FEASIBILITY ASSESSMENT FOR MAINTAINING OR INCREASING SUSTAINABLE HARVEST OF SITKA BLACK-TAILED DEER IN A PORTION OF GAME MANAGEMENT UNIT 1A

Prepared by

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BACKGROUND

Sitka Black-tailed Deer:

Sitka Black-tailed Deer live throughout Game Management Unit (Unit) 1A, although mainland densities are consistently lower than those on maritime-influenced offshore islands. Deer populations tend to fluctuate seasonally, primarily in response to winter weather and wolf and bear predation. A series of severe winters during Regulatory Years (RY) 2006-2008 and 2011 impacted deer populations throughout Southeast Alaska, including in Unit 1A. Deer numbers are currently at very low levels throughout most of Unit 1A.

Weather conditions and population levels influence the numbers of deer harvested by hunters. Since 1984, Unit 1A harvests have ranged from a low of 143 (2005) to a high of 914 (1995). Hunting was open each year from August through December. Limited hunting of antlerless deer in Unit 1A was allowed before 1978, but hunts have been for bucks only since that time. As clear-cut logging continues to reduce old-growth habitat in portions of the unit and previously logged areas convert to stem exclusion seral stages, deer populations are expected to decline. Additionally, clear-cut logging has and will continue to reduce carrying capacity in some areas, which may impact deer. Population models predict declines in deer carrying capacity of 50–60% by the end of the logging rotation in 2054 (USFS 1989).

Wolves:

Wolves live throughout the islands and mainland of Unit 1A, although densities on the mainland are generally lower than on maritime-influenced islands. Wolves are capable swimmers and regularly travel between nearby adjacent islands in search of prey.

On islands in southern Southeast Alaska, wolves feed primarily on deer. Analyses of scats (feces) collected on Prince of Wales (POW) Island contained, in order of frequency: deer, beaver, river otter, black bear, small mammals, and fish (Kohira and Rexstad 1997). Most wolf scats contained a combination of prey, suggesting they are opportunists rather than prey specialists. Fish are consumed seasonally in the fall when salmon are spawning in creeks and rivers. Szepanski et al. (1999) concluded that up to 25% of the diet of wolves may be from marine-derived resources. Marine mammals, salmon, waterfowl, and small mammals supplement the diets of wolves in this area. Wolves along the lower mainland have fewer deer available due to low densities and likely rely on a more varied diet.

Wolves are social animals that travel in packs and actively defend territories from encroachment by other individuals or packs (Mech 1970). In Southeast Alaska, minimum convex polygon (MCP) home ranges for wolf packs on Revillagigedo (Revilla) Island averaged 279 square kilometers (108 mi^2); range 79 to 447 square kilometers (30 to 170 mi^2) (Smith et al. 1987). During a study of wolves on Revilla, wolf pack sizes averaged 5.4 (range 2 to 12) (Smith et al. 1987).

No accurate population estimates are available currently for Unit 1A wolves. However, based on the moderate harvest levels reported, staff observations, and moderate indices of abundance (I_A) reported by trappers, the wolf population in Unit 1A appears to be stable at moderate levels and there are no current threats to long-term sustainability (ADF&G 2010a).

Gravina Island near Ketchikan is an area approximately 249 square kilometers (96 $mi^{2)}$ with low deer numbers. Wolves on Gravina Island are having an impact on the already limited deer numbers in this popular deer hunting area. The wolf predation in this area is compounding the effects of several moderately severe winters, poor habitat quality and productivity, black bear predation, and limited winter habitat for deer. Recent reports of wolves killing and eating domestic dogs near homes on Gravina Island suggest wolves are searching for alternative food sources.

Distribution and Movements

Wolves are found in all of Unit 1A, including all of the mainland, several islands, and along the Cleveland Peninsula. Wolves are known to move considerable distances in this unit. One radio collared male marked on Kupreanof Island near Petersburg was observed moving over 120 miles overland and across several saltwater crossings. During a 2-year period, this wolf moved from the study site on Kupreanof south to where it was caught by a trapper near Neets Bay on the north end of Revilla Island.

S&I Management Objective

- Maintain sustainable wolf populations within Unit 1A.

Deer:

S&I MANAGEMENT DIRECTION

MANAGEMENT GOALS

Unit 1A has a population goal of 15,000 deer and a hunter harvest goal of 700 deer, based on high consumptive use of the deer population in the unit.

MANAGEMENT OBJECTIVES

- Maintain populations in excess of 45 deer per mi^2 of winter range, as determined by mean densities of 1.4 pellet groups per plot (Kirchhoff 1990).

During the fall 2008 Board of Game (BOG) meeting in Juneau, a proposal was passed affecting deer hunting on the Cleveland Peninsula. Prior to the passage of this proposal the bag limit was 2 bucks on the Unit 1B portion of the peninsula and 4 bucks on the Unit 1A side. Due to conservation concerns and in order to spread opportunity, the bag limit was changed to 2 bucks for all of the Cleveland Peninsula south of the divide between Yes Bay and Santa Anna Inlet.

During the fall 2010 BOG meeting, a proposal was passed to shorten the deer season in Unit 1A by one month, changing the season from Aug. 1–Dec. 31, to Aug. 1–Nov. 30.

Overall assessment of potential to increase harvest *Low, Moderate, High*[1]: Moderate

We consider the potential to increase deer through intensive management of wolves in this area to be moderate. There are likely a number of factors limiting deer numbers in Unit 1A, and we are not sure that removing wolves will provide enough relief from mortality to increase the deer numbers to levels that would provide a substantive increase in harvest. Within Unit 1A, the following factors are known to limit deer numbers, but how these factors work individually or in combination with others is unknown. For example, the amount of snow accumulation and the persistence of snowfall have direct effects on deer survival. Heavy snow winters, such as we experienced during RY2006-2008 and again in 2011, cause die-offs due to starvation and higher predation rates because animals are in poorer condition. Even areas like Unit 4, where wolves are absent, experienced severe die-offs during some of these same heavy snow years. At the same time, in Unit 1A we are faced with habitat alterations related to clear-cut logging that tends to exacerbate the effects of even mild winters. Clear-cut logging removes old growth forest that is important over-wintering habitat for deer, especially during winter when snowpack accumulates in areas not protected by large-canopy trees. This habitat is important because the large tree canopy intercepts snow and allows deer to move within the landscape with less energy expenditure. This canopy also intercepts snow that would otherwise cover important evergreen forbs. As more of these forest patches are removed, deer are forced into smaller areas and thus are competing more intensively for forage as well as being more vulnerable to predation. Additionally, the remaining habitat in portions of 1A is not as productive for deer (lack of favored winter browse species), and those areas with good forage show signs of intensive browsing.

Though removal of some wolves should allow more deer to survive annually, our objective for wolf removal on Gravina is to remove 100% of the population. . Another complicating factor is the multiple predator system that includes black bears and wolves, and the lack of alternative prey species. Both bears and wolves are known to prey on deer, but the degree to which removing wolves will enhance the deer populations unknown. We have data from a study in nearby Unit 2 (POW Island) that shows black bears are an important predator of deer fawns, though their impacts on deer are mostly limited to the neonate fawn age class. Finally, there are concerns with just how successful trappers can be in eliminating wolves from the treatment area, which would be necessary to enhance the deer population and evaluate the utility of this approach.

Noteworthy is the fact that other areas in Southeast, with similar habitat alterations, do not display the same chronic low deer numbers as Unit 1A. For example, POW Island (Unit 2) has been heavily logged, receives substantial amounts of snow during some winters, and has both wolves and black bears, yet the deer population there is meeting Intensive Management (IM) population and harvest objectives. We have observed significant differences in habitat quality between the POW archipelago and Unit 1A. For instance, much of the Unit 1A understory

[1] Component factors are discussed in Section II.

consists of salal (*Gaultheria shallon*) an evergreen shrub that is poor quality deer forage, versus Vaccinium sp, common on POW, and known to be a very important forage species for deer, especially in the winter. This difference in plant communities directly affects the nutritional quality of forage available to deer which may have population level impacts.

Information needs:

Below we describe the limitations of the data we presently have on deer and wolf populations, and the types of data we believe is essential before embarking on this proposed IM action. Any decision should be dependent on having baseline data on the population levels of these species, the ability to monitor these populations, and the ability to detect changes to assess the success of the program toward meeting IM objectives.

- **Deer**: Because the focus of the IM program under consideration is to increase the deer population in a portion of Unit 1A, our most critical information needs include the ability to accurately measure and track changes in both deer numbers and hunter harvest. Such information will be critical to our ability to accurately evaluate the effectiveness of the program to increase deer numbers and hunter harvest.

- The only feasible method of estimating deer numbers appears to be through the use of deer fecal pellets. However, the traditional pellet-group surveys we have employed in the past are not suitable for detecting fine-scale changes in deer abundance. They are instead designed only to obtain general trends in deer numbers over longer periods of time (years).

- We are currently experimenting with a new DNA-based methodology for estimating deer numbers. This technique involves extracting deer DNA collected from fresh pellets and using resulting information to develop a mark-recapture estimate of deer abundance and density. This methodology is still being developed, but has promise as a tool for measuring deer densities at small geographic scales. We are currently awaiting analyses of samples collected from within the considered treatment area in Unit 3 during spring 2012. We expect to obtain the results of this analysis and complete an evaluation of the method's potential for estimating low density deer populations sometime in late 2012. However, it may require a few more years of development and testing before we can determine its utility in estimating deer numbers over large areas.

- In addition to being able to accurately estimate deer numbers and measure subtle changes to populations, an IM project would also benefit from a better understanding of deer mortality factors. We currently lack a good understanding of the respective roles wolves and black bears play with regard to limiting deer numbers. Assessing the mortality factors influencing deer populations would require radio-marking a sample of deer so that their survival could be monitored and any mortalities investigated in a timely manner. This would require live capturing deer, fitting them with radio-collars equipped with mortality sensors, and having staff available to investigate mortalities as they occur.

- **Wolves**: The primary focus of this IM program would be to reduce wolf numbers in a select portion of Unit 1A, so it seems essential that we have some understanding of how many wolves there are in both the removal and experimental areas prior to embarking on wolf removal. It is currently only possible to develop crude population estimates for Unit 1A wolves based on average home range and pack sizes derived from extensive radio-telemetry studies conducted on POW Island during the 1990s (Person 2001). Wolf numbers would have to be monitored for the life of the IM action to evaluate the ability or inability of the program to meet the specified objectives. Determining wolf numbers and monitoring them over a period of several years would require either collecting DNA from hair or scats, or by marking animals and affixing radio collars. Collaring would require the capture and handling of wolves within both the treatment and comparison areas. GPS radio collars with remote download capabilities would provide the best means of gathering data and assessing home ranges and travel corridors, which would be important to effectively direct removal efforts. Additionally, radio-collared wolves could then be radio tracked and observations made regarding pack sizes. This, along with home range information, would provide biologists with site-specific data for use in obtaining an accurate estimate of Unit 1A wolf numbers.

Benefit of the above information toward the IM program: These data would benefit the IM program in at least two ways. First, the public expects the department to take action based on credible science, and these data seem essential to achieving that. Second, to determine the ability or inability of an IM program to achieve stated objectives, we need to be able to detect fine scale changes in deer numbers and associated changes in the predator population.

Endangered Species Petition: In 1993, the Biodiversity Legal Foundation (Boulder, CO) and an independent biologist from Haines, Alaska filed a petition with the U. S. Fish and Wildlife Service (FWS) requesting that wolves in Southeast Alaska be listed as a threatened subspecies pursuant to the Endangered Species Act (ESA). The FWS ruled that a listing was not warranted at that time.

More recently, in August 2011, Greenpeace and the Center for Biological Diversity collectively petitioned the FWS to list the Alexander Archipelago wolf (*Canis lupus ligoni*) as a threatened or endangered subspecies throughout its range, and also petitioned FWS to declare wolves on Prince of Wales Island as a threatened or endangered Distinct Population Segment (DPS). They also requested that the FWS designate critical habitat to ensure survival and recovery of the subspecies and the DPS.

Although the portion of Unit 1A being proposed for wolf removal is within the range of the wolves covered by part of the petition for listing under the ESA, the department does not have conservation concerns for wolves in southeast Alaska. There are however, some local areas on Prince of Wales Island where harvest of wolves may need to be reduced by the Federal Subsistence Board to meet mutually agreed wolf management objectives.

Department recommendation: _____

I. FEASIBILITY ASSESSMENT[2]

A. *Definitions*

1. Define the relevant geographic area for assessing abundance of prey and predators (Appendix A, part 1).

It is not feasible to perform intensive management on Unit 1A as a whole because of the logistical challenges associated with accessing areas, as well as a lack of system closure to the recolonization of predators. However, within this unit there are two key areas close to communities where deer were once abundant and where prey numbers are currently chronically low that would be best suited for a predator control effort. These include the Cleveland Peninsula and Gravina Island, both located a short distance from Ketchikan and both once popular deer hunting areas for Ketchikan residents (Figure 1). The area being considered for this experimental wolf reduction plan is Gravina Island, which encompasses approximately 259 km^2 (100 mi^2) or approximately 2% of the land area in Unit 1A. Gravina Island is semi isolated by the Tongass Narrows on the north, Clarence Strait on the west and south sides, and Nichols Passage along the east shoreline (Figure 2). It is accessible by vehicle via the airport ferry to a limited road system and by boat along an extensive shoreline. This area is popular for deer hunting, fur trapping, and recreating by residents of Ketchikan and Saxman, located on nearby Revilla Island, and Metlakatla, located to the east on nearby Annette Island. Annette Island is one of only two Federal Indian Reservations in Alaska. We have no research information to accurately estimate wolf or deer numbers on Gravina Island, but based on wolf research from POW (Person 2001) and good measures of wolf home ranges in many habitat types from southern Southeast Alaska, we do not believe Gravina would support more than one breeding wolf pack along with a few dispersing wolves. Based on anecdotal information and on information obtained through recent reconnaissance efforts by department staff, we believe fall wolf numbers are stable on Gravina Island at between 8-12 animals. Land ownership on Gravina is divided among Mental Health Trust, USFS, State of Alaska (DNR), private citizens, and Ketchikan Gateway Borough (Figure 3).

2. Recommend a time period for evaluation of the proposed program that matches the regional Alaska BBOG cycle:

6 years[3].

3. Note if the feasibility assessment is for intensive management (IM; legal requirements in Appendix A and the *Intensive Management Protocol*) or another purpose.

[2] The purpose of the feasibility assessment and process are described in *Intensive Management Protocol*.

[3] Six years is the recommended time period for evaluating progress toward objectives because it fits either a 2-year or 3-year regional BOG cycle and should provide adequate time to assess whether a program is causing improvement in ungulate abundance or harvest in the defined area.

This feasibility assessment is for intensive management consideration.

B. *Review Management Objectives and Current Abundance and Harvest*

1. List the population and harvest objectives for prey species and current estimates of each; objectives may be in regulation for IM (Appendix A, part 2) or in survey and inventory reports.

- Population objective: IM population objectives are identified for all of Unit 1A, and are not broken down into islands or smaller areas. Objectives developed by BOG identify Unit 1A as important for providing high levels of harvest for human consumptive use, and established a population objective of 15,000 deer.
- Current population estimate: In the absence of methods for developing precise population estimates for deer in Southeast Alaska, we conduct spring pellet-group surveys in order to measure changes in winter deer densities within selected areas. This is not meant as a method to assess the population unit-wide, rather these are indices of population trends over time in selected watersheds.
- Harvest objective: IM harvest objectives are identified for all of Unit 1A, and are not broken down into islands or smaller areas. The current harvest objective of 700 deer/year was established by the BOG and was based on the average harvest during 1994–1999. These years represented the highest harvests on record, and may be set at an unrealistically high level given the continued loss of habitat due to timber harvesting and the conversion of past timber harvest areas into stem exclusion.
- Current harvest estimate: Prior to 2012, we also used a regional questionnaire mailed randomly to 33% of deer harvest ticket holders to estimate deer harvest. That questionnaire has now been replaced with a hunt report that all hunters receive when they obtain their deer tags and must submit at the end of the season. Estimated harvest during the past 5 years for Unit 1A has been 231 deer (range 154-309).

2. Briefly review biological rationale of IM objectives (Appendix A, part 2) or other objectives for prey species.

   Population objective: The current population objective (15,000) and harvest objective (700) for Unit 1A were established by the board in fall 2000. The population objective was estimated using a USFS habitat capability model for deer combined with a qualitative estimate of deer numbers by ADF&G biologists based on deer pellet counts and general range condition. The harvest objectives were based on the average annual harvest during 1994-1999. We note that these objectives were set based on peak harvest years with mild winters, and a 20-year harvest average may be more realistic for establishing long-term harvest capability. For Gravina Island this would be 74 deer..

3. List the population and harvest objectives for predator species in survey and inventory reports;

- Wolves: Maintain sustainable wolf populations within Unit 1A. We do not have specific wolf harvest objectives for Gravina Island.
- Black bear: Maintain a male to female ratio in the harvest of 3:1, maintain an average male spring skull size of 17.5 inches. These apply to all of Unit 1A and not just Gravina Island.

C. *Recommended Management Strategy*

1. Briefly describe the proposed management strategy for the ungulate population (actions to be taken on habitat, predation, harvest, access, or other factors) [*This section could include PredPrey or other population modeling to forecast response in prey during proposed treatment period under scenarios of no action (continue current situation) and under the proposed action (active management); include brief statement of modeling assumptions*].

   - The considered IM action involves hiring 2 experienced wolf trappers to eliminate wolves from the treatment area during the established wolf trapping season. The intent would be to increase the deer population and provide for additional harvests by humans. Also, this effort will provide information about the effectiveness of removing wolves to enhance deer numbers. Information obtained from this work can be applied elsewhere in the region.

2. Propose measures of progress toward population or harvest objectives to be evaluated, identifying if additional data collection beyond survey and inventory program is necessary.

   - A number of long-established deer pellet-group transects are located within the proposed "treatment" area on Gravina Island. If deemed necessary, additional pellet-group transects will be established in treatment areas to monitor changes in deer density and help evaluate the ability or inability of the considered action to reduce wolf numbers and increase deer abundance. The department will recommend that deer hunting remain open for bucks-only within the treatment area. This is essential as catch per unit effort by hunters will be one of our main criteria towards measuring the success of this program. The harvest of a few bucks is not expected to cause a further decline in deer numbers or prevent recovery of deer.
   - Harvest statistics derived from the recently-implemented deer harvest report cards (including days hunted per deer harvested) will be an important measure of deer abundance that will also be useful for evaluating progress toward achieving the program's objectives.

   - Other Options Considered:

- Use radio telemetry to monitor doe survival (known fate survival rate).
- Conduct spotlight surveys to measure changes in deer abundance.
- Conduct track surveys for deer (snow covered roads) to measure changes in deer abundance.
- Implement a deer registration permit hunt for either the project area or all of Unit 1A.

3. Provide a brief explanation for collecting or evaluating data from untreated areas for comparison to areas treated under the management program as evidence in a scientific study design that the treatment effects are working as intended and not simply an artifact of no treatment effects (e.g., widespread improvement in calf survival because of mild winter across region, not because of predation control in a specific area).

   - The department will recommend that deer hunting remain open for bucks-only within both the treatment and comparison areas. The harvest of a few bucks is not expected to cause a further decline in deer numbers or prevent recovery of deer. Harvest statistics derived from the recently-implemented deer harvest report cards (including days hunted per deer harvested) will be a useful measure of deer abundance that will be helpful for evaluating progress towards achieving the program's objectives.

4. Provide an estimated cost of implementation (operations and field staff salary) for the proposed program over the evaluation time period.

   - Hire trappers: this would entail hiring 2 trappers for 4-5 months/year at a FW Tech III level, plus provisions such as food, fuel, and other miscellaneous supplies and equipment. This is expected to cost about $60-70K/year. We would want to continue the trapping effort for a minimum of 5 years in an attempt to fully eliminate wolves from the treatment area. The cost for 5 years is expected to be $300K-350K.
   - Traditional deer pellet transects: these transects have been conducted for decades, albeit at irregular intervals, in both the experimental and the comparison areas, giving us long-term population trend information. Although recognizing the limitations of this technique for detecting short term changes in the population, we may continue sampling these transects to add to long-term trend assessments. The cost of completing these transects would be $3-5K/year, and $15-25K over the 5 years of the study.
   - DNA deer pellet surveys: this technique is still in the development phase but has shown promise for estimating deer numbers on POW (Unit 2) and NE Chichagof Island (Unit 4), and in spring 2010 was implemented "experimentally" in that portion of Unit 3 being considered for treatment. Until the data collected in Unit

3 this spring has been thoroughly analyzed, we will not know if this new technique will be useful for estimating deer abundance in areas where deer exist at low densities. If this new technique can be successfully applied in such areas, it will allow us to identify real time changes in deer density which will aid in evaluating the effectiveness of the IM action being considered. Ideally, we would sample both the treatment and comparison areas during the first year of implementation. This would require a team of 4-6 people for approximately five weeks during the spring. Depending on the accessibility of the sampling plots, we would likely need some level of helicopter support, 2 highway vehicles, and food and housing for field crews. We estimate the first year cost would be $75K. At this point, we do not know if this method can be successfully applied in Unit 1A where deer densities are low. Only after running the analysis on the spring 2012 data will we be able to evaluate the effectiveness of this technique and develop an appropriate sampling strategy for future years.

- Other sampling methods: we have not considered other methods at this time.

II. POTENTIAL TO ACHIEVE UNGULATE POPULATION AND HARVEST OBJECTIVES[4]

A. Population increase in ungulates required to reach population objective (may be represented as comparable density).

- The treatment area represents only a portion of Unit 1A, so anticipated increases in deer abundance from this IM program is not expected to provide enough deer to meet the IM harvest objective on a unit-wide basis. For instance, the harvest objectives for the Unit are 700 deer/year, while over the past 5 years the average annual harvest has been 231 deer, leaving us at nearly 470 deer below the harvest objective. Meanwhile, the highest harvest ever estimated for Gravina Island (treatment area) was 180 deer, with a 20 year average of 74, leaving us well short of the 470 deer we would need to harvest to meet the unit-wide IM harvest objective.
- As noted previously, the harvest objective might be more appropriately calculated based on a 20-year average rather than on the 1994-1999 seasons, when harvests were especially high. If successful, this program could provide a blueprint for expanding the program to other parts of Unit 1A and the region to further increase deer numbers.
    a. Because precise population estimates are not currently available for Unit 1A deer, changes in deer pellet-group densities and hunter harvests will be used in lieu of other more direct measures of population change to evaluate progress towards IM objectives. Because of uncertainties about our ability to measure precise changes in deer population size, we recommend focusing on hunter harvest to measure progress toward IM objectives.

[4] The background data used in evaluating potential are found in Appendices B and C.

B. Increase in average estimated harvest (last three regulatory years [RY]; RY = 1 July–30 June) to reach harvest objective [*if applicable, clarify for IM areas at low density how many prey are needed to meet local needs as an initial means of contributing toward IM objective for that unit*].

   a. The average annual harvest during the past 3 RYs has been 191 deer, or 509 deer below the IM harvest objective of 700.

C. Potential to mitigate biological limitations in considered IM area (Appendix B.I). *Low/Moderate/High*

- Moderate: Any of the following biological factors, functioning either independently or collectively, could influence deer numbers in Unit 1A:
  - Severe winter weather;
  - Reductions in deer carrying capacity resulting from logging of productive old growth stands important for over-winter survival of deer; and
  - Predation by wolves and/or black bears.

The majority of the land area in Southeast Alaska, and in Unit 1A, is under federal ownership and managed by the USFS. While the effects of winter weather might be partially mitigated by retaining as much old growth forest as possible to function as deer winter range, the department has little influence over forest management activities occurring on federal lands. While the Forest plan manages wildlife at viable levels, the State manages for sustainable levels (i.e., providing subsistence and recreational harvests). .

Although we are not proposing to mitigate the effect of bear predation on the deer population, research being conducted in neighboring Unit 2 indicates that on POW Island black bears prey heavily on deer fawns.

D. Potential to reduce or moderate hunting conflicts (Appendix B.II) *Low, Moderate, High*

- High. Few, if any, hunting conflicts currently exist, nor are they anticipated as a result of the IM activity under consideration.

E. Anticipated public participation based on expense and other factors (Appendix B.III). *Low/ Moderate/High*

- High. The IM treatment area we have selected is located in Unit 1A and would include all of Gravina Island. This island is located near Ketchikan and is accessible by vehicle via airport ferry to a limited road system and by boat along an extensive shoreline. This area is popular for deer hunting, fur trapping, and recreation from communities of Ketchikan and Saxman, located on Revilla Island, and Metlakatla, located on nearby Annette Island. While there are a few wolf

trappers operating within portions of the proposed treatment area, high fuel prices and low pelt prices limit the intensity of trapping efforts.

F. Data availability for designing an effective management plan [Appendix C]. *Low/Moderate/High*

- Low/Moderate. Precise population estimates are not available for deer or wolves in the unit, although we have long-term data from pellet-group surveys that provide us with general population trend information. If we are able to successfully implement the DNA-based methodology for estimating deer density then we will substantially improve our ability to detect changes in deer numbers, which will be important for an effective management plan. Until then, our traditional pellet-group data combined with deer hunt reports are our only ways of assessing changes in deer numbers..
- We currently have wolf research efforts ongoing on POW Island and from this research we will make inferences about the Unit 1A wolf population and predator/ prey relationships.

G. Potential to measure or demonstrate progress in ungulate population recovery or an increase harvest within a defined time period (Appendices B.I.E. and Appendix C). *Low/Moderate/High*

- Low/Moderate. Deer pellet-group counts will be conducted annually to measure changes in deer density on winter range. Traditional deer pellet transects are located in two watersheds on Gravina Island, one on the north end with three transects (Figure 7) and another at the south end of the island located near Dall Bay (Figure 8). Annual variations in winter severity can confound interpretation of the results of pellet-group counts, which presents problems with correlating these results with the actual deer population. Because of these complications, tracking the harvest may give us a better assessment of an increase in deer numbers. All deer hunters are now required to have a harvest ticket with a harvest report for hunting deer; from these reports we will be able to gather data on the locations they hunted, number of days hunted, and the number of deer harvested. This added reporting information will provide us with more detail than in the past, about harvests and enable us to better assess the effects of IM actions

H. Potential to document reasons for success or failure in population recovery or harvest increase (Appendix B.I.E). *Low/Moderate/High*

- Low/Moderate. The specific reasons for ungulate recovery will be more time consuming and difficult to tease apart, but efforts will be made to isolate and test the necessary variables.
- Since the mi*d* 1980s, the department has monitored trends in Sitka black-tailed deer populations in Southeast Alaska using a systematic survey of fecal pellet groups. Counts of pellet groups are made along straight-line transects, ideally

located within deer winter range from sea level to 1,500 feet elevation. Transects are established throughout the region and surveys are conducted during the spring to estimate activity of deer over the winter. However, fecal counts are confounded by seasonal and weather-related variability that influences the persistence of pellets in the environment, defecation rates, and detectability of pellets at different elevations and within different habitat types. Moreover, deer activity within winter range is strongly influenced by winter weather and snow conditions. Therefore, there is a great deal of "noise" in the data that is unrelated to numbers or densities of deer. It is also difficult to use pellet group counts to estimate population abundance or density because scaling factors used to convert pellet counts to numbers of deer are based on few empirical data and rarely evaluated over time. As a result, population indices based on pellet counts are typically imprecise and unreliable.

- A number of long-established traditional deer pellet-group transects are located throughout Unit 1A, including the considered "treatment" and "comparison" areas on the Cleveland Peninsula. If deemed necessary, additional pellet-group transects could be established within the treatment area to monitor changes in deer pellet-group density. Recently, deer pellet numbers have been low on Gravina Island, as has deer harvest (Figure 4).

- Harvest statistics derived from the recently-implemented deer harvest report cards (including days hunted per deer harvested) will be a useful additional measure of deer abundance and is expected to be helpful for evaluating progress toward the program's objectives. We are hopeful that, with internet reporting, we will obtain approximately 70-80% returns. If necessary, we can follow up with reminder letters to those who fail to report, as an attempt to achieve a higher reporting rate from the IM area. This process could be enhanced with the requirement of a registration hunt permit for all hunters if we find that the harvest ticket reporting is not sufficient. A registration permit would allow us to acquire data from all hunters given the stricter reporting requirements than that of harvest ticket reports.

- DNA deer pellet transects: Brinkman et al. (2010) developed and tested a protocol to efficiently locate and sample fecal pellets deposited by Sitka black-tailed deer, extract and sequence DNA from those pellets, and use the resulting genotypes to estimate deer abundance. They developed a method that was reliable, flexible to local environmental conditions, and that could be useful at varying temporal and spatial scales. They tested several DNA protocols suitable for extracting and amplifying DNA from fecal pellets, and identified a suite of polymorphic loci useful for distinguishing between individual deer. They also developed a pellet sampling design and procedures that maximize sampling efficiency and simultaneously minimized the degrading effects of weather on the epithelial-cell DNA adhering to pellets. And finally, they adapted accepted methods of mark-recapture analysis to the sampling design and genetic data.

  The department is currently evaluating this new DNA-based technique for

estimating deer density and/or population size. This technique shows promise with providing us real-time data on deer density, and may be essential if we are to use deer pellets as a means of measuring changes in deer numbers. This method includes collecting fresh deer pellets and extracting DNA in order to identity individual deer. In so doing, we can conduct a mark-recapture experiment and determine deer density and/or population size, depending on sampling intensity. During the past 3 years we have implemented this technique on a portion of Northeast Chichagof Island (2010 and 2011) and on Mitkof and Kupreanof islands in 2012. At this point, we are uncertain whether or not the DNA-based approach to estimating deer numbers will work in areas such as Unit 1A, where deer occur at low density. Data analysis is still ongoing to determine the utility of this method in measuring deer population size, which is necessary to measure changes should we implement wolf removal through IM.

APPENDIX A. Legal elements and criteria for intensive management objectives and a feasibility assessment.

Endangered Species Petition: In 1993, the Biodiversity Legal Foundation (Boulder, CO) and an independent biologist from Haines, Alaska filed a petition with the FWS, requesting that wolves in Southeast Alaska be listed as a threatened subspecies pursuant to the Endangered Species Act (ESA). The FWS ruled that a listing was not warranted at that time.

More recently, in August 2011, Greenpeace and the CBD collectively petitioned the FWS to list the Alexander Archipelago wolf (*Canis lupus ligoni*) as a threatened or endangered species throughout its range and requested that the FWS designate critical habitat to ensure its survival and recovery. That portion of Unit 3 being considered for wolf removal is within the range of the Alexander Archipelago wolf; therefore, wolves within the area being considered for IM action are implicated in the petition. While the department does not have conservation concerns for the A.A. wolf and does not believe the petition is warranted or that this subspecies should be listed , the petition to list the wolf under the ESA could complicate implementation of the considered IM action (wolf reduction program). This said, we do not believe that the proposed IM program would affect either the viability or sustainability of the A.A. wolf.

Department staff should review and ensure the following four elements have been met [*Brief listing of information by bullet may be useful for Sections 1, 2, and 3 this appendix*]:

1. Definition of populations:
   - The relevant area for defining an ungulate population under intensive management (IM) is that defined as a positive determination in Title 5, Alaska Administrative Code, Chapter 92, Section 108 (5 AAC 92.108).
     - GMU 1(A) 5,300 square miles.

   - "Game population" is defined in AS 16.05.940(20) as a "group of game animals of a single species or subgroup manageable as a unit." Clarify the purpose of ungulate or predator management zones proposed to be smaller than areas under 5 AAC 92.108.

     It is not feasible to perform intensive management on Unit 1A as a whole because of the remote and logistically challenging landscape, and lack of system closure to delay recolonization of predators after treatment. However, within this unit there are two key areas close to communities where deer were once abundant and where prey numbers are currently chronically low that would be best suited for a predator control effort. These include the Cleveland Peninsula and Gravina Island, both located a short distance from Ketchikan and both once popular deer hunting areas for Ketchikan residents (Figure 1). The area being considered for this experimental wolf reduction plan is Gravina Island, which encompasses approximately 259 km^2 (100 mi^2), or approximately 2% of the land area in Unit 1A. Gravina Island, though near Ketchikan, is semi isolated by the Tongass Narrows on the north, Clarence Strait on the west and south, and Nichols Passage along the east coast (Figure 1). It is accessible by vehicle via the airport ferry to a limited road

system and by boat along an extensive shoreline. This area is popular for deer hunting, fur trapping, and recreation from residents of Ketchikan and Saxman, located on nearby Revilla Island, and Metlakatla, located on nearby Annette Island.

- Consider whether a population with a positive determination for IM (5 AAC 92.108) should match or differ from amounts necessary for subsistence (5 AAC 99.025) for the same geographic area.
    - The amount necessary for subsistence (ANS) for deer in Unit 1A is 225-250, well below the harvest objective of 700 or the population objective of 15,000.

2. The BOG has established population and harvest objectives for IM of identified ungulate populations for a high level of harvest by humans:
    - Positive determination made for species and herd (caribou) or unit/subunit (moose, deer) per 5 AAC 92.106(1) by considering the following factors:
        - Historic harvest that meets or exceeds defined levels (caribou: 100, deer: 500, moose: 100); the highest three consecutive years and three most recent years are provided by department.
            - Unit wide deer harvest
                - Highest 3 years: RY 1985-1987 = 750/yr
                - Most recent 3 years: RY 2008-2010 = 191/yr
        - Accessibility (roads, rivers, trails, landing strips).

          The considered treatment area is highly accessible using either highway vehicles, boats, ATV's, snow machines, float planes, or a combination of these means of transportation.
        - Use of harvest primarily for meat.

          Deer harvest is primarily for meat but there is also interest in large trophy-class bucks.
        - Hunter demand (reported hunting effort, number of applicants for permits).

          Deer hunters in Unit 1A reported spending 1,651 days in the field during 2010.
    - Population and harvest objectives established in 5 AAC 92.108 based on these criteria in 5 AAC 92.106(2):
        - Effects of weather, habitat capability, diseases, and parasites.
            - Weather: Severe winter weather is believed to have the greatest impact on Unit 1A deer populations, often resulting in high rates of mortality. Severe winters generally occur in cycles and appear to be associated with the Pacific Decadal Oscillation. Historically, two or

three bad winters are followed by seven to ten mild winters.

- Habitat capability: Past, present, and anticipated future reductions in important deer winter range (old growth forest) remain a management issue as it affects the ability of the landscape to support deer. On this larger scale, the ability of the habitat in Unit 1A to support deer will decline, and these habitat changes likely play a role in the recent population decline. Nonetheless, we suspect that in the treatment area deer are well below the carrying capacity of the remaining habitat and could increase substantially while remaining within the carrying capacity of this area.
- There is no evidence that disease or parasites are contributing to low deer numbers in Unit 1A.

o Maintenance of viable predator populations (see definition in *Intensive Management Protocol*).

- Wolf surveys or population estimates are not feasible across this entire the unit; however, the unit-wide wolf harvest (as enumerated through sealing records) has remained relatively stable at approximately 40 wolves per year over the last 2 decades. Wolves in the treatment area are part of a much larger wolf population that interchange freely with wolves from nearby islands and the mainland. Therefore, even with a high rate of wolf removal from within the treatment area, the wolf population over the broader area will continue to be managed at sustainable levels.
- The wolf harvest in Unit 1A has fluctuated over time with low harvests being less than 10 wolves some years and high harvests nearing 50 wolves per year (Figure 6). Wolf harvest on Gravina Island is typically low; some years no wolves are harvested. The high harvest of 8 wolves in 2007 was one of the highest on record for Gravina Island (Figure 6).

o Maintenance of habitat conditions suitable for other species in the area.

- Habitat in the unit, including the considered treatment and comparison areas, consists of a diverse mixture of productive and nonproductive old growth forest stands, managed second-growth stands, muskeg, and subalpine habitats. Commercial timber harvest represents the one activity having the greatest impact on deer habitat. While habitat alterations brought about by logging may be beneficial to some species over the short-term, they are likely to reduce habitability over the long term. The USFS is undertaking thinning of some logged areas to promote understory growth, but the long-term value of such treatments to wildlife remains unknown and may be short-lived.

- Effects on subsistence users.
  - Low deer numbers have greatly reduced harvest opportunity for both State and Federal hunters. Local users are being forced to either forego deer meat, or travel substantial distances to neighboring units with more abundant deer populations. Given the water crossings involved, travel to neighboring units in search of deer can increase hunting expenses and increase the risk to personal safety. Additionally, the most likely alternative hunting area is Unit 2 where recent Federal restrictions to non-federally qualified users has led to a shorter season for Ketchikan hunters. Non-federally qualified hunters cannot start hunting deer in Unit 2 until August 16, rather than August 1.

- Cost, feasibility and potential effectiveness of possible management actions.
  - Cost: The cost of this program would include hiring two FW Tech IIIs to work on the trapping component. Additional costs would include fuel and other supplies. The Tech III would be using department boats and/or vehicles to access trapping sites. An additional $20K will be needed for administrative costs associated with the project.
  - Feasibility and effectiveness of management actions: On a unit-wide basis, the Unit 1A deer population is thought to currently be substantially lower than the population objective of 15,000 deer. The current population objective and harvest objective (900) for Unit 1A were established by the BOG in fall 2000. The population objective was estimated using a USFS habitat capability model for deer combined with a qualitative estimate of deer numbers by department biologists based on deer pellet counts and general range condition. The harvest objectives were based on the average annual harvest during 1994-1999. We note that these objectives were set based on peak harvest years with mild winters, and may be unrealistically high.

    Deer pellet transects indicate low deer numbers, and declines in the deer harvest beginning in the mid 1990s appears to support the deer pellet-group findings. Although deer populations can be influenced by many variables such as severe winter weather, habitat alteration, disease, and predation by bears, we believe predation by wolves to be one of the primary factors currently limiting recovery of deer populations within the considered treatment area. The considered wolf reduction plan is an experiment that we believe may be successful in increasing deer numbers. Removal of wolves would be conducted by 2 experienced trappers who, contingent upon favorable weather conditions, should be able to harvest wolves at a relatively high rate. These trappers have spent years perfecting their techniques, and all indications are that with department support (particularly fuel) they represent the most feasible method of reducing the wolf population within the considered treatment area.

- Landownership patterns within the range of the population. Land ownership on Gravina includes USFS, State, Private, and Mental Health (Figure 3).

- Accessibility to harvest.
  - The treatment area (Gravina Island) is widely accessible from the shoreline by boat and a road system accessible by the airport ferry and is close to Ketchikan. Gravina consists of approximately 100 sq. miles of land and approximately 70 miles of shoreline.

- Other factors considered relevant by the BOG.
  - This is the most accessible area in Unit 1A for Ketchikan hunters with some roads and access by boat in relatively protected ocean water. To access other deer hunting areas near Ketchikan one must either take an expensive ferry to POW Island and drive, or, to access areas of Unit 2 or Unit 1A shoreline, hunters must boat across dangerous open stretches of water in sometimes inclement weather conditions. Most of these factors make if infeasible for most Ketchikan residents to routinely hunt deer in Unit 2 or other remote parts of Unit 1A.
  - Deer Harvest Estimates: Deer harvest estimates have been based on extrapolated hunter survey questionnaires since 1984, and the poor quality of the data, especially for small areas, limits its utility. Estimated deer harvest on Gravina has varied with the high recorded in 1995, when over 300 deer were harvested (Fig. 5). The long-term average reported harvest has been 90 deer/year. Since 1995, deer harvest has declined and most recently both effort and harvest have remained low at an annual average of 68 deer. During some years there are only a few deer harvested from Gravina. Relative contributions of various factors involved in this deer decline have not been determined.

  - Deer season was recently reduced by one month in Unit 1A because of low numbers and concerns about several easily accessible areas being over harvested. With the change from the deer harvest questionnaire to harvest report cards in 2011, we expect that harvest data collection will improve in future years and we hope to be able to better determine minimum harvest levels in addition to estimated total harvests.

3. Depletion of the ungulate population (abundance or harvest below objectives) or reduction of the "productivity" (recruitment) of the population has occurred and may result in a "significant" reduction in the allowable harvest per Alaska Statute, Title 16, and Chapter 5 (AS 16.05.255 [e].

- Yes. The unit-wide deer harvest is well below the IM harvest objective (Figure 4). Although a precise population estimate is not available for the unit, the deer population is also believed to be well below the IM population objective.

4. Enhancement of abundance or productivity of the big game prey population is feasibly achievable utilizing recognized and prudent management techniques (AS 16.05.255[e][3]).

   - Yes. Trapping is widely recognized to be a prudent management technique. By hiring trappers who will work full time in the treatment area under consideration, the department believes that wolf numbers can be eliminated, thereby increasing survival and recruitment of deer and eventually resulting in increased deer harvest.

5. The BOG is not required to adopt regulations to provide for an IM program per AS 16.05.255(f)(1) if a proposed IM program is:

   - Ineffective based on scientific information. We know severe winter weather can have a profound impact on deer numbers. We also know that habitat alterations resulting from logging and the elimination of critical winter habitat have had detrimental effects on deer by removing critical winter habitat. And we know from studies being conducted in neighboring Unit 2 that black bears are efficient predators on deer fawns. However, what's not known is to what extent each of these variables affects deer populations in Unit 1A. Despite the unknowns, we believe that removing wolves is the most practical and achievable option for increasing deer numbers.
   - Inappropriate due to landownership pattern. The land ownership (Figure 3) in this area is mostly federal (USFS), but the trapping activities would be conducted on state lands below mean high tide. Therefore, land ownership issues are not expected to hinder an effective control program.
   - Against the best interest of subsistence uses. Subsistence users throughout the unit would benefit from any increase in the availability of deer, and most would support any effort by the department to increase deer numbers.

6. The BOG may forego a feasibility assessment if per AS 16.05.255(f)(2) it declares that a biological emergency exists and takes immediate action to protect or maintain the big game prey population in conjunction with the scheduling for adoption of those regulations that are necessary to implement section (e).

APPENDIX B. Elements of a feasibility assessment for an area (deer, moose) or herd (caribou).

[*The assessment identifies factors that have the potential to hinder or prevent progress toward maintaining or elevating ungulate harvest (ultimate goal of intensive management [IM] and common to other management programs). Two general situations are high and low density of prey. For ungulate populations already at high density, managers typically seek to maintain or improve nutritional condition of the animals by reducing the browsing or grazing on forage plants, by increasing forage production, or both. Thus, a strategy at high density may seek to purposefully reduce ungulate populations (often accomplished by increasing harvest) or enhancing habitat. In contrast, for populations at low density where nutritional condition is generally good and predation is the primary limiting factor, strategies will often include predation control where the initial focus is to increase the ungulate population by improving recruitment of young into the breeding population. Predation control (particularly for wolves in areas of deep snow) may also improve survival of older age classes to allow population growth. Alternatively, predation control might be applied, particularly in focused geographic areas, in an attempt to initially reallocate part of the predation mortality to harvest without expecting a substantial increase in population.*

There may be situations where dramatic change in habitat has reduced carrying capacity, resulting in reduced density. For example, during several decades following coastal timber harvest there may be lack of canopy interception of snow by mature conifers that hinders deer access to upland browse, followed by a period of dense regeneration where canopy hinders understory forage development by blocking sunlight.

In all situations, hunting conflicts can limit harvest potential and should be identified (along with strategies to reduce conflict) before drafting an operational plan and implementing a management program to increase the population (see Intensive Management Protocol). The primary (but not exclusive) forum for defining acceptable hunting practices, discussing access conflicts, or recommending evaluation parameters is the local Fish and Game advisory committee. For example, greater hunter success per unit of effort (i.e., fewer days required to harvest an animal) may be considered an acceptable outcome of management because of fuel savings, even if the harvest objective is not achieved. Where appropriate, based on factors assessed, an area smaller than the IM subunit or herd range may be identified for implementing and assessing results of IM programs as a means to make progress toward achieving the population and harvest objectives for the game management unit (deer, moose) or herd range (caribou) or as specified in regulation.]

I. BIOLOGICAL FACTORS

Biological factors are the basis for evaluating potential to achieve population or harvest objectives. Information may be yes/no, numeric, categorical, or not applicable depending on species or area. Brief explanations may be warranted along with local data where available. In most instances professional judgment by department staff will be required to put numbers in context in the recommended management strategy (Section I:Feasibility Assessment, p. 1).

A. *Nonpredation and Nonhunting Mortality of Prey.*

1. How frequently is there markedly reduced survival due to annual weather (snow depth, especially associated with complicating factors, such as severe cold; ice on snow events; flooding; drought)? [*Expected primarily to affect young, but not exclusively. General examples of thresholds include snow ≥36 inches deep for moose or ≥20 inches for deer, or prolonged wind chill <0°F for deer in shrub-dominated coastal areas. Other empirical values may pertain in specific areas*.]

    - Severe winter weather has the potential to retard or prevent recovery of deer, even if wolves are successfully reduced in the treatment area. However, severe winters generally occur in cycles and appear to be associated with the Pacific Decadal Oscillation. Usually two or three bad winters are followed by seven to ten mild winters. Separating the effects of severe winter weather and wolf predation is difficult because these two factors are strongly linked. Winter weather on Gravina Island is a limiting factor for deer survival. Snow depths exceeding 22 inches are common during winter months and this amount of snow cover is sufficient to cause deer to drop to a negative energetic balance and a poor nutritional condition. Lack of old growth forest available for deer winter habitat and refuge from extreme winter weather cause deer to disperse to muskeg scrub forest and second growth forest where food is relatively more scarce and mobility relatively more limited. Wolves, believed to be the primary predator on Gravina Island, hunt best on flat or gently sloping terrain and are efficient at killing deer in patchy and broken habitat. As such, reducing wolf numbers should reduce predation and increase deer survival. Gravina Island is mostly muskeg scrub forest with very few intact patches of old growth forest. Those few old growth patches have been depleted of deer forage after many years of browse when winter snow forced existing deer into small areas for extended periods.

2. How extensive is vehicle mortality along road and rail systems that reduce harvestable surplus in the population (estimated number killed annually or as a percentage of total kill by humans that includes harvest and defense of life or property)?

    - This area has limited roading and the existing ones are gravel and necessitate slow driving. Consequently, few deer are killed by vehicles.

B. *Productivity of Prey Population and Habitat* (may include prey density effects)

1. Evidence of inherent habitat limitation (e.g., nutrient deficiency) manifested in low reproduction, body weight, or survival? *Yes/No* [*There are examples of areas with low predation and high density that still exhibit an ability to increase, such as moose in GMUs 20A, 20B, and 20D; the Stikine River Valley; and on Kalgin Island. Low birth rate in itself does not mean the population can't increase. However, it is a first cut to understanding relative system productivity. Predation control applied to a system with low productivity may allow some increase in abundance, such as with Nelchina caribou, or reallocation of mortality from predators to harvest. It provides a context for what to expect in a response to a management treatment*.]

    - We do not have data on deer condition, reproduction, or survival for this area. However, given the low deer density we would not expect to see density dependant effects related to poor body condition or low productivity. Although the habitat may be less optimal than other areas in Southeast, we still would not expect the low number of deer to be nutritionally stressed.

2. How strong a negative effect from the local prevalence of diseases or parasites? *Low/Moderate/High*

    - Low: There is no evidence that disease or parasites play a role in limiting the deer population in this area.

3. Evidence of longer term weather trend changing forage production or other habitat requirements (e.g., markedly increased area in recent burns or noticeably less frequent flooding) and its consequence for the ungulate in question *Yes/No.* Note trend in habitat capability. *Positive/Negative*

    - There is no evidence that climate change will result in lower deer numbers in this area.

4. Evidence of high or excessive levels of forage use (excessive means evidence of plant mortality from inability to rejuvenate after persistent grazing or browsing at some proportional level of biomass removal). *Yes/No*

    - Yes. In parts of the unit (i.e., Cleveland Peninsula), past browse utilization appears to have reduced preferred browse species such as *Vaccinium* spp. Other, less palatable and useful browse species (i.e., salal) has become more common in this area. Availability of sufficiently high quality browse in some parts of the unit is thus reduced..

5. Has the combination of natural and human-caused disturbance produced an extent and mixture of vegetative seral stages capable of maintaining the present productivity if the population changes due to management treatment at a moderate level of increase? *Yes/No*. At a substantial level of increase? *Yes/No*

- *No and No.* Gravina Island habitat is mixed with isolated small stands of large diameter spruce and hemlock along riparian corridors and in only a few other small patches. The dominant habitat type is muskeg scrub with small cedar and lodgepole pine patches. Large diameter cedar patches previously capable of providing winter shelter and winter forage for deer along the north end of Gravina were commercially harvested by Mental Health Trust using selective helicopter methods in summer 2008. Access roads were also built to reach state lands in the center of the island during 2005 and DNR harvest sites in 2007- 2009. More small timber sales are available under state timber offering but to date there has not been reasonable bids for this timber. Several USFS timber sales in the center and south end of the island are in advanced stages of planning and layout; however the Federal roadless rule has placed these sales temporarily on hold and they are unlikely to move forward anytime soon.

- Around the time of the deer decline on Gravina, several older timber sales, in previously prime south facing winter habitat, reached the stem exclusion stage and likely reduced overall carrying capacity for deer in the center and the north end of the island. Even some previously productive alpine habitat has very few deer, probably because there is no winter habitat for alpine deer to retreat to when the winter snow covers the high elevation open habitats. Winter weather, heavy snowfall, and late spring persistence of deep snow during the winter of 1998-1999 had a severe impact on the remaining deer numbers on Gravina Island.

- An extensive forest fire around 1960 caused loss of winter habitat along the south end of the island. The majority of this low elevation habitat remains in the stem exclusion stage where very few forage plants are present under the closed forest canopy.

- Opportunistic vegetation surveys and observations during annual deer pellet surveys suggest deer numbers may have reached artificially high levels at some time in history (i.e., mid 1990s) and caused damage to forage plants important to deer in winter such as blueberry and huckleberry. Assessment of vegetation will continue on Gravina to better understand possible changes related to browsing.

- Winter weather on Gravina Island is a limiting factor for deer survival and population trends. Snow depths exceeding 20 inches (deer breast height) is common during winter months and this amount of snow cover is sufficient to cause deer to drop to negative energy levels and poor nutritional planes. Lack of old growth forest available for deer winter habitat and refuge from extreme winter weather cause deer to disperse to muskeg scrub forest and second growth forest where food is scarce and mobility limited. Wolves, believed to be the primary predator on Gravina Island, hunt best on flat or gently sloping

terrain and are especially efficient at killing deer in patchy and broken habitat. Gravina is mostly muskeg scrub forest with very few scattered patches of intact old growth forest. Those few old growth stands have been depleted of deer forage after many years of heavy browse by deer when winter snow pushed existing deer into small areas for extended periods.

C. *Potential Effectiveness of Proposed Predator Control* (based on number of predator species and seasonal prey location).

1. Is effect of predation by individual predator species known for the ungulate species of interest in the proposed area? *Yes/No* [*by predator species*]

- Yes. While little area-specific information is available regarding predation on deer in Unit 1A, research conducted on deer, wolves, and black bears in neighboring Unit 2 (POW Island) provides useful information on the predator/prey relationship of these species in a similar environment. For example, for wolves and Sitka black-tailed deer in Southeast Alaska, the estimated predation rate is 26 deer per wolf per year (Person et al. 1996). Additionally, a deer fawn mortality study ongoing in Unit 2 indicates that black bears are notable predators on deer fawns during the first 2-3 weeks of fawns' lives.

2. Is predation control being proposed for one or multiple predator species? *One/Multiple* [*list predator species*]

- One. Wolves only.

3. Are there concentrated calving and/or young rearing areas of ungulates for focused bear or wolf control? *Yes/No* [*define which predator(s)*]

- No. Based on data from nearby Prince of Wales Island, deer tend to be dispersed on the landscape during fawning which would result in any predator seeking fawns to be widely dispersed as well.

4. Are there concentrated winter ranges of ungulates suitable for focused wolf control? *Yes/No/Unknown*

- Yes. In winter, many deer tend to use low-elevation portions of their home ranges that are typically closer to shorelines. As a result, wolves typically frequent these same areas in search of prey. For this reason we believe focusing trapping efforts along state tidelands during the winter months has a chance of effectively reducing wolf numbers.

D. *Potential Effectiveness of Public Participation in Predator Control (under permit) or Predator Harvest* (see also III.A and III.B this appendix)

1. Number of licensed hunters and trappers within or near proposed management area (size of potential participant group) and the proportion of these hunters and trappers actively harvesting predators.

    - Over the last 2 decades, trappers and hunters have harvested an average of approximately 30 wolves annually (range 9-50) in Unit 1A (Figure 5). Trappers account for most of the annual harvest (70%) with incidental shooting accounting for 30%.

2. Estimated wolf harvest rate (percentage of estimated fall population, average of three most recent regulatory years).

    - Recently, Gravina Island wolf trapping and wolf hunter harvest has been low, with a few spikes (range 0-8) (Figure 7). Most trappers access traplines by boat, although recently with the new logging roads, several Ketchikan residents have trapped new parts of the island along the limited road system. Winter travel by boat is weather dependent and persistent severe winter weather conditions can restrict trapping effort in locations like Gravina. Consequently, some years show very low wolf harvests. The same mercurial pattern is evident throughout Unit 1A, where fluctuations in wolf harvest is driven more by weather and ocean boating conditions rather than changes in predator numbers (Figure 6).

      By our best estimation, there are approximately 10-14 wolves on Gravina Island for a fall estimate, yet local trappers rarely catch more than a couple each year. However, during 2007 four trappers caught a total of 8 wolves on Gravina, one of the highest Gravina wolf harvests on record (Figure 7).

      It is possible wolves move between Gravina, Revilla, and Annette islands by swimming Nichols Passage and/or the Tongass Narrows. We currently have no information on wolf movements between these islands.

      Hide quality of wolves in Southeast Alaska is moderate to poor and many hides are not saleable at competitive fur auctions. The wiry hair and low hair quality cannot compete with interior and Canadian wolves in open fur markets. Some hides are tanned and sold to tourist outlets as souvenirs or throws, but few are used for fur garments. Consequently, there is little incentive for trappers to target wolves because of the work involved, and because of high fuel costs and costs for specialized wolf trapping gear.

      The potential of landing fixed-wing aircraft to locate and or remove wolves during winter is extremely low. Attempts to locate wolves during good snow

conditions, even with helicopters, have been unsuccessful due to terrain and dense vegetation.

3. Estimated black bear harvest rate (percentage of estimated spring population, average of three most recent regulatory years).

    - Precise population estimates are not currently available for black bears in the unit; however, we did our best to estimate bear density, population size, and harvest rates during BOG preparations in 2010. For all of Unit 1A, our estimated densities ranged from 0.5-2.5 bears/mile^2, our estimated population size ranged from 2,652-4,384, and our estimated harvest rate ranged from 2.3-13%. These density estimates were derived from subjective assessments made by area biologists by comparing each area to Kuiu Island (where bear density estimates have been scientifically derived), along with habitat capability models. Harvest records and anecdotal information and observations from big game guides, hunters, and agency biologists suggest that black bear populations may have declined over the last decade. Black bears are known to prey on deer, and particularly on deer fawns. Therefore, reducing wolf numbers at a time when black bear populations are at lower levels may increase the likelihood that wolf removal will increase deer survival and result in increased deer numbers.

4. Estimated grizzly/brown bear harvest rate (percentage of estimated spring population, average of three most recent regulatory years).

    - While brown bears are known to have occurred on Revilla Island in Unit 1A, their numbers are believed to be extremely low. No evidence exists of brown bears inhabiting Gravina Island. Therefore, brown bears are not believed to be a significant contributing factor to low deer numbers in the unit.

5. Historical effectiveness of a predator control program in this area (where applicable).

    - Wolves were controlled in Southeast Alaska during the 1950s using poison, trapping, and the bounty system. The wolf control program was apparently effective because, by the late 1950s, deer numbers were high and biologists worked hard to convince hunters to shoot more female deer (Dave Klein, personal communication). During the late 1960s, in response to severe winter weather and reduced deer numbers, the state Legislature appropriated money for wolf control in Southeast Alaska and animal control agents and biologists with ADF&G used traps and strychnine poison to reduce wolf numbers (McKnight 1973). This program was not continued after 1968, and in the early 1970s severe winters reduced the reportedly moderate deer numbers to low levels. Although the bounty ($50) on wolves in Southeast Alaska remained in place after statehood, the Legislature did not fund it after 1967 and it was eliminated in 1977. No formal wolf control program has been conducted in Unit 1A since 1968 and, despite long seasons, public trapping

has been ineffective for significantly reducing wolf numbers or predation on deer. In November 2010, the BOG extended the wolf hunting season until the end of May in Unit 1A to provide more opportunity for black bear hunters to take wolves. This action, however, has so far contributed little to increasing the unit-wide wolf harvest.

6. Number of competing predator control programs in the region and the anticipated impact of adding an additional program (potential dilution of participation by skilled members of the public).

   There are no other predator control programs in Region 1. An experimental predator control program is similarly being considered for a small portion of Unit 3 near Petersburg. With the exception of the bounty system, which was funded until 1967, there has been no recent state sponsored IM activity in the Region. There are some other areas in Unit 1A that have been considered for some form of predator management, but associated public discussions have met with disapproval by local trappers in those areas. Those trappers have not been in favor of department research projects being conducted in their trapping areas, nor have they supported intervention from the department, either by wildlife biologists conducting trapping efforts or by the department hiring skilled trappers to reduce wolf numbers.

E. *Ability to Confirm Treatment Response* (e.g., predator control, habitat enhancement, selective harvest) in treatment areas with data from nearby and comparable untreated areas through assessment of biological parameters using existing techniques. Low sample size for survey data may limit applicability in low density situations. Describe whether the following criteria for evaluating response to treatment are possible or recommended (*Yes/No* answers):

1. Established periodic survey for abundance.

   A number of long-established deer pellet-group transects are located on Gravina Island and the Cleveland Peninsula, including transects within considered "treatment" area (Figures 8 and 9). If deemed necessary, additional pellet group transects will be established in treatment and comparison areas to help evaluate the success or failure of the proposed trapping effort. However, the deer pellet-group methodology is not designed to detect precise changes in deer numbers, but is instead used to assess general trends in deer population fluctuations (i.e., determining whether they are increasing, stable, or decreasing). Interpretation of pellet-group results (Figure 10) can be confounded by a number of factors (snowfall, snow persistence, pellet persistence) independent of whether there is any change in actual deer numbers. While the pellet group data is one tool used to measure long-term trends in deer numbers, it is not well suited to measuring short term changes in deer population size.

DNA deer pellet transects: The department is currently experimenting with a new pellet-group methodology that, if successful, should allow us to more accurately estimate deer densities and/or population size. This method involves collecting fresh deer pellets and extracting DNA to determine the identity of individual deer. In so doing, it may be possible to conduct a mark-recapture estimate of deer density and/or population size depending on the level of effort expended. We are currently planning on conducting some level of analysis using this methodology in the IM area being considered in Unit 3 to measure deer density prior to taking any control measures. We would then continue this effort during the control period to measure changes in deer density/population size.

Deer catch per unit effort: Despite low deer numbers on Gravina Island, the department will recommend that deer hunting initially remain open for bucks only. Harvest of a few bucks is not expected to cause a further decline in deer numbers or prevent recovery of deer, and harvest statistics (including days hunted per deer harvested) will provide an important measure of deer abundance and availability that will be useful for evaluating progress toward the program's objectives.

2. Fall composition surveys for young to adult female ratio as index to survival [*e.g., bear predation during prior summer where wolf predation on young is comparatively low*].
   - We have not conducted these types of surveys.
3. Fall composition surveys for yearling to adult female ratio as index to survival [*e.g., wolf predation during year since prior fall survey where bear predation on young is comparatively low*].
   - No. Not feasible due to sightability problems associated with dense vegetation and rugged terrain.
4. Radiotelemetry for survival of specific age cohorts.
   - Possibly. Pending available funding only. However, given the low density of deer in this area, capturing a sufficient sample size of deer could be difficult.
5. Total prey harvest and age-sex composition of harvest among local residents, state residents, and nonresidents (where applicable).
   - Yes. Historic deer harvest survey information and recently-implemented deer harvest report cards.
6. Harvest per unit effort, particularly in focused program areas where the initial intent is reallocation of mortality from predators to harvest to first meet local harvest needs.
   - Yes. Historic deer harvest survey information and recently-implemented deer harvest report cards.

II. SOCIETAL FACTORS

Societal factors associated with hunting conflicts (e.g., constraints to access, acceptable methods, and harvest expectations), hunter access, and public tolerance for intensive management practices.

A. *Public expectation for predator control and increased ungulate harvest* must be understood prior to initiating programs to increase ungulate populations. Public conflicts over ungulate harvest methods can reduce options for controlling population growth. Failure to limit growth can reduce the condition of habitat and ungulates to the extent of reduced productivity. Critical components of conflict mitigation are identifying acceptable predation control methods as well as the potential for additional ungulate harvest opportunities that are acceptable to the hunting and nonhunting public. Defining the benefits of increased harvest is complex because hunter motivation may include economic factors (cost of meat replacement) and intangible measures of satisfaction (continuation of hunting culture, time spent in the field with family or friends, etc.).

1. Has the public defined an acceptable quantity and sex/age structure of ungulate harvest? *Yes/No*

   - Yes. Residents of Unit 1A have cited the scarcity of locally available deer and have requested measures to enhance deer populations and harvest. Public outside of Unit 1A have not been involved in the process to date.

2. Does the level of unreported or unknown harvest hinder the ability of the department to evaluate response to management treatments? *Yes/No*

   - Yes. The department has concerns with illegal harvest on Gravina Island and is concerned that this harvest may be substantial enough to influence our ability to measure any response to wolf control.

3. Has the department informed constituents about ecological and biological constraints (nutrition, forage condition) relative to setting upper limits for population densities of managed ungulates? *Yes/No*

   - No. High deer numbers have not been an issue since the mid 1990s in Unit 1A. The department anticipates that hunters will be able to limit growth of deer numbers in the treatment area because of the high interest in participating in this hunt and ease of hunter access from the shoreline.

4. If possible from historic data, characterize hunter density where significant conflicts occur between hunters: *Low, Moderate, High* and between hunters and nonhunters: *Low, Moderate, High*

   - Low and Low. Hunter conflicts are rare in this part of Southeast Alaska. With the long season and liberal bag limit, hunters are dispersed over large areas.

5. If possible from historic data, what is potential for conflict in rural areas between local hunters and nonlocal hunters? *Low, Moderate, High*

   High. Rural designated and federally qualified hunters from Saxman and Metlakatla will likely petition the Federal Subsistence Board to include Gravina as an exclusive hunting area. Doing so would exclude Ketchikan residents from hunting federal lands on Gravina.

6. Conflicts or problems associated with access, such as existing access constraints. *Few, Some, Many*

   - Few.

7. Acceptable strategies to spread out hunters and minimize trespass on private lands. *Few, Some, Many*

   - Few.

8. Acceptable strategies to minimize unacceptable levels of trail damage on public lands. *Few, Some, Many*

   - Few. There are very few developed trails on Gravina and hunters will be dispersed over a large area.

9. Acceptance of restricted methods or means for *harvest, partic*ularly *near communitie*s (e.g., archery or muzzleloader). *Yes/No*

   No. There are only a few residences along Gravina Island's shoreline and weapons restrictions are not necessary.

10. Anticipated increase in vehicle mortality with ungulate population growth (poses a public safety risk). *Low, Moderate, High*

    - Low. There are few developed roads on Gravina and we would not expect vehicle mortalities to be an issue.

11. Anticipation of strongly adverse public reaction to a management tool (e.g., predation control, prescribed fire, selective harvest), geographic area, or other facet of the proposed program. *Low, Moderate, High*

    - Moderate. It is hard to anticipate the reactions to a predator control program on Gravina Island. However, it is likely that some people would oppose this action.

12. Potential for predator control to have indirect negative effects on alternate prey, such as increase in medium predators that can prey on ungulate young, particularly in species of high interest to hunters (e.g., increased coyote abundance following

extended periods of wolf control to benefit moose or caribou could increase predation on Dall sheep lambs during peak abundance of hares, with implications on number of legal rams in future years). *Low, Moderate, High*

- Low. We do not anticipate any indirect negative effects of removing wolves on alternate prey.

13. Coordination among hunters and trappers about control methods and allocation among ground-based trappers, aerial gunners by permit, and departme*nt use of helicopters. Low, Moderate, High*

- High. We anticipate a high level of cooperation among hunters and trappers with regard to reducing wolf numbers as a means of increasing deer populations. There are approximately 10-15 trappers per year who actively trap wolves at varying intensities in Unit 1A. The Ketchikan trappers mostly know each other and respect one another's traditional traplines.

B. *Landownership* may influence or restrict access for predator control or ungulate harvest. Proximity of restrictive status to communities or areas where management treatments would be most effective is the important context (see discussion of management strategy, Section I:Feasibility Assessment, p. 1). If the objective is to increase harvest in a local area as progress toward a larger area objective, a program to reallocate mortality from predation to harvest without a substantial increase in ungulate abundance may be feasible with harvest coordination (see Section III.A.3).

1. Percentage of national park or preserve and national wildlife refuge (where predator control may be restricted) in game management unit or subunit or caribou herd range.

- Approximately 85% of Gravina Island is federal land and managed by the USFS.

2. Percentage of area in federally designated wilderness or wilderness study areas where habitat or wildlife management may be subject to more extensive public process.

- There are no wilderness designated lands on Gravina Island.

3. Percentage of Alaska Native corporation land.

- There are no Alaska Native corporation lands on Gravina Island.

4. Access for predator control or ungulate hunting allowed on Alaska Native corporation lands? *Yes/No*

- No.

C. *Access for Predator Reduction and Ungulate Harvest* (see also Sections II.A.6 and II.A.7)

1. What is the extent of all-season roads? *Limited/Moderate/Extensive*

- Limited. There is only one short section of road that will be plowed and open during the peak of winter weather.

2. What is the extent of ATV trails? *Limited/Moderate/Extensive*
   - Limited. There is an 11 mile section of logging road that will be closed by a locked gate but open to ATV access.
3. What is the extent of navigable rivers? *Limited/Moderate/Extensive*
   - Limited. There are no navigable rivers in this area.
4. What is the feasibility of landing fixed-wing aircraft in winter for predator removal?
   - Low. There are only a few lakes big enough to land a float-equipped airplane and not predictable snow to land ski-equipped aircraft.
5. What is the feasibility of landing fixed-wing aircraft in fall for ungulate hunting?
   - Low. There are only a few lakes big enough to land a float-equipped airplane and not predictable snow to land ski-equipped aircraft.
6. What is the feasibility of ocean shoreline access for hunting or predator removal?
   - High. There is extensive shoreline and beach access for hunting and trapping.
7. Is use of helicopters by the public (under permit) allowed for trapping or retrieval of carcasses from aerial shooting?
   - No, not at this time.
8. Are there controlled use areas that prohibit aircraft access for ungulate harvest?
   - No, currently there are no control use areas on Gravina Island.

III. ECONOMIC FACTORS

Economic factors define estimated costs of management programs and expectations for public participation in predator control programs for comparison to perceived benefits by the BOG and the public.

A. *Cost of Participation* (in prey harvest or predation control by the public)

1. Price (dollars/gallon) of unleaded gasoline (average among communities).
   - Cost of unleaded gasoline currently in Ketchikan is $4.25 per gallon.
2. Price (dollars/gallon) of 100 octane low lead aviation fuel (average among communities).
   - Cost of 100 octane low lead aviation fuel in Ketchikan is currently $6.45 per gallon.

3. Cost to hunters per prey animal harvested from alternative area (e.g., transportation cost to hunt in adjacent areas with harvestable surplus of ungulates). *Low/Moderate/High*

   - Difficult to quantify; depends on method of travel and final destinations. When compared to hunting locally (within the considered treatment area) the cost to hunt in adjacent Unit 2 is considerably higher in terms of both transportation costs and risks to personal safety (i.e., extensive open water crossings).

4. Value of predator hides or other parts legal to sell.

   - Low. Green wolf hides = $100 ea. Tanned wolf hides = $200-$300 ea.

B. *Potential for Participation* (in predator control or harvest by public)

1. Would creating a new predation control program hinder ability to maintain public involvement in existing predation control programs in the region? No
2. Will a predation control program, habitat enhancement project, or ungulate harvest strategy conflict with existing harvest of predators by reducing opportunity for local hunters or trappers?

   Yes, to some extent. There is some potential for conflict with local trappers. However, we feel that through discussions with local trappers we could either work around existing private traplines or encourage intensified public efforts to harvest wolves.

3. Potential to conduct department-sponsored control programs if public participation is lower than expected. *High*

   - High. The considered wolf control program will not rely on public participation to meet program objectives. The program will rely on trappers hired by the department. Public participation in wolf trapping and the intensity of these efforts are low in Unit 1A because of high fuel prices and frequently inclement winter weather conditions. Low public participation in trapping could actually benefit the considered program because inexperienced public trappers tend to "educate" wolves and make trapping more difficult for professional trappers. In spring and fall, hunters take wolves opportunistically while hunting for black bears and deer. This harvest will continue and will contribute to reducing wolf numbers in the treatment area.

C. *Potential for Cost Sharing* (in habitat enhancement) (see also Section II.B)

   - Low. Deer are currently believed to be far enough below carrying capacity that nutrition is not believed to be a contributing factor to the recent population decline. Deer numbers have declined to low levels in all habitats. Precommercial thinning of the dense second-growth stands that have resulted from clearcut

logging provides the only real opportunity to improve habitat conditions for deer. However, most of the unit is comprised of federal lands (National Forest) and it is not within the State's authority to undertake such activities. Even if it were feasible, because deer in the unit do not appear to be food-limited, we would not expect such efforts to significantly improve deer numbers in the near-term.

1. Potential to collaborate on prescribed fire where hazardous fuel reduction is the primary goal. *Low/Moderate/High*

   Not applicable.

2. Potential to collaborate on forest management or mechanical vegetation treatments to produce wood products or reduce hazardous fuels. *Low/Moderate/High*

   - Low. One of the limiting factors for deer in this area is lack of old growth forest that provides critical winter habitat, especially during deep snow winters.

APPENDIX C. Availability of population and harvest information.

Data include status of predators, ungulate species, and habitat for modeling predator removal rates and time until increase in harvest of ungulates is feasible [*Yes/No/Unknown/Not applicable*]

- Ungulate population status:
  - Abundance survey within last 2 years. No.
  - Abundance surveys on set schedule to estimate trend. No.
  - Composition survey within last 2 years. No.
  - Estimate of parturition rate within last 5 years. No.
  - Young survival estimate with mortality causes identified. No.

- Harvest of prey:
  - Trends in reported harvest by residents and "local" (game management unit) residents among general season, drawing permit, registration permit, and Tier II categories over last 10 years.
    i. Gravina Island has experienced substantial reductions in hunter effort and success over the last 10 years. In 2001, 248 hunters killed 123 deer. From 2007-2009, an average of 65 hunters killed just an average of 10 deer per year. This trend is similar for the other major areas of Unit 1A, including Revilla Island, the Cleveland Peninsula, and the mainland/Misty Fjiords area. Over the entire unit, numbers of hunters has decreased from approximately 650 to approximately 250 and the harvest has dropped from 352 deer in 2001 to 75 in 2008.

    ii. Total harvest in the unit is estimated by combining the reported harvest from surveys with estimated illegal and unreported kills. The unreported and illegal take for Unit 1A is estimated to equal approximately half of the legal harvest each season. The last five seasons have seen a precipitous drop in hunter numbers, hunter effort, and deer harvest when compared to that of 1998–2004. From 2006-2009, an annual average of 279 hunters have spent 1,243 days afield in order to harvest an average of 193 deer. The 2008 and 2009 seasons were particularly low, with possibly the lowest harvest on record at just 75 and 138 deer reported, respectively.

    iii. The number of hunters utilizing Gravina Island continues to be low. During 2008, 83 hunters reported a harvest of 11 deer, while in 2009, 55 hunters reported taking 19 deer. Both of these harvests, though low, are substantially better than 2007 when no deer were reported taken. After several years of no reported harvest, the Cleveland Peninsula continues to be very low, with 0 and 3 bucks reported killed during 2008 and 2009, respectively. This is exactly the same as was taken during the 2 years of the previous report period.

  - Where unreported harvest occurs, public perception of trend.
    i. No information available on this factor.

- Estimate of unreported harvest from telemetry, Division of Subsistence, or other sources. The department estimates up to 50% illegal/unreported harvest.
- Department estimate of current sustainable harvest.
  Amount necessary for subsistence (specify date of determination or updates, whether specific to proposed intensive management (IM) area or larger area, and number relative compared to IM objective).

  700, although this number was obtained at a period of high abundance and may not be realistic or appropriate over the long-term. Over 90% of Unit 1A hunters are local residents living within the unit. During the period 2008-2009, 199 and 245 local hunters averaged 22% and 24% success. This is down substantially from the previous two years, when 267 and 206 local resident hunters had success rates of 49% and 39%, respectively. Many nonresident deer hunters hire registered guides, which increases their chances of successfully harvesting deer. Nonlocal resident hunters also had low success in 2008 and 2009, with success rates slipping to 28% and 30%, respectively, from a previous high of 81% just 2 years earlier.
- Historical harvest by nonresidents? None.
- Present harvest by nonresidents? None.

- Status and harvest of predators:
  - Survey/census of wolf density within last 5 years. No.
  - Survey/census black bear density within last 5 years. No.
  - Survey/census grizzly/brown bear density within last 5 years. NA.
  - Predator-prey ratio estimated. No.
  - Survey of alternative prey adequate to aid predator recovery. No.
  - Most wolf harvest accounted for by sealing data. Yes.
  - Most black bear harvest accounted for by sealing data. Yes.
  - Department estimate of black bear harvest where sealing does not occur. NA.
  - Most grizzly/brown bear harvest accounted for by sealing data. NA.

- Habitat condition (methods may be specific to region or species):
  - Proportional removal of browse biomass in previous 5 years with no large population change or widespread disturbance (e.g., fire) since browse survey. No.
  - Proportion of browse species with broomed growth structure (history of browsing). Unknown.
  - Proportion of area burned in last 10 years (potential browse availability). Two percent old burn on south end of Gravina.
  - Proportion of area in appropriate habitat type based on vegetative classification (define as forage, cover, etc.). Gravina Island contains a variety of habitats that are of value to deer, but depending on the winter severity, it is the old growth forests that are the limiting factor.
  - [*Other metrics? Describe*].

- Ungulate nutritional condition (representative of environmental conditions experienced during the most recent population census or estimate; may be specific to area/region or herd) [*options currently being discussed*]:
    - Percentage of productive 3-year-old female caribou (cohorts are radiomarked for calf weights and monitored for photocensus coverage). NA.
    - Weight of 4- or 10-month-old females (*caribou, deer, moose*). Unknown.
    - Weight of adult (5–6 year old) female caribou (herd specific; requires baseline). NA.
    - Yearling female mandible length. NA.
    - Ratio of femur to hind foot length. NA.
    - Two estimates of moose twinning rate in previous 5 years with no large population change. NA.

      [*Other metrics? Describe*].
      Ultrasound for deer pregnancy/twinning rates
      Fecal nitrogen analysis
      Ultrasound body fat
      Buck body condition from harvested deer
      Pregnancy rates from blood samples

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Figures

Figure 1. Unit 1A, 5300 square miles.

Figure 2. Gravina Island and surrounding islands.

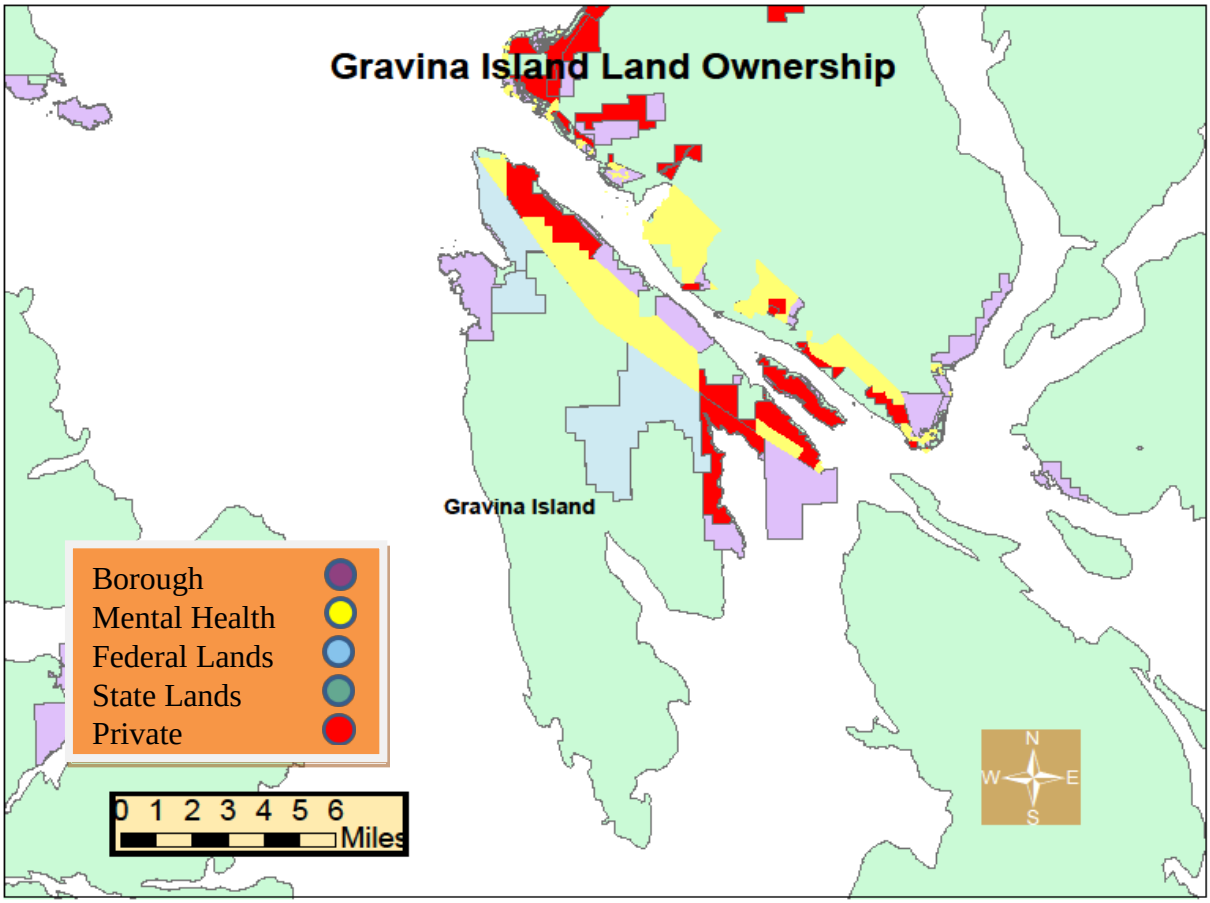

Figure 3. Gravina Island, with current land ownership status.

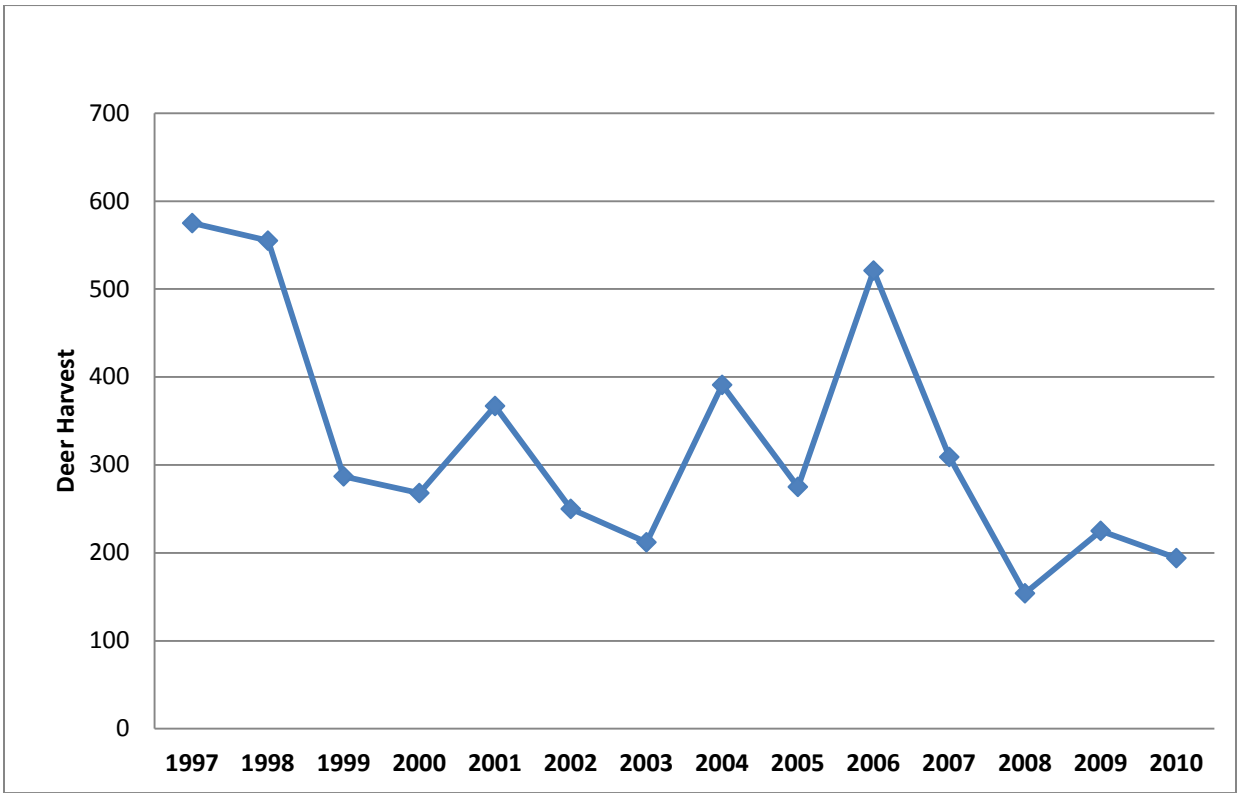

Figure 4. Deer harvest in Unit 1A, 1997-2010.

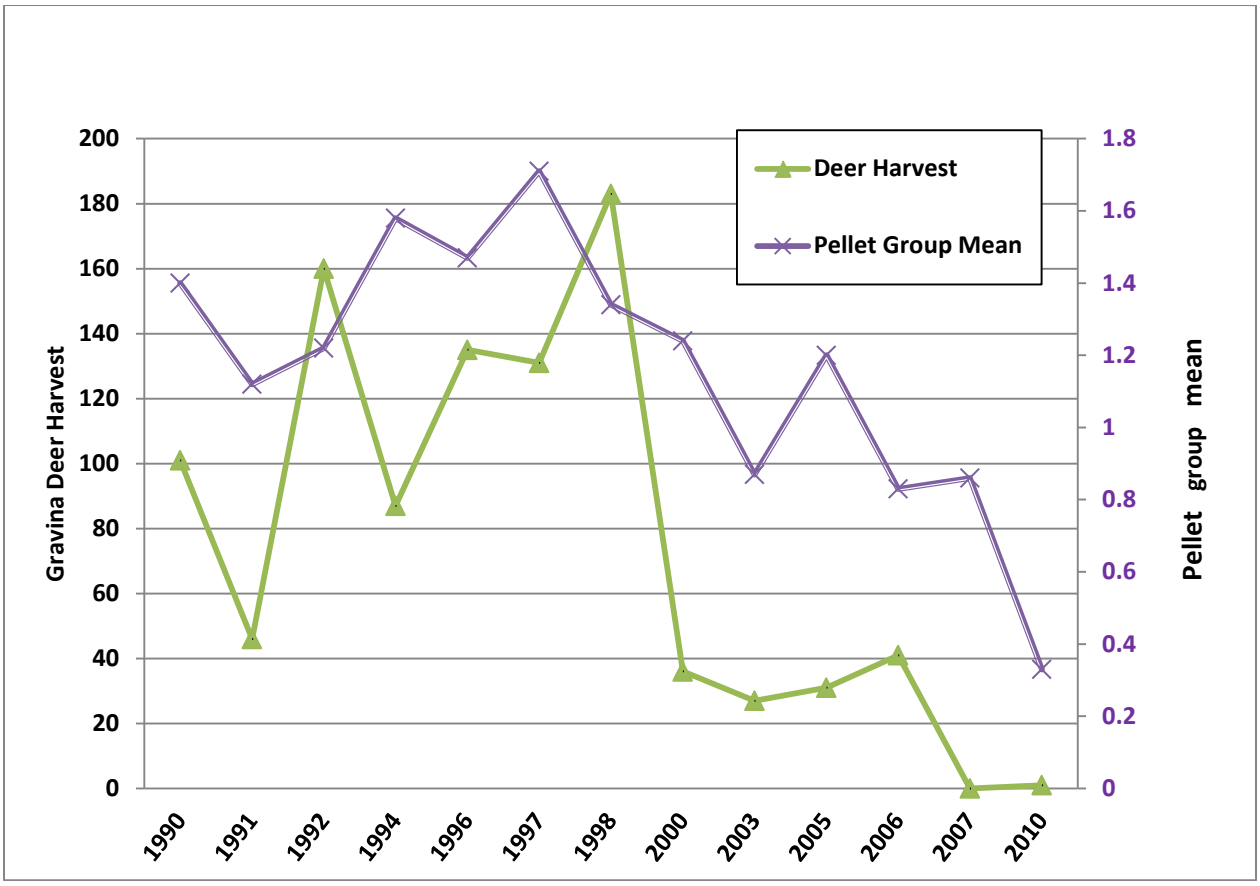

Figure 5. Gravina Island deer harvest and deer pellet group mean per plot, 1990-2010.

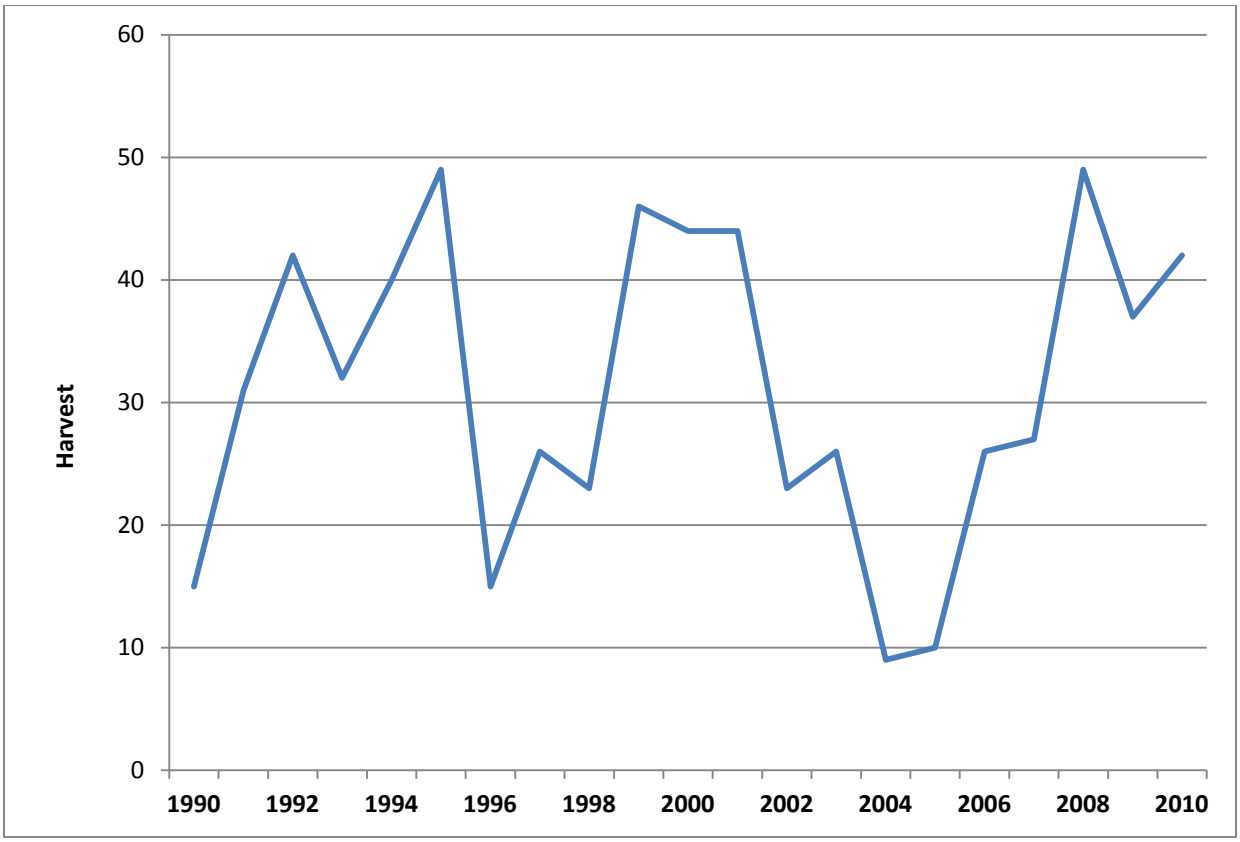

Figure 6. Unit 1A wolf harvest, 1990-2010.

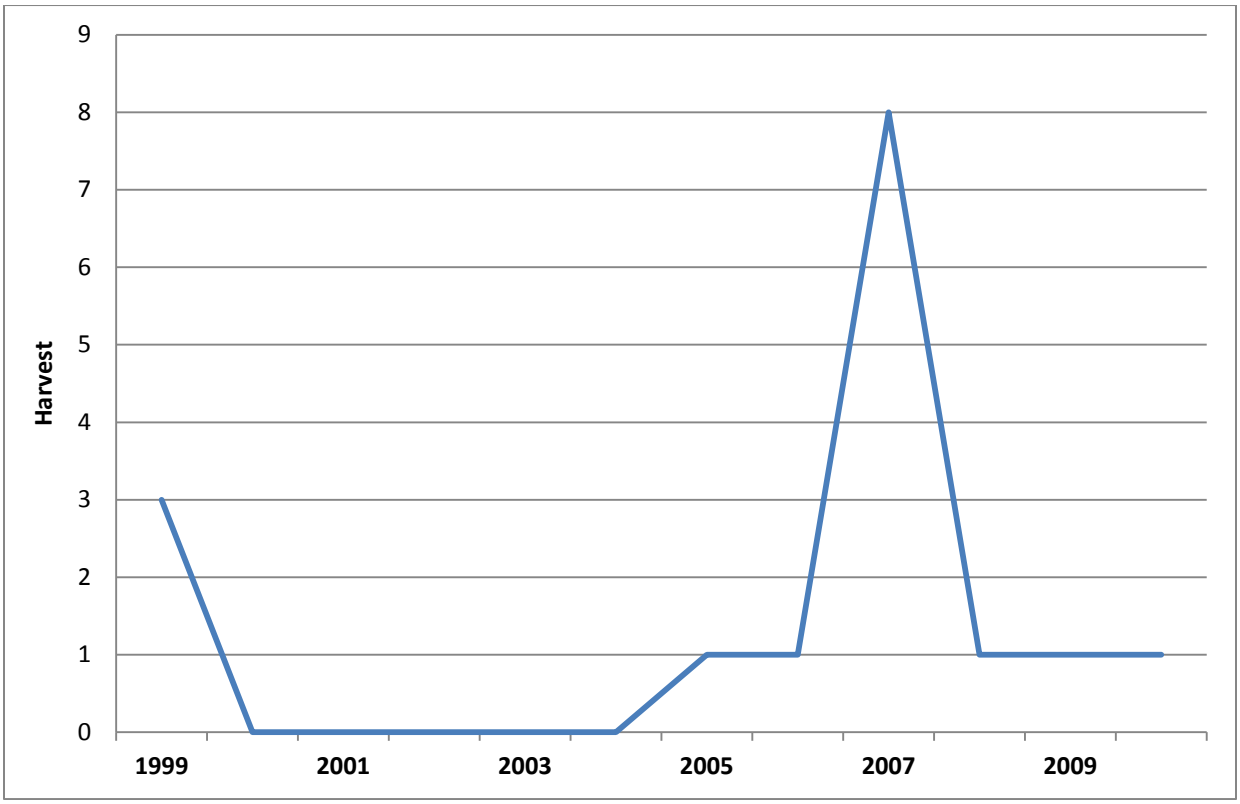

Figure 7. Gravina Island wolf harvest, 1999-2010.

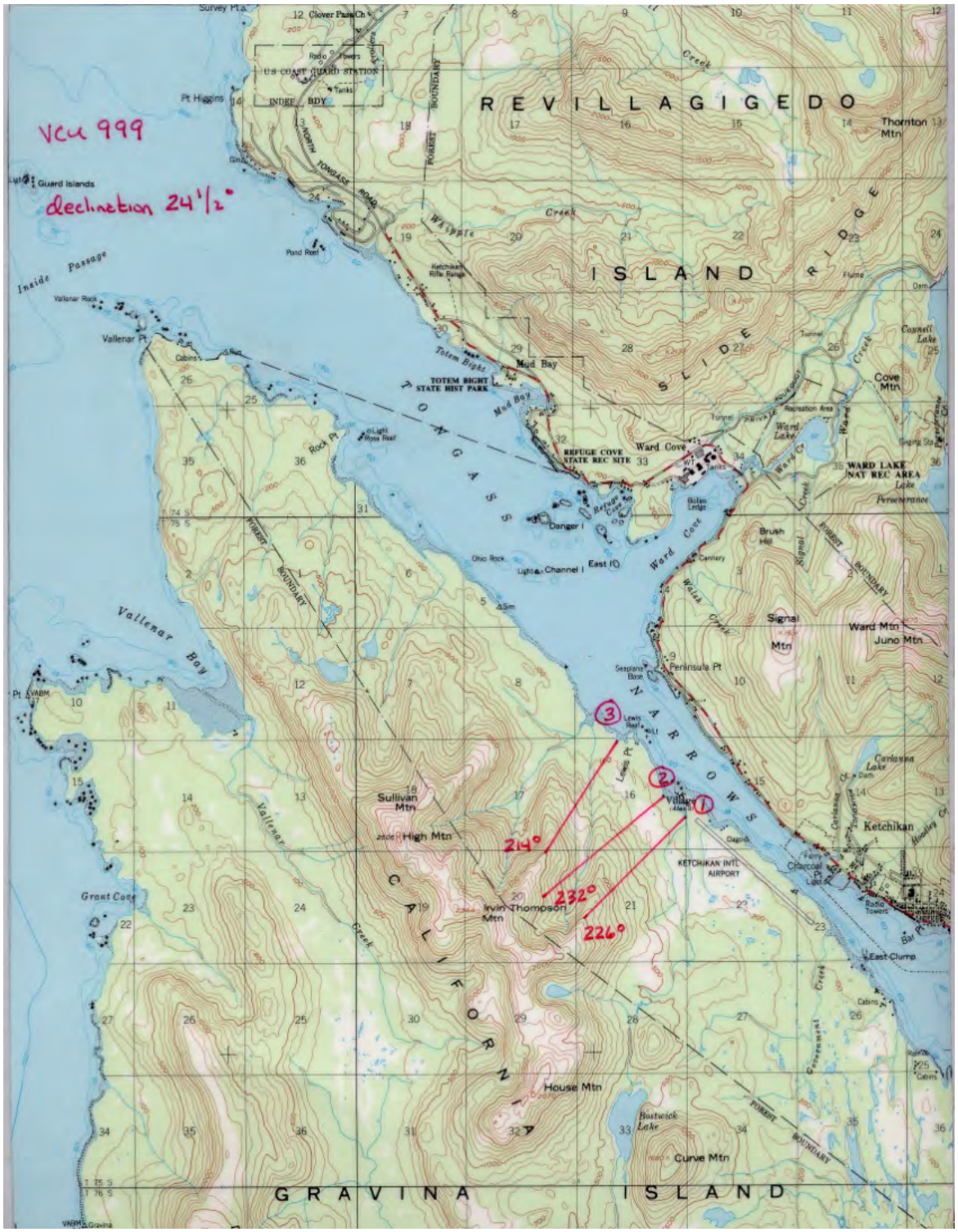

Figure 8. North Gravina deer pellet-group transects, VCU 999.

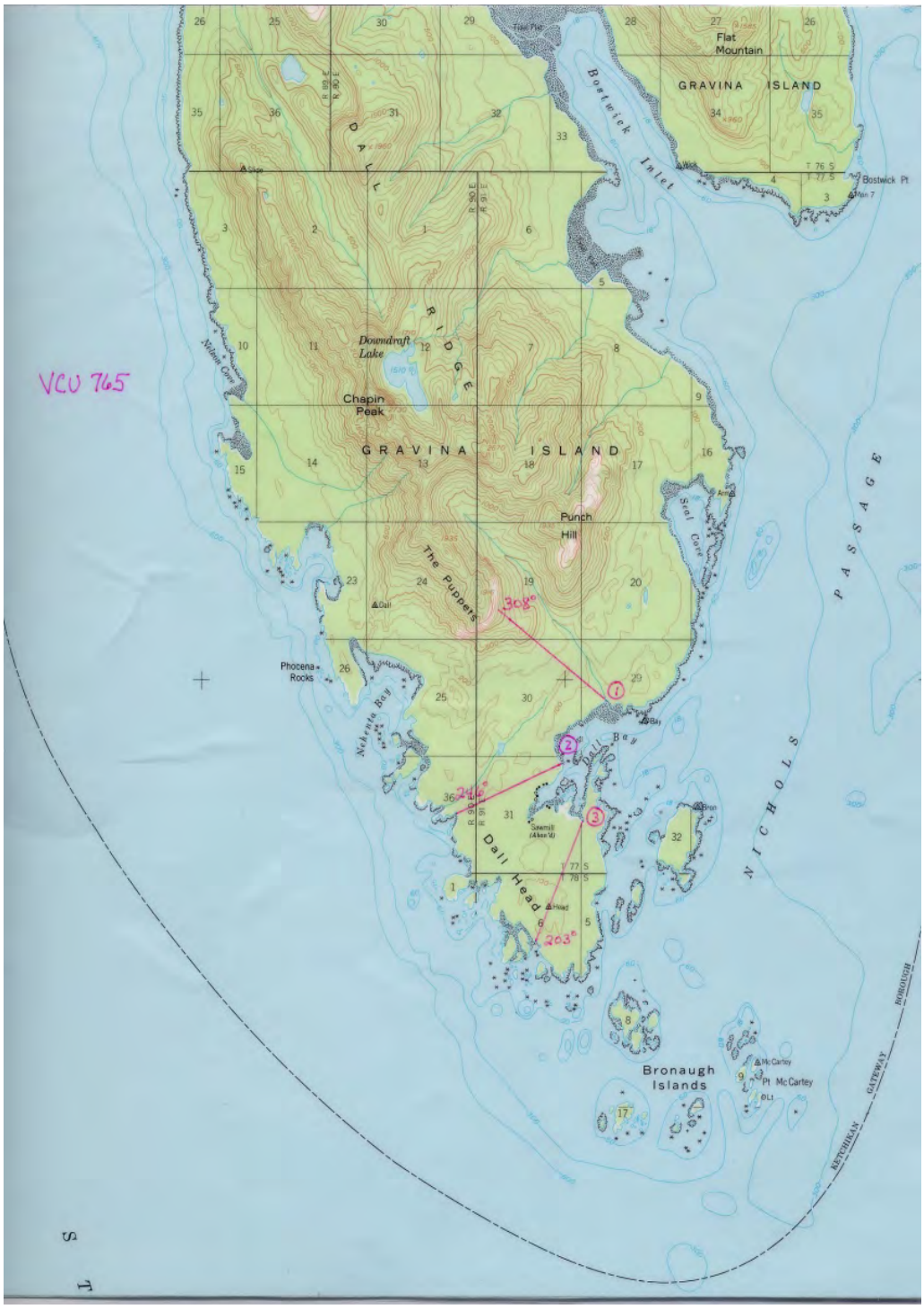

Figure 9. South Gravina deer pellet-group transects, VCU 765.

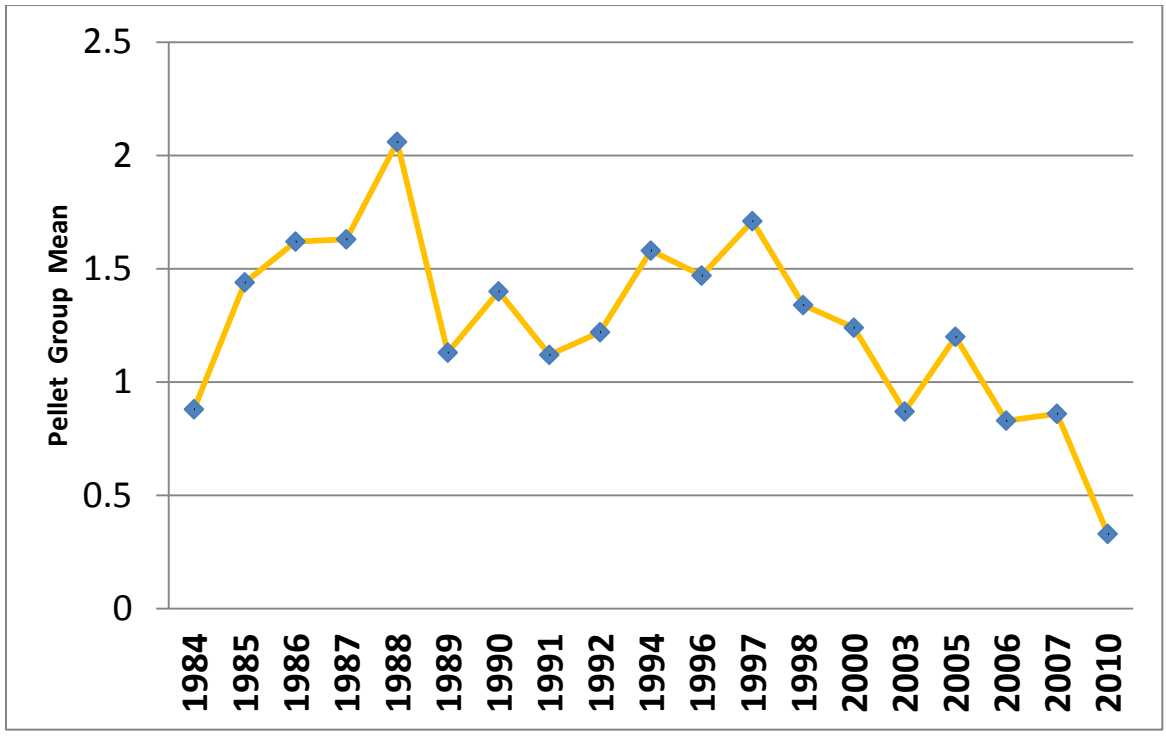

Figure 10. Gravina Island deer pellet-group annual means, 1984-2010.