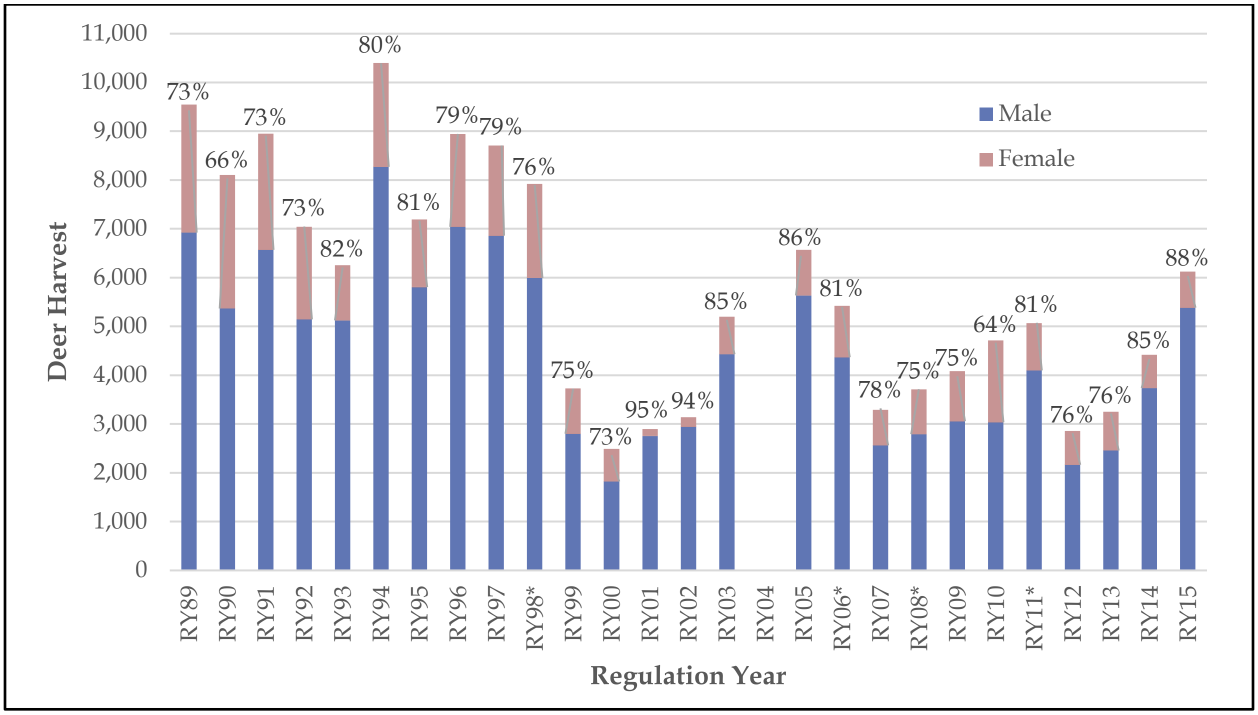

Figure 4. Estimated deer harvest in Unit 8 by gender, Kodiak Archipelago, Alaska, regulatory years (RY) 1989–2015. Percentages indicate male harvest. No estimate was available for RY04. In RY11 harvest reporting converted from a random questionnaire to mandatory harvest ticket reporting.

Permit Hunts

None.

Hunter Residency and Success

The number of hunters afield during this reporting period varied, presumably due to weather patterns and seasonal conditions. The number of hunters decreased 23% from a reported 3,205 in RY11 to 2,455 in RY12 before increasing through RY13 (2,532) and RY14 (3,637) to a peak of 4,250 in RY15. The annual mean number of hunters afield during the past 5 years (RY10–RY14) was 3,061 (Table 2).

Unit 8 residents composed 37–40% of deer hunters RY11–RY15 (annual mean = 38%), similar to the previous 5-year annual mean of 39%. Nonlocal residents made up 44–48% of the hunters RY11–RY15 (annual mean = 45%), slightly higher than the previous 5-year annual mean of 42%. Nonresidents composed 13–20% of deer hunters RY11–RY15 (annual mean = 16%), lower than the previous 5-year mean of 19%. Nonlocal resident and nonresident participation often decrease in years following severe winters as deer become sparse and hunter success declines. Interestingly, this was not the case following the severe winter of RY11.

Hunter success by residency varied considerably during this reporting period, from a low of 49.5% for nonresidents in RY12 to a high of 79.7% for Unit 8 residents in RY15 (Table 2). However, overall annual mean hunter success this reporting period was the same as the long-term (10-year; RY06–RY15) annual average of 72%. Data regarding mean number of deer harvested per hunter are no longer gathered.

Harvest Chronology

November is consistently the peak month of harvest in Unit 8. During RY11–RY15, 41.5–49.2% of the deer were harvested in November each year (mean = 44.4%), similar to the previous 5-year annual mean of 44.2% (Table 3). Hunters prefer to hunt during the months of October and November on Kodiak as the onset of snow in the higher elevations forces deer to move to lower elevations, increasing exposure to hunters. In addition, deer typically enter the rut in November increasing the vulnerability of males to hunters.

Transport Methods

Similar to previous years and due to the remote setting, inaccessibility, and lack of roads throughout the Kodiak Archipelago, hunters primarily used boats (5-year mean = 43.4%) or airplanes (5-year mean = 25.6%) to hunt deer during RY11–RY15. However, some hunters traveled by highway vehicle (5-year mean = 15.5%), foot (5-year mean = 4.8%) or use of 3 or 4-wheeler (5-year mean = 7.4%). Charter boats are consistently common modes of transportation for deer hunters throughout the archipelago; however, the number of boat hunters from Homer and other off-island locations appears to fluctuate with deer density and availability. Other modes of transportation included travel by horse, snowmachine, or off-road vehicle (ORV); however, these modes of transportation were used considerably less (<1%; Table 4).

Other Mortality

The severe winter of RY11 resulted in high fawn mortality and a noticeable decline in the deer population throughout most of the archipelago (Table 1). The winters of RY12–RY15 were comparatively mild and abundant food resources were readily available throughout much of the winter resulting in a reduction in winter mortality throughout the archipelago. However, an increase in juvenile mortality was still apparent in RY12 as a result of reduced maternal nutritional condition the following severe winter (RY11).

Free-roaming dogs can be significant predators of deer near communities and isolated residences (Van Daele et al. 2013). Deer–motor vehicle collisions kill an estimated 40–50 deer annually along the Kodiak road system. Brown bear predation of deer occurs predominantly in late winter and early spring as bears emerge from dens and deer exhibit reduced body condition and increased vulnerability. However, bears do not appear to be an important factor limiting the deer population.

Table 2. Unit 8 deer hunter residency and success, Kodiak Archipelago, Alaska, regulatory years 1999–2015.

	Successful					Unsuccessful					
Regulatory year	Local resident	Nonlocal resident	Nonresident	Total	%	Local resident	Nonlocal resident	Nonresident	Total	%	Total hunters
1999	638	829	372	1,839	62.3	567	274	274	1,115	37.7	2,954
2000	515	608	201	1,324	56.6	503	257	257	1,017	43.4	2,341
2001	770	674	155	1,599	78.1	291	79	79	449	21.9	2,048
2002	705	693	207	1,605	63.7	523	195	195	913	36.3	2,518
2003	1,065	1,027	308	2,400	80.9	356	105	105	566	19.1	2,966
2004	---	---	---	---	---	---	---	---	---	---	---
2005	1,268	1,350	430	3,048	84.2	292	139	139	570	15.8	3,618
2006	1,154	1,135	433	2,722	74.8	429	245	245	919	25.2	3,641
2007	583	630	588	1,801	60.3	360	412	412	1,184	39.7	2,985
2008	882	732	206	1,820	70.5	447	158	158	763	29.5	2,583
2009	725	968	291	1,984	80.9	296	86	86	468	19.1	2,452
2010	767	876	302	1,945	72.1	347	202	202	751	27.9	2,696
2011	1,002	1,158	406	2,566	80.1	295	172	172	639	19.9	3,205
2012	608	718	218	1,544	62.9	467	222	222	911	37.1	2,455
2013	679	906	181	1,766	69.7	410	178	178	766	30.3	2,532
2014	909	1,225	356	2,490	68.5	424	492	231	1,147	31.5	3,637
2015	1,237	1,456	644	3,337	78.5	316	412	185	913	21.5	4,250

Table 3. Unit 8 chronological deer harvest listed as percentage of harvest by month, Kodiak Archipelago, Alaska, regulatory years 2002–2015.

Regulatory year	Percentage of Harvest by Month							
	Aug	Sept	Oct	Nov	Dec	Jan	Unk	*n*
2002	6.0	5.8	22.7	37.7	25.8	2.0	0.0	3,031
2003	7.1	6.5	20.8	39.1	25.3	1.3	0.0	4,955
2004	---	---	---	---	---	---	---	---
2005	7.4	6.4	23.6	45.3	17.0	0.3	0.0	6,360
2006	5.7	6.0	21.6	46.3	19.7	0.8	0.0	5,305
2007	7.5	5.0	19.5	43.8	22.7	1.5	0.0	3,273
2008	5.7	7.1	21.7	44.9	17.7	2.9	0.0	3,600
2009	5.6	3.3	19.3	46.4	23.1	1.8	0.6	4,034
2010	6.8	8.6	20.7	39.9	21.7	1.6	0.7	3,989
2011	6.2	3.7	22.3	44.4	21.2	0.5	1.6	5,102
2012	6.2	3.9	24.7	44.8	19.3	0.9	0.4	2,855
2013	5.2	3.1	21.0	49.2	20.4	0.7	0.3	3,247
2014	7.5	5.4	33.3	41.5	10.7	1.2	0.4	4,419
2015	8.0	7.0	27.0	42.2	15.3	0.3	0.2	6,124

Table 4. Unit 8 deer harvest by transport method percentage of harvest, Kodiak Archipelago, Alaska, regulatory years 2002–2015.

Regulatory year	Percentage of harvest								
	Aircraft	Horse	Boat	3 or 4-wheeler	Snow Machine	Off-road vehicle (ORV)	Highway vehicle	Foot	Unk
RY02	16.0	0.2	40.4	7.3	0.0	0.7	13.8	17.1	4.5
RY03	19.5	0.6	42.1	7.2	0.0	1.5	13.8	12.0	3.3
RY04[a]	---	---	---	---	---	---	---	---	---
RY05	20.8	0.4	42.5	9.6	0.0	0.9	15.2	10.6	0.0
RY06	17.7	0.2	38.8	9.3	0.0	2.4	17.5	14.1	0.0
RY07	21.1	0.2	40.2	8.9	0.0	1.2	16.6	11.8	0.0
RY08	14.7	1.2	36.8	13.5	0.0	0.4	16.6	15.7	1.1
RY09	20.1	0.4	46.3	6.6	0.0	1.4	11.6	12.5	1.1
RY10	17.8	0.0	43.9	6.8	0.0	1.2	14.6	12.1	3.6
RY11	24.1	0.4	43.8	6.7	0.1	1.4	11.9	6.3	5.3
RY12	25.7	0.5	43.0	8.0	0.1	1.1	14.0	7.4	0.2
RY13	25.2	0.5	43.8	7.9	0.0	1.6	17.4	3.6	0.0
RY14	26.5	0.1	43.0	7.0	0.0	0.1	17.0	3.8	2.5
RY15	26.3	0.6	43.3	7.6	0.1	0.2	17.1	3.0	1.8

[a] No deer harvest data was collected in 2004.

Alaska Board of Game Actions and Emergency Orders

In March 2011 the Board of Game adopted a weapons restricted youth hunt within the Kodiak Road System Management Area. Hunters between the ages of 10–18 who successfully completed both a basic and an archery/muzzleloader hunter education course could take 1 deer of either sex during the 15 November–31 December season.

Recommendations for Activity 2.2

Although the harvest ticket system has the possibility of providing more reliable estimates of harvest, it is critical to develop a robust method to estimate nonresponse bias. Further, it is vital to have a clear understanding of the assumptions related to expansion factors prior to implementing this technique.

3. Habitat Assessment–Enhancement

No habitat or assessment activities were undertaken during RY11–RY15.

Nonregulatory Management Problems or Needs

As we continue to identify issues and work through concerns related to the deer harvest reporting system it is imperative the department strive to develop an appropriate method to estimate unreported hunter harvest. As we work through these challenges it would be valuable to continue to reach out to hunters and encourage their submission of harvest report cards.

Similar to previous years, hunters continue to report harvested males with malformed antlers caused by abnormal testicular development (“steer deer”), particularly from the south end of Kodiak. Hunter questionnaires indicated that about 3% of male deer taken in 1999 were steer deer, with the highest prevalence being on the Hepburn Peninsula (13%). From 1999 to 2010, a local big game guide collected samples from normal and abnormal deer harvested on the Aliulik and Hepburn peninsulas. Staff at the University of Guelph in Ontario, Canada, and researchers at Colorado State University analyzed these samples. Results suggest an unusual occurrence of underdeveloped testes and/or testes that had not descended in adult males (unilateral and bilateral cryptorchidism; Bubenik et al 2001). The cause of this phenomenon has not been determined, but it is likely caused by an environmental factor rather than a genetic anomaly (Veeramachaneni et al. 2006; Latch et al. 2008). Despite increasing reports of abnormal deer, harvest data from the affected areas do not indicate discernable changes in the population and we feel that no management action is practical or necessary at this time.

Data Recording and Archiving

All data, survey memos, and forms are located at the Kodiak Fish and Game office.

Agreements

Although no formal agreements are in place, various surveys, including deer mortality surveys and some habitat assessment efforts, are cooperative projects with ADF&G and the Kodiak National Wildlife Refuge.

Permitting

None

Conclusions and Management Recommendations

Alaska Statute 16.05.255 mandates that population and harvest objectives be established for Unit 8 deer because of their importance as a human food source. ADF&G, in close cooperation with the Kodiak Fish and Game Advisory Committee, Kodiak National Wildlife Refuge, commercial operators, and individual hunters attempted to satisfy this requirement by using the best available data to estimate population size and harvest. We recognize there is considerable room for improvement in the current estimates and data gathering techniques.

Several techniques for assessing the deer population in Unit 8 have been considered and attempted (Van Daele 2003, Cobb 2014); however, hunter harvest reports and anecdotal evidence collected from hunters, guides, and transporters continue to be the primary tools available and these are insufficient. The implementation of deer harvest information collected by hunter harvest report cards provided some objective data and helped us refine our management program. That reporting system has been improved with online reporting capabilities and provides managers with up-to-date harvest information. However, other more rigorous population estimation and population monitoring techniques are needed as reliable and objective data do not exist. We anticipate changes in management objectives as new rigorous population assessment techniques are developed, implemented, and refined.

II. Project Review and RY16–RY20 Plan

Review of Management Direction

Management Direction

- Provide hunting opportunities that allow for the continued sustainable harvest of Kodiak deer.

Goals

The deer management goal for Unit 8 is to maintain a healthy, viable population providing sufficient sport and subsistence harvest opportunities for residents and nonresidents of Alaska.

Codified Objectives

Amounts Reasonably Necessary for Subsistence Uses (ANS)

In January 1993 the Alaska Board of Game made a positive customary use determination for deer in Unit and set the amounts reasonably necessary for subsistence uses at 3,600–4,100 deer unitwide.

Intensive Management

It is expected that intensive management objectives set by the Board of Game will remain the same:

- Population objective: 70,000–75,000
- Harvest objective: 8,000–8,500

MANAGEMENT OBJECTIVES

The codified objectives will continue to be the management objectives.

REVIEW OF MANAGEMENT ACTIVITIES

Management activities conducted during RY11–RY15 will continue RY16–RY20 with changes to methods as noted below. In addition, new population assessment activities may be developed.

1. Population Status and Trend

No specific new population assessment activity is planned for RY16–RY20; however, it is anticipated that new population assessment methods will be investigated during this period.

Data Needs

Reliable methods to determine population status and assess fluctuations in population trends and demographics are needed, particularly because deer in Unit 8 are classified as an Intensive Management (IM) species.

Methods

Various methods are currently being considered, including camera surveys, pellet surveys, forward looking infrared radar (FLIR), and distance sampling.

2. Mortality–Harvest Monitoring

ACTIVITY 2.1 Conduct coastal mortality surveys each spring to estimate annual winter mortality and analyze data in association with temperature and snowfall weather data.

Data Needs

Estimates of annual winter mortality and an understanding of weather patterns are necessary to understand what impact severe winters have on local deer populations and forage availability. The development of a winter severity index would be useful and provide insight into impacts of winter severity on deer survival.

Methods

Although current methods provide a broad index of winter mortality, the current survey design is too limited in scope and distribution. We intend to increase the distribution and frequency of coastal mortality surveys and develop a winter severity index that incorporates daily mean snow depth, mean wind speed, rainfall, minimum ambient temperature and other relevant weather characteristics that may impact deer survival. Mean daily winter severity can be estimated by averaging the sum of snow depth, wind speed, and rainfall and subtracting the derived value from daily minimum temperature (*in sensu* Duquette et al. 2014). Snow depth and temperature can also be assessed by deploying 'snow stakes' and/or 'I-buttons' that provide relevant weather information. We will also investigate alternative methods to estimate sources of deer mortality (i.e. predation). Current methods are not sufficient to provide conclusive findings so alternate methods will continue to be explored.

3. Habitat Assessment–Enhancement

ACTIVITY 3.1 Investigate movement, distribution, and resource use of deer on the Kodiak archipelago

Data Needs

Determine seasonal and annual fluctuations in movement, distribution and resource use throughout the archipelago to provide information on resource needs or limiting factors impacting deer at various times of year.

Methods

We will aerial capture, immobilize, and attach global positioning system (GPS) radio collars to ~100 adult deer (50 male, 50 female) across Kodiak Island to identify seasonal movements, distribution, and resource selection. Collars will attempt relocations at 60-minute intervals for at least 24 months continuously. Seasons will be based on deer behavior and biology and defined as winter (1 December–30 April), pre-fawning/fawning (1 May–30 June), summer (1 July–30 August), and rut/post-rut (1 September–30 November). We will use available satellite imagery to develop a land cover layer for resource use modeling. We will use ArcGIS (Environmental Systems Research Institute, Redlands, California, USA) to create and overlay a grid with pre-determined grid cell sizes (based on deer movements and home range size) across the island. We will then extract resource attributes and deer location data. For each cell we will determine proportional land cover type as well as other relevant covariates using ArcGIS (Belant et al. 2010). We will also calculate the distance from the center of each grid cell to the nearest road and distance to nearest landcover edge, using Patch Analyst 4.0 for ArcGIS.

To estimate seasonal deer resource use, we will use three generalized linear mixed models (GLMMs) with seasonal location data and compare their performance using Akaike's Information Criterion adjusted for small sample size (AICc) to select the random model structure most appropriate for final analyses. Each random model structure will contain a different random effect variable: animal ID, year, or animal ID nested within year. Generalized linear mixed models with the appropriate random structure used for final analyses of seasonal deer resource use will include season, land cover, and distance from nearest road and habitat edge as fixed effects and number of animal locations during each season as the response variable. We will include the global and the null (intercept only) models and use all combinations of model parameters to determine the best-supported model. We will use AICc to compare model performance. Models with AICc scores within 2 of the best-supported model will be considered similarly supported (Burnham and Anderson 1998). We will calculate Akaike weights (w) to measure model support and model selection uncertainty (Burnham and Anderson 1998). If appropriate, we will use model averaging to estimate model parameters with 95% confidence intervals (Burnham and Anderson 1998). We will also calculate pseudo R^2 values to determine the percent variation in deer locations explained by the best supported models (Hardin and Hilbe 2007). Relative use of land covers will be assessed based on model parameter estimation.

Before running models we will test for multicollinearity between covariates. For covariate pairs with a Spearman rank test value of $\rho \geq 0.70$, we will exclude the variable thought least biologically important from analyses. We will evaluate candidate models using Akaike's Information Criterion adjusted for small sample size (AICc), where models with AICc values of 2 or less of the best supported model are considered equally plausible (Burnham and Anderson 2002). We will also compare candidate models using Akaike weights (w_i) which represents the relative likelihood that a specific model is best (Burnham and Anderson 2002).

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Data Recording and Archiving

All data, survey memos, and forms will be located at the Kodiak Fish and Game office.

Agreements

Various surveys, including deer mortality surveys and some habitat assessment efforts, are cooperative projects with ADF&G and the Kodiak National Wildlife Refuge.

Permitting

None.

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