Please Note: Submitted by Board Support Division to replace PC25 that was inadvertently distorted during submission due to technical issues

GREENPEACE Sitka Field Office Box 6484 Sitka, Alaska 99835 907-747-7557

March 1, 2013

Alaska Board of Game
c/o ADF&G, Boards Support Section
by FAX: 907-465-6094

Subj: Comments on Proposals 179 and 179-A and the IM Operational Plan **for GMU 3**.

Dear Board of Game members;

We request that you either disapprove Proposals 179 and 179-A for the reasons given herein or that you adopt the *substitute proposal* below. The proposals are for control of wolves on Gravina Island in Unit 1A for the purpose of deer intensive management. We incorporate by reference the comments on the feasibility assessments that we co-signed for the January Board of Game meeting (January PC-24) as well as the testimonies by Larry Edwards, Paul Olson and Dave Beebe.

I. Our Recommendation and Request

We recommend and request that the Board of Game strike the content of Proposals 179 and 179fa-A, and substitute and approve the following:

> The Department of Fish & Game is directed to:
>
> (1) develop a program to establish a baseline of deer browse conditions on eastern Kupreanof Island, and Mitkof and Woewodski Islands, and a baseline of deer nutritional conditions in those areas, and to report the results to the Board;
>
> (2) supply comments directly to the responsible federal or state agency, rather than through any other agency of state government, regarding proposed actions that may impair or benefit the State's game and wildlife resources or their habitat; and
>
> (3) prepare new deer population and harvest objectives for deer, for consideration at the next Board of Game meeting.[1]

The Proposals and the Operational Plan do not comply with the *Board of Game Wolf Management Policy* (2011-185-BOG) or with ADF&G's 2011 *Intensive Management Protocol.* Also, the proposal is not cost effective and is likely to be generally ineffective. Reasons for these conclusions are explained below. Approving part (1) of the above substitute language will provide a way forward for understanding the deer-wolf-habitat situation in Unit-1A and particularly on Gravina Island.

Approving part (1) the substitute measure will still allow ADF&G to further develop its proposal for future consideration by the Board, would contribute to such an effort, and would also afford an opportunity for ADF&G to evaluate the alternative program we identify at the end of these comments.

---

[1] We neglected to add this item in our recommendations regarding Proposals 178 and 178-A, for Unit-1A, so please consider them added through this note.

Part (2) of the proposed substitute language is necessary to help ensure that the state's game, wildlife and habitat resources get the attention that they deserve from decisionmakers of development projects, toward avoiding significant impacts. Unit 1A, and Gravina Island in particular, are examples of how development decisions can cause significant game, wildlife and habitat losses that endure and affect people for decades. The relevant problem we identified in our comments and testimony for the January Board meeting is the State's "one-voice" policy. By this policy (as presently constructed), the comments of all state agencies are filtered through the Department of Natural Resources. We believe the governor has the authority to advocate whatever position he has on a particular issue or development; however, we also believe that all the facts and expert opinions need to be on the table for the public and a decisionmaker to see and evaluate. Allowing the selective filtering of such information for political reasons or through a Department of Natural Resources that has removed the word "conservation" from its mission statement is contrary to good government and the duties, under the state Constitution, of this Board and the Department. Because the problem the Proposal is addressing is one largely due to habitat loss, we believe it is important for the Board to take this step now toward minimizing future losses here and elsewhere in the state.

II. Reasons Proposals 179 and 179-A Should Be Disapproved

The Board should disapprove the proposals because although the Board is required to consider wolf control, implementing such control is discretionary and:

1. The Operational Plan fails to establish evaluation criteria and a study design for key elements of the program, in violation of ADF&G's 2011 *Intensive Management Protocol*.

By reducing predation and increasing deer numbers, the program has a potential to adversely impact habitat and forage conditions, yet the Operational Plan lacks real "criteria and study design to document treatment response." (See heading of Op. Plan section III, at 15.). No criteria or study design was presented for *Habitat and Forage Condition*. (Section II.B). The subsection consists of one sentence saying no studies have yet been conducted in the area; however, the purpose of the subsection is to disclose the criteria that will be used and the design of the study, not discuss the lack of past studies.

Similarly, subsection III.C, which is supposed to disclose criteria and study design for *Prey Abundance, Age-sex Composition and Nutritional Condition* contains no criteria and no study design elements concerning how to judge whether wolf numbers will have been "reduced sufficiently by trapping to improve deer harvest," and how the study will be designed to make that determination. (Id.) "Improved harvest levels" of deer is a generality, not a criteria.

The *Prey Harvest* subsection also does not contain any criteria for judging success in increasing deer harvest.

2. The *Decision Frameworks* in the Operational Plans for Proposals 179 and 179-A violate *Principle 4* of ADF&G's *"Intensive Management Protocol"* of December 2011.

The Decision Framework for an IM program is expected to be "transparent" and "explicit." (*Protocol* at 6, title of Principle 4), but several elements of the Decision Framework (Sec. IV) of the Operational Plan are neither.

i. On p.16, the Operational Plan presents *Thresholds for continuing or suspending wolf control*, including categories of deer abundance and wolf abundance. No threshold is provided for taking action if there is a deleterious reduction in browse (particularly winter browse) as the deer population increases. This is a critical lack because suspension of the program is otherwise not provided for until a tripling of the deer population is reached. At the same time, the habitat is further degrading further year-by-year as canopy closure progresses as a result of past logging. The Feasibility Assessment and the Operational Plan have noted the problem caused by this past logging, yet the Operational Plan does not provide criteria for judging whether, during the program, there is a collision between increase deer numbers and declining habitat carrying capacity in either particular places of the treatment area or throughout that area. There needs to be an effective vegetative threshold for suspending the program, based on browse condition.

For these reasons the section does fulfill the functional need, and is not "transparent and explicit."

ii. Deer Abundance threshold number 2 (p.17) is contrary to the intent of the Unit-3 wolf control program as it was presented to the public and the Board in the October 2012 Feasibility Assessment. That intent was for a five year wolf control program. This threshold instead establishes ADF&G as the decider of whether or not to suspend the control program at the end of the five years if the deer population "has not changed." Instead in this case, the Department should make a formal proposal to the Board if it wishes to renew the program. The threshold as stated is improper.

2. Proposals 179 and 179-A are not feasible due high cost and likely ineffectiveness.

The Operational Plan claims that a "cost efficient predator control strategy" will be used. (Op. Plan at 5). However, as we pointed out in our comments and testimony for the January Board of Game meeting, the program for the Unit-3 treatment area is anything but cost efficient. In our comments (January PC24 at 11) we estimated that the elimination of the wolves on Gravina Island may result in a harvest increase of 50 deer, at a cost of $8,000 to 9,000, each.

The Board of Game has delayed consideration of the cost of the Unit-3 proposal until the March meeting. ADF&G has not provided any further cost discussions in the materials it has provided for the March meeting, nor has it contested our cost figures. In the meantime, the Operational Plan indicates that trappers will be hired, whereas the 2012 Feasibility Assessment and discussion at the January board meeting indicated that trappers would be contracted. The above cost estimates were based on contracting, but if trappers are hired as state employees the cost of the program is bound to be higher. At the earlier estimate of $416,000 to $476,000, the cost was already out of hand. Even as an experiment, we do not believe the cost of Proposals 179 and 179-A can be justified.

Moreover, the Board considered material from ADF&G in 2000, when deliberating on deer population and harvest objectives, which supports our contention that wolf control in Southeast Alaska is overly expensive (not "cost efficient") and likely to be ineffective:

> With the notable exception of ensuring maintenance of existing old-growth forests, **little can be done to increase deer densities in Southeast Alaska.**
>
> Wolf control efforts in the 1980s in Southeast Alaska **were found. to be expensive, time consumptive, and ineffective.**

(*Intensive Management Population Identification Worksheet*, at 2, 8 and 10, emph. added. Provided as Attachment-1).[2] From October to the present, ADF&G has not presented any

[2] This document was obtained through a February 2013 request to Board staff for deer-related materials that were considered by the Board in 2000.

documents to the public or the board that discuss these findings from the 1980s and the importance that was placed on them for the Board of Game's 2000 deliberations. In the absence of a whole record for public and the Board to consider, Proposals 179 and 179-A should be disapproved because it is apparently likely that the wolf control program will be inordinately expensive (as we already know) and ineffective.

3. The deer population and harvest objectives were set much too high because of: (1) faulty modeling the objectives were based on, and (2) unusually high harvest in immediately preceding years.

As discussed in our comments and testimony for the January Board of Game meeting, the deer population and harvest objectives were set much too high by the Board in 2000. (See pages 3-7 of comments January PC24, included here, as corrected in January, as Attachment-2).

As shown in the second section of the main section of Figure 2 in Attachment-2, the winter deer habitat modeling ADF&G relied upon when advising the Board in 2000 on setting deer objectives for Unit-1A gave results now known to have over-estimated carrying capacity by 13% (17 deer per square mile under the old modeling, and 15 under the corrected modeling). In addition, when setting the harvest objective for Unit-3 in 2000, the Board rounded up ADF&G's recommended harvest objective from 852 to 900 deer, a 6% increase. For these reasons it appears that the harvest objective is around 20% too high. If the harvest objective were adjusted according, it would be 720 deer. That is not far off from the 2010 harvest of 673.

Because Proposals 179 and 179-A are largely driven by an impetus to meet the 2000 objectives, the only way the Board could rationally approve the Proposals would be to first reconsider the objectives through a formal process.

Two other related factors militate for disapproving the Proposals at this time. The 2000 objectives were based on harvests from several years earlier when harvests were at the peak three years, in a period of generally mild winters. There were also some shoulder years at nearly the same level, before and after. (See Feasibility Assessment; see also Op. Plan Fig. 2). With the exception of the peak and shoulder years and the two recent hard winters of 2006/2007 and 2007/2008, the deer harvest has been consistent between 600 and 750. Despite the two hard winters, deer harvest began recovering in 2009 and 2010 and at 673 was in the center of that range.

We believe it is critically important the Board table Proposals 179 and 179-A, and decide that a reconsideration of the deer population and harvest objectives is necessary first.

Finally, we believe that the Proposals cannot legitimately be approved at this time because of the failures and shortcomings we have pointed out. We ask that our substitute for the Proposal, given at on our first page, be adopted instead.

Sincerely,

L. Edwards

Larry Edwards
Greenpeace
Box 6484
Sitka, Ak 99835
907-747-7557

Attachment - 1

Intensive Management Population Identification Worksheet

Species: Deer **Population:** Unit 1A

Brief description of the population:
This deer population inhabits the mainland and near-shore islands in Unit 1A. Densities have generally been highest on the lower Cleveland Peninsula and Gravina Island. Densities are lowest on the mainland east of Ketchikan where very limited deer hunting occurs. Buck-only harvests, with a 4-buck limit, have been in effect in the unit for the past 20 years.

Criterion #1 – Harvest:

a. Maximum average harvest for any 3 consecutive years: 788 during 1994–1996.

b. Estimated average harvest for 1991–1996: 652

Criterion #2: - Accessibility:
Most access is by boat, some by floatplane. Highway vehicles are used to access areas on the limited Ketchikan road system, and 3- and 4-wheelers are used occasionally to access areas associated with remote logging roads. Boat and airplane access is extremely weather-dependent.

Criterion #3: – Use for meat:
Alaska residents, primarily those residing within the Ketchikan Gateway Borough, use this population of deer primarily for meat and recreation.

Criterion #4 – Hunter demand:

a. Estimated or reported hunter effort: During 1991–1995, hunters spent a seasonal average of 4,534 days hunting deer. Effort data was not collected during 1996.

b. Number of applicants for permit hunts, if applicable: NA

c. Other indicators of demand: None

Is this population important for providing high levels of human consumptive use?

Department Recommendation:	Board of Game Action:
Yes: _X____	Yes: _X_
No:	No:

Intensive Management Objective Worksheet

Species: Deer **Population:** Unit 1A

(1) **Effects of weather, habitat capability, diseases and parasites:** Diseases and parasites appear to have negligible impact on deer populations in Unit 1A. Severe winter weather causes periodic declines in the deer population, especially in areas where clear-cut logging has removed old-growth forests. Among other deleterious effects, the removal of the old-growth canopy allows snow accumulation on the ground above "normal" levels, limiting the value of critical habitat to support over-wintering deer populations.

(2) **Maintenance of viable predator populations:** Brown bear predation on deer is apparently negligible. We believe that black bear predation on deer is significant where they occur at high densities. Anecdotal evidence supports the idea that scavenging of deer carcasses by brown bears, marten, and bald eagles may provide periodic food resources, but is probably not important for maintaining these populations. Deer are the mainstay of the diet of wolves in this unit.

(3) **Maintenance of habitat conditions suitable for other species in the area:** Evidence suggests that deer and mountain goats may compete for limited food resources in some limited situations. However, for current deer and goat population levels in Unit 1A, there appears to be no direct correlation in terms of population densities.

(4) **Effects on subsistence users:** The islands and the Cleveland Peninsula portion of Unit 1A are in the Ketchikan Nonsubsistence Area, and make up most of the quality deer habitat in the Unit. Subsistence use of deer in Unit 1A depends largely on deer abundance. As deer numbers increase following mild winters, hunter effort increases proportionately. Deer meat provides a considerable amount of the red meat for consumption by Unit 1A residents, as the only other available ungulates are mountain goats (common) and moose (scarce).

(5) **Cost, feasibility, and potential effectiveness of possible management actions:** With the notable exception of ensuring maintenance of existing old-growth forests, little can be done to increase deer densities in Southeast Alaska. The ADF&G needs to continue working with the US Forest Service and private landowners in an effort to maintain quality habitat. Where logging occurs it is imperative that proliferating human access be minimized by strict attention to road placement, administrative and/or mechanical road closures after logging, and regulations that ensure viable deer populations.

(6) **Land ownership patterns within the range of the population:** The vast majority of deer habitat in Unit 1A is under federal jurisdiction of the Tongass National Forest. In addition, a portion of the mainland is designated as the Misty Fjords National Monument within the Tongass.

(7) **Degree of accessibility to harvest:** Accessibility by boat is very good throughout the area. The only areas largely inaccessible are parts of the mainland away from the coast, where deer habitat is limited because of high elevations and snow and ice cover.

(8) **Other factors, if any:** Since 1990, both state and federal subsistence hunting regulations have been in effect. State regulations were adopted by the Alaska Board of Game and applied to all lands in Unit 1A. State and federal deer hunting regulations remain identical in the Unit.

Department Recommended Objectives:

Population	14781
Harvest	725

Current management objectives for Unit 1A deer are to: 1) maintain a population in excess of 45 deer per mi^2 of winter range (1.4 pellet-groups per plot); and 2) monitor deer densities using pellet-group surveys.

Board Action:

Objectives:

1. Population: 15020
2. Harvest: 700

Intensive Management Population Identification Worksheet

Species: Deer **Name of the Population:** Unit 1C

Brief description of the population:
Deer are found throughout Unit 1C, but the highest concentrations are found on three islands Douglas, Shelter, and Lincoln. Deer are also found on the mainland in very low densities due to a greater snowpack and the presence of wolves.

Criterion #1 - Harvest:

a. Maximum average harvest for any 3 consecutive years: 583

b. Estimated average harvest for 1991–1997: 467

Criterion #2 - Accessibility:
Portions of the Unit 1C mainland and Douglas Island are accessible by highway vehicle. Hunters also use boats to access the south and western sides of Douglas Island, as well as Shelter and Lincoln Islands.

Criterion #3 - Use for meat:
Considering the limited opportunities available for harvesting moose in Unit 1C, most hunters secure wild meat through the harvest of local deer. Deer hunting is also an important recreational activity for Juneau area residents.

Criterion #4 - Hunter Demand:

a. Estimated or reported hunter effort: From 1991–1995 the average number of hunters/year was 939, and these hunters combined for 3,324 hunter days. 1996 and 1997 data is only available for successful hunters, and therefore not included in the above average.

b. Number of applicants for permit hunts, if applicable: NA

c. Other indicators of demand: The deer hunter survey indicates hunters pursue deer throughout the 3-½ month season in Unit 1C.

Is this population important for providing high levels of human consumptive use?

Department Recommendation:	Board of Game Action:
Yes: __X__	Yes: __X__
No:	No:

Intensive Management Objective Worksheet

Species: Deer **Population:** Unit 1C

(1) **Effects of weather, habitat capability, diseases and parasites:** Winter weather, especially deep and persistent snow, is a critical factor in regulating deer numbers. Deep snow hinders foraging ability of deer by limiting mobility, increasing energy expenditure, and by concentrating deer at lower elevations which increases intraspecific competition. Altitude, aspect, and browse species availability can severely limit habitat quality and quantity, and high deer densities result in starvation or increased susceptibility to predation caused by the poor nutritional state of the animals (Olson, 1979). Unit 1C has both mainland and island deer habitat. Douglas, Lincoln, and Shelter islands harbor higher deer densities than the mainland because of lower snowfall, mostly undisturbed forest habitat, and lack of wolves. These easily accessible islands support most of the deer hunting effort within the subunit. The capability of the habitat to support deer in Southeast Alaska is dependent on the amount of mature forest available. Diseases and parasites do not appear to be factors limiting deer populations in Southeast Alaska.

(2) **Maintenance of viable predator populations:** Mainland deer densities are low enough that wolves rely upon a wide array of prey to subsist, and wolves in this area are not highly dependent on deer. On the islands within the subunit, wolves are virtually absent. We believe that black bear predation on deer is significant where bears occur in high densities. Anecdotal evidence supports the idea that scavenging of deer carcasses by marten and bald eagles may provide periodic food resources, but is probably not important for maintaining these populations. Changes in human harvest objectives would most likely occur on the islands, where changes in deer numbers would not have a substantial effect on predators.

(3) **Maintenance of habitat conditions suitable for other species in the area:** Long term planning to maintain large tracts of mature forest is the only way of sustaining a viable deer population. Other species that use mature forests would benefit by having habitat available to them. Deer and mountain goats compete for limited food resources in some limited situations. However, for current deer and goat population levels in Unit 1C, there appears to be no direct correlation in terms of population densities.

(4) **Effects on subsistence users:** Subsistence use of deer in Unit 1C depends largely on deer abundance. As deer numbers increase following mild winters, hunter effort and success increases proportionately. Deer meat provides most wild red meat for consumption by Unit 1C residents, with moose and mountain goats supplementing deer meat.

(5) **Cost, feasibility and potential effectiveness of possible management actions:** We believe that predation is not a substantial problem for deer in this subunit, and attempts at predator control would be extremely costly. Mainland snowfall is heavy enough that even in the absence of predators it is unlikely that deer numbers will ever increase substantially. It is not

feasible to enhance mature forest habitats, which are key to the well being of the deer herd. Retention of critical habitat is a key management strategy.

(6) **Land ownership patterns within the range of the population:** Significant private and municipal land ownership is an issue in the area, and our ability to control development on these tracts of land is limited. Douglas Island deer winter range is in private and municipal ownership and may be developed for residences and a golf course.

(7) **Degree of accessibility to harvest:** Island deer habitat in Unit 1C is easily accessible from the state's third largest city by road system, trails, and boat. Away from mainland roads and trails access is more difficult.

(8) **Other factors, if any:** If the Juneau human population continues to grow, there will likely be an increase in deer hunting effort. Given the easy access, deer in this area could be susceptible to overharvest.

Department Recommended Objectives:

Population ___6240___

Harvest ___450___

****

Board Action:

Objectives:

1. Population: ___________
2. Harvest: ______________

Intensive Management Population Identification Worksheet

Species: Deer **Population:** Unit 2

Brief description of the population:
This deer population inhabits Prince of Wales and adjacent islands. Densities have fluctuated historically, primarily in response to winter weather conditions, although predation by wolves and black bears contributes to annual mortality. Deer are known to travel between islands, as are their predators.

Criterion #1 – Harvest:

a. Maximum average harvest for any 3 consecutive years: 2,970 during 1993–1995.

b. Estimated average harvest for 1991–1996: 2,831

Criterion #2: - Accessibility:
Most hunters access deer with highway and off-road vehicles on the extensive road system found on central to northern POW Island. A few hunters access alpine lakes early in the season with floatplanes, and some travel to small offshore islands by boat.

Criterion #3: – Use for meat:
Primarily Alaska residents residing on Prince of Wales Island use this deer population for meat and recreation. Several Ketchikan residents travel to Unit 2 each season to hunt deer for meat and recreation as well.

Criterion #4 – Hunter demand:

a. Estimated or reported hunter effort: During 1991 –1995, hunters spent a seasonal average of 12,242 days hunting deer in Unit 2. Effort data was not collected during 1996.

b. Number of applicants for permit hunts, if applicable: NA

c. Other indicators of demand: None

Is this population important for providing high levels of human consumptive use?

Department Recommendation:
Yes: __X__
No:

Board of Game Action:
Yes: __X__
No:

Intensive Management Objective Worksheet

Species: Deer **Population:** Unit 2

(1) **Effects of weather, habitat capability, diseases and parasites:** Diseases and parasites appear to have negligible impact on deer populations in Unit 2. Severe winter weather causes periodic declines in the deer population, especially in areas where clear-cut logging has removed old-growth forests. Among other deleterious effects, the removal of the old-growth canopy allows snow accumulation on the ground above "normal" levels, limiting the value of critical habitat to support over-wintering deer populations. Prince of Wales Island has seen some of the more aggressive logging in Southeast Alaska, and within the next 20–30 years we anticipate deer habitat capacity to decrease substantially.

(2) **Maintenance of viable predator populations:** Wolf populations are healthy in Unit 2 and can effect deer populations at least in local areas. We believe that black bear predation on deer is significant where bears occur in high densities. Anecdotal evidence supports the idea that scavenging of deer carcasses by marten and bald eagles may provide periodic food resources, but is probably not important for maintaining these populations.Deer are the mainstay of the diet of wolves in this unit.

(3) **Maintenance of habitat conditions suitable for other species in the area:** There are no other ungulate populations in Unit 2 that deer compete with, although marten exist in the unit and have been shown to be old-growth dependent.

(4) **Effects on subsistence users:** Subsistence use of deer in Unit 2 depends largely on deer abundance. As deer numbers increase following mild winters, hunter effort increases proportionately. Deer meat provides a large proportion of the red meat for consumption by Unit 2 residents, although there is significant use of seals and some amount of use of black bears.

(5) **Cost, feasibility, and potential effectiveness of possible management actions:** With the notable exception of ensuring maintenance of existing old-growth forests, little can be done to increase deer densities in Southeast Alaska. The ADF&G needs to continue working with the US Forest Service and private landowners in an effort to maintain quality habitat. Where logging occurs it is imperative that proliferating human access be minimized by strict attention to road placement, administrative and/or mechanical road closures after logging, and regulations that ensure viable deer populations. Wolf control efforts in the 1980s in Southeast Alaska were found to be expensive, time consumptive, and ineffective.

(6) **Land ownership patterns within the range of the population:** Most of the deer habitat in Unit 2 is under federal jurisdiction of the Tongass National Forest, although private corporations own a considerable amount of land in this Unit.

(7) **Degree of accessibility to harvest:** Accessibility by boat and highway vehicles is very good throughout most of the area. Off road vehicle use is increasing by deer hunters.

(8) **Other factors, if any:** Since 1990 both state and federal subsistence hunting regulations have been in effect. State regulations were adopted by the Alaska Board of Game and applied to all lands in Unit 2. In recent years there has been a federal doe season in Unit 2 that is only open to federally qualified subsistence hunters (rural residents of Units 1A, 2, and 3).

Department Recommended Objectives:

Population	71248
Harvest	2728

Current management objectives for Unit 2 deer are to: 1) maintain a population in excess of 45 deer per mi^2 of winter range (1.4 pellet-groups per plot); and 2) monitor deer densities using pellet-group surveys.

Board Action:

Objectives:

1. Population: 71,000
2. Harvest: 2,700

Intensive Management Objective Worksheet

Species: Deer **Population:** Unit 3

(1) **Effects of weather, habitat capability, diseases and parasites:** Diseases and parasites appear to have negligible impact on deer populations in Unit 3. Severe winter weather causes periodic declines in the deer population, especially in areas where clear-cut logging has removed old-growth forests. Among other deleterious effects, the removal of the old-growth canopy allows snow accumulation on the ground above "normal" levels, limiting the value of critical habitat to support over-wintering deer populations.

(2) **Maintenance of viable predator populations:** Wolf populations are healthy in Unit 3 and can effect deer populations at least in local areas. We believe that black bear predation on deer is significant where bears occur in high densities. Anecdotal evidence supports the idea that scavenging of deer carcasses by marten and bald eagles may provide periodic food resources, but is probably not important for maintaining these populations. Deer are the mainstay of the diet of wolves in this unit.

(3) **Maintenance of habitat conditions suitable for other species in the area:** Evidence suggests that deer, moose, and elk may compete for limited food resources in some situations. However, for current deer, moose, and elk population levels in Unit 3, there appears to be no direct correlation in terms of population densities.

(4) **Effects on subsistence users:** Subsistence use of deer in Unit 3 depends largely on deer abundance. As deer numbers increase following mild winters, hunter effort increases proportionately. Deer meat provides a large proportion of the red meat for consumption by Unit 3 residents, although there is significant use of moose and black bears.

(5) **Cost, feasibility, and potential effectiveness of possible management actions:** Protecting old-growth forests and treating second growth clear cuts can maintain existing deer densities in Southeast Alaska. The ADF&G needs to continue working with the US Forest Service and private landowners in an effort to maintain quality habitat. Where logging occurs it is imperative that proliferating human access be minimized by strict attention to road placement, administrative and/or mechanical road closures after logging, and regulations that ensure viable deer populations. Wolf control efforts in the 1980s in Southeast Alaska were found to be expensive, time consumptive, and ineffective.

(6) **Land ownership patterns within the range of the population:** Most deer habitat in Unit 3 is under federal jurisdiction of the Tongass National Forest, although a private corporation owns a large section of north Kupreanof Island.

(7) **Degree of accessibility to harvest:** Accessibility by boat is good throughout most of the area. Highway vehicle access is good on islands with communities.

(8) **Other factors, if any:** Since 1990 both state and federal subsistence hunting regulations have been in effect. State regulations were adopted by the Alaska Board of Game and applied to all lands in Unit 3. State and federal deer hunting regulations remain identical in Unit 3.

Department Recommended Objectives:

Population 14868

Harvest 852

Current management objectives for Unit 3 deer are to: Increase populations on deer winter range (<1,500 ft elevation) to 32 deer/mi^2, measured by a mean pellet density of 1.0 pellet group/20m^2 plot.

Board Action:

Objectives:

1. Population: 15,000
2. Harvest: 900

C

7-0

Attachment – 2

Excerpt of comments PC24, from the Jan. Board of Game meeting

• Greater SE Alaska Conservation Community • Alaska Wildlife Alliance •
• Tongass Conservation Society • Greenpeace • Center for Biological Diversity •

Alaska Board of Game
c/o ADF&G, Boards Support Section
by FAX: 907-465-4094

December 28, 2012

Subj: ***Unit 3:*** Comments on "*Feasibility Assessment … Black-tailed deer*"

…

III. The Deer Objectives Are Outdated and Therefore Do Not Support Wolf IM.

The current objectives for deer population and deer harvest in Unit-3 are outdated because they are based on older deer modeling which produced over-estimates of the carrying capacity of winter habitat.

A. The current deer objectives for Unit-3, and how they were determined.

The current deer population and harvest objectives for Unit-3 were adopted by the Board of Game in 2000, setting them at 15,000 and 900 respectively. (Assessment at 8). They are based in large part on the Forest Service's 1997 deer model, which was used to estimate the winter carrying capacity of the habitat for deer, and on harvest rates from 1994 to 1999 which were the peak years for the Unit. (Id.). As recognized in the companion Assessment for Unit-1A that the Board is reviewing, the objectives set in 2000 are "unrealistically high" because of the data used to set them. (See: companion Assessment for Unit-1A at 7, 18). The same factors invalidate the Unit-3 deer population and harvest objectives, namely that the basis was years among those with the highest deer population and harvest, and the use of a version of the deer habitat capability model that is now outdated and which over-estimated carrying capacity.

Moreover, we note that the Unit-3 deer harvest rebounded by 2010 to 73% of the current harvest objective after a decline following successive severe winters, two years after the low year. (Assessment Fig. 8).

B. Problems with the deer model results that the harvest objective was based upon.

The Board of Game, in its 2000 determination of Unit-3 deer population and harvest objectives, relied upon deer carrying capacity data from the Forest Service's 1997 deer model. (Assessment at 8). The model estimates carrying capacity over winters of average intensity.

The Forest Service updated the model for the 2008 Tongass Forest Plan, and the new model[1] makes significantly lower carrying capacity estimates.

Three corrections that have been made to the model since 2000 were substantial:

(1) In its FY-2000 Monitoring & Evaluation Report (published April 2001),[2] the Forest Service corrected the conversion factor (called the Deer Multiplier) used to change the model's non-dimensional output to carrying capacity in deer per square mile, from 125 to 100.[3] The Deer Multiplier is based on deer pellet transect data, and is the carrying capacity of best quality habitat (of which very little exists). The older model results in over-estimated carrying capacity by 25%. From the information in the Assessment we don't know which multiplier had been used when the Board of Game set the Unit-3 objectives.

(2) In 2008 the Forest Service made a further correction to use of the Deer Multiplier.[4] From 1997 through 2007 the scale for the non-dimensional habitat value outputs was a range "habitat suitability index (HSI)" of from zero to 1.3. The value 1.3 represents best quality habitat. However, the way the Deer Multiplier was used during those years, it corresponded to a value of 1.0 in that range, which is incorrect and results in a 30% over-estimation of carrying capacity. If these and the previous error were both present in the data the Board considered in setting the objectives, the total error was a 62.5% carrying capacity over-estimation.

(3) The vegetative dataset used in the 1997 deer model was later found by a Forest Service statistical study to be uncorrelated to habitat quality. (Caouette et al. 2000).[5] An adequate dataset was not used until adoption of the 2008 Tongass Forest Plan. The new dataset "results in an overall reduction in average HSI[6] values because fewer stands would be classified as high and medium volume strata and more stands would be classified as low volume strata compared to the old volume strata mapping used in the 1997 Forest Plan Revision Final EIS." (2008 Forest Plan FEIS at 3-265 to 266). This change resulted in significantly lower carrying capacity estimates by the new model, nearly everywhere in the Tongass, but because the previous dataset's non-correlation to habitat quality had made the amount of error erratic the changes were not the same everywhere and in a small minority of WAAs the results were a higher carrying capacity.[7]

---

[1] When we speak here of a "version" of the model, this encompasses the core of the model and the vegetative data and directives for some external settings that are used when carrying capacity in deer per square mile is calculated from the model's non-dimensional output. The core of the model has not changed over the years, only the other factors in its application.

[2] USFS R10-MB-431, at 2-155.

[3] The multiplier represents the winter carrying capacity of the highest quality habitat type; however, this kind of habitat is scarce.

[4] 2008 *Tongass Forest Plan (TLMP) FEIS*, at 3-266: "HSI values were standardized to range from 0 to 1.0, by dividing all values by 1.3, because outputs from such models represent a range from 0 to 100 percent habitat suitability, with higher values indicating higher habitat capability." Also at 3-284 in footnote 2: "Habitat capability in terms of deer density calculated using a multiplier of 100 deer persquare mile equating to a habitat suitability index score of 1.0."

[5] Caouette, J.; Kramer, M.; & Nowacki, G. (2000). *Deconstructing the Timber Volume Paradigm in Management of the Tongass National Forest.* USDA Forest Service, Pacific Northwest Station. PNW-GTR-482. 20p. http://tongass-fpadjust.net/Documents/Caouette_eta_%202000_GTR482.pdf

[6] HSI is habitat suitability index, the non-dimensional output of the model that was mentioned in a previous footnote.

[7] These effects can be seen in the "1995 Over-estimation" column of our Fig. 2.

C. The Amount of Deer Modeling Error, As Incorporated in the Unit-3 Objectives.

The 2008 corrections made by the Forest Service to its 1997 modeling of deer winter habitat carrying capacity indicate that the 1997 modeling made these over-estimations:

Fig. 1: Over-estimations of the earlier model.

Unit 3 (overall)	20%	**Over-estimation**
"Treatment Area"	12%	**Over-estimation**
Western Kupreanof Isl.	11%	**Over-estimation**
Kuiu Island	16%	**Over-estimation**
Wrangell-Etolin-Zarembo, etc.	42%	**Over-estimation**

(See calculations in Fig. 2, next page.) But percentages don't tell the whole story. The Tongass Forest Plan has a standard and guideline of providing a deer habitat carrying capacity of at least 18 deer per square mile (where possible), in order to sustain both wolves and deer hunters. ADF&G has advocated the use of this standard and guideline (S&G), and the department played a major role in its adoption by the Forest Service. Note in Fig. 2 that according to the 1997 modeling, among the four major segments of Unit-3 three were above the S&G and one was somewhat below (at 17). This[8] was a basis for the 2000 deer population and harvest objectives. However according to the corrected 2008 model, for the current condition (in 2006) these three WAAs all scored below the S&G and two of them (including the treatment area) were significantly below that level, at 15.1 and 15.2 deer per square mile. The causes of these low scores (with the improved modeling) are partly the natural condition of the habitat and partly the destruction of old-growth deer winter range by widespread logging.[9] Further, it is important to note that the future stem exclusion condition of second growth which was less than 25 years old in 2006 (or not yet created by clearcutting) is not reflected in Fig. 2 but has or unavoidably will in the foreseeable future be subtracted from the winter habitat capability shown.

The point here is that the deer modeling basis for the current deer population and harvest objectives that were set by the Board of Game in 2000 is no longer valid. An urgently needed action by the Board is to update those objectives. It is not valid to initiate a program of wolf intensive management on the basis of the outdated objectives.

IV. Whether Available Deer Winter Habitat is Currently a Limiting Factor

After assessing the model results for Unit 3 it seems unsurprising that the harvest of deer and the amount of hunter effort have declined and that deer numbers are low (Assessment at 1, 3, 13, 17), particularly after recent hard winters. However, the Assessment wavers on whether the reduced amount of winter habitat combined with some hard winters are the culprit or whether deer numbers are low enough that habitat availability is not a factor.

> "Unit 3 deer are at such low density that populations are not currently limited by the availability of winter habitat. **On the other hand, it is also possible that reductions in the amount of winter habitat exacerbated the effects of the severe winters experienced in Unit3 during 2006-2009 thereby causing deer numbers to decline**

---

8 Or a similar run made with the same model, just before the objectives were set in 2000.

9 Part of the difference between results in Fig. 2 is from the 1997 and 2008 models is the from the progression of second-growth succession during the 11-year interim. The model estimates that canopy closure occurs in 25-year old second-growth, at which point the winter habitat value drops to near zero, and some stands reached that age during the interim between this two model runs.

Fig. 2: **Unit-3 Deer Model Carrying Capacities by WAA, for 1997 vs. 2008 models**

Edwards (27Dec12, for BoG comments)

WAA Location	WAA Number	1997 Model: 1995 Carrying Capacity	2008 Model: 2006 Carrying Capacity	Model Comparison: 1995 Over-estimation	Land Area (sq-mi)	Land Area (sq-mi)	1997 Model Area-Weighted Capacity	2008 Model Area-Weighted Capacity	1997 Model Carrying Capacity	2008 Model Carrying Capacity	
N Etolin Island	1901	23	16.0	44%	207.2	774.5	4766	3315	21.5	15.2	Wrangell / Etolin Area
Deer Island	1902	25	16.2	54%	14.9		373	241			
Wrangell Island	1903	18	12.2	48%	176.9		3184	2158			
Stikine Islands	1904	25	16.7	50%	36.2		905	605			
Zarembo Island	1905	19	14.8	28%	180.9		3437	2677			
S. Etolin Island	1910	25	17.3	45%	158.4		3960	2740			
Mitkof Island	**2007**	**17**	**14.3**	**19%**	**170.2**	**542.5**	**2893**	**2434**	**17.0**	**15.1**	*"Treat-ment"* **Area**
Woewodski Island	**2008**	**50**	**26.6**	**88%**	**16.6**		**830**	**442**			
Bohemia	**5135**	**12**	**13.2**	-9%	**86.6**		**1039**	**1143**			
Mission Peaks / Scott Peak	**5136**	**20**	**13.7**	**46%**	**93.6**		**1872**	**1282**			
Petersburg Creek	**5137**	**19**	**16.0**	19%	**79.0**		**1501**	**1264**			
Lindenberg Peninsula	**5138**	**11**	**17.1**	-36%	**95.5**		**1062**	**1650**			
W. Kupreanof Island	5130	26	19.1	36%	144.5	639.3	3757	2760	19.5	17.6	West Kupreanof Island
S. of Kake	5131	19	17.0	12%	109.8		2086	1867			
Kake	5232	7	14.7	-52%	57.9		405	851			
Westside Duncan Canal	5133	18	16.6	8%	168.3		3029	2794			
SW Kupreanof Island	5134	20	18.8	6%	158.8		3176	2985			
NW Kuiu Island	5012	27	20.9	29%	225.8	765.5	6097	4719	28.5	24.5	Kuiu Island
Bay of Pillars/Port Camden	5013	29	23.8	22%	99.0		2871	2356			
E. Kuiu	5014	36	29.0	24%	62.5		2250	1813			
Tebenkof Bay	5016	36	30.2	19%	108.4		3902	3274			
Affak Canal	5017	31	26.4	17%	193.5		5999	5108			
Three-mile Arm	5018	9	19.7	-54%	76.4		688	1505			
Coronation Island	5015	51	20.6	148%	29.8	29.8			51.0	20.6	Coronation
UNIT-3 TOTAL						2751.7	60081.5	49983.9	21.8	18.2	

Overall deer carrying capacity over-estimations of the 1997 model:

Wrangell / Etolin Area	**42%**
"Treatment Area"	**12%**
West Kupreanof	**11%**
Kuiu Island	**16%**
Coronation Island	**148%**
ALL OF UNIT-3:	**20%**

Data Sources: 1997 model results are from the 1997 TLMP FEIS, Table 3-112.
2008 model results and WAA land areas are from 2008 TLMP planning record document 0935 (0935.xls).

further than they might have had the habitat remained intact." (Assessment at 1, emph. added).

"We believe the observed declines in both pellet-group densities and estimated hunter harvest reflect actual declines in deer numbers. **Factors potentially contributing to the decline in the Unit 3 deer population and harvest in recent years include** 3 consecutive deep snow winters, predation by wolves, and **reductions in deer carrying capacity** resulting from the harvest of productive old growth stands **important for overwinter survival**. Additionally, second growth forest stands entering stem exclusion further reduce carrying capacity for deer." (Assessment at 2, emph. added).

"If deer numbers are high, the reduction in preferred winter range caused by logging could result in food competition among the remaining deer. In addition, the more concentrated deer could also be more vulnerable to predation by wolves. As a practical matter, in Unit 3, deer numbers are now so low that the influence of habitat on deer numbers is likely to be of very little import for many years." (Assessment at 3, emph. added).

"**Maintenance of old growth forest has the potential to keep carrying capacity of deer winter range high and perhaps to mitigate the effects of severe winters, especially when deer numbers are high**. However, based on deer pellet data and hunter harvest, deer appear to be so far below carrying capacity in Unit 3 that habitat is unlikely to be limiting deer numbers at this time." (Assessment at 13, emph. added).

"**Severe winter weather has perhaps the greatest impact on Unit 3 deer populations, often resulting in high levels of mortality**. ... Past, present and anticipated future reductions in important deer winter range (productive 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 3 to support deer will decline,** but deer numbers are so low in the unit that carrying capacity issues are unlikely to be a concern at the present time." (Assessment at 17, emph. added).

"Although we do not have quantitative measures of body condition for deer in Unit 3, hunters report that deer are in excellent condition with large reserves of body fat during the hunting season in October. At present this is the best measure we have for insight into the fitness of deer in Unit 3." (Assessment at 22).

The message here is clear that ADF&G believes deer numbers are low enough that winter habitat does not matter — at the moment. But these bald statements with no evidence to support them raise significant questions, particularly in view of the accompanying statements that can be contradictory. The first question is, how was it determined that the ratio of deer population to available winter habitat is such that there is a habitat surplus at the moment? A corollary to that is, did a shortage of winter habitat play a major role in the population crash in the first place? Also, which winter habitat characteristics have been most crucial for deer in the area during recent winters – those affecting mobility, thermal cover or food? The Assessment seems to be focused primarily on the food aspect. What winter mortality studies have been done on deer in the area, for example looking at bone marrow, and has it been possible to separate predation mortality from scavenging during these studies? And there are other questions along those lines. Regarding the last block quote above, fat deer in Fall are a good sign. Have deer commonly been equally fat in the Falls preceding the hard winters when the population declined? What has been the condition of surviving deer in March or April over the past decade, and what periodic trends have been found? Do the fat deer of this October perhaps indicate a rapid up-trend coming in the deer population? The harvest estimates (to the extent they can be an indicator) for all of Unit-3 and for Kupreanof and Mitkof Island all show a rapid up-tick since 2008 or 2009 which, even though the initial values are low. Over one year (2009 to 2010) the Mitkof Island harvest was up by a factor of 2.7x and the Kupreanof Island harvest was up 56%. For Unit-3 the harvest over the two years 2008 to 2010 was up 74%. In fact, at 656 deer the Unit-3 harvest for 2010 was 73% of the Board of Game's harvest objective of 900 deer. That seems to be a good recovery in progress.

It is also worth noting that Kupreanof and Mitkof Islands, where the proposed wolf eradication would occur, have acre-for-acre produced by far more deer harvest than the rest of Unit-3, except since the hard winters beginning in 2006/2007. The Petersburg area had the highest snowfalls in the region during that period. The acre-for-acre production of the two islands appears to be catching back up quickly. This is shown in our Figure 3, which applies data from Assessment Tables 6, 7 & 8. Looking at the plots of actual data in the figure, it seems that whenever the population is such that the combined harvest for Kupreanof and Mitkof reaches about 500 deer, something happens and the population declines for a number of years. Similarly, at three points the Unit-3 harvest curve approaches or somewhat exceeds 1000 deer, and then there is a decline. During the build-up of the harvest from 1982 to 1995 there were was only one insubstantial decline, but as population gets higher decline sets in. Of course a hard winter may be a trigger, but it appears from these plots that a carrying capacity limitation may be involved. Importantly for Unit-3, the limitation appears be right about the 900 level of the current harvest objective. This suggests that the objective should be lowered. And, as ADF&G recognizes in the Assessment, future reductions in carrying capacity are coming from the "succession debt"[10] that has not yet been paid from past logging, and the Tonka timber sale on the Lindenberg Peninsula of Kupreanof (in the treatment area) is under contract and ready to be logged.

In summary, we believe winter habitat capability for deer is a limiting factor in the area, even if the deer population may have momentarily been too last year for it to matter, and that it has played a big role in creating the current situation of low population and low harvests.

[10] A term coined by ADF&G research biologist Dave Person.

Attachment - 3

FINAL REPORT (RESEARCH)

State: Alaska

Cooperators: USDA Forest Service

Project No.: W-22-4 Project Title: Big Game Investigations
W-22-5
W-22-6 Job Title: Wolf-Deer-Habitat Relationships in Southeast Alaska

Job No.: 14.13R

Period Covered: 1 July 1984-30 June 1987

SUMMARY

Although originally scheduled to continue for 5 years, field work for this study was terminated after 2 years. Reasons for termination include limited progress on study objectives due to adverse weather; low densities of deer (Odocoileus hemionus sitkensis) and wolf (Canis lupis) populations; limited sightability of deer and wolves due to dense vegetation; budget shortfalls; and personnel reductions. Results presented here are based on relatively small sample sizes and should be considered preliminary.

The wolf population of Revillagigedo Island appears to be relatively stable, consisting of 35 to 50 wolves in 7 or 8 packs which occupy distinct territories. Additional single wolves or pairs that roam over several packs' territories may also occur. Although packs occasionally trespass on adjacent wolves' ranges, all such movements that were detected were relatively brief; at least 1 wolf was killed by other wolves while trespassing. One juvenile male dispersed from his natal pack and moved extensively before apparently establishing a bond with remnant members of another pack that had been reduced through hunting and trapping. Our data imply that vacant areas do not exist on the island and that food resources are limiting wolf numbers.

Although overall deer population densities are relatively low on Revillagigedo Island, wolves appear to be extremely efficient at locating areas where deer occur. While direct evidence of hunting patterns is limited, the distribution of relocations and results of scat analyses confirm that deer are the major food source for these wolves. Nevertheless, regional differences in diet occur on the island and other food sources such as beaver (Castor canadensis) and garbage are important for some packs. In addition, most wolves on the island appear to feed heavily on spawning salmon (Oncorhynchus spp.) in late summer and fall.

The availability of diverse food sources may enable wolves to sustain their numbers at higher levels than could be supported by deer alone. As a result, wolf predation on deer may, in turn, be increased. Nevertheless, any major reduction in deer numbers due to catastrophic winter conditions, or due to habitat alteration resulting from clear-cutting, could be expected to reduce wolf numbers or productivity.

Key words: Canis lupus, deer, food habits, habitat relationships, Odocoileus hemionus sitkensis, predator-prey, wolf.

CONTENTS

BACKGROUND

This study was initiated as a long-term investigation of interactions between wolves (Canis lupus), deer (Odocoileus hemionus sitkensis), and habitat in coastal Alaska. Of particular concern was the effect of habitat alteration, through forest management, on the spatial relationships of deer and wolves, and the influence of wolf predation on deer numbers. A previous report completed under this study (Smith et al. 1986a) reviewed pertinent literature and identified the major needs for accomplishing the study objective. Concurrent work in the Petersburg area (Smith et al. 1986b, in press) also contributed to our understanding of relationships in this study.

Unfortunately, present levels of both wolf and deer populations are too low to facilitate efficient progress on several key jobs under this study. The nature of the vegetation and climate, combined with limited accessibility of most of the study area, severely hampered attempts to capture wolves for telemetry and limited our ability to observe wolves or deer. Accordingly, it was decided to terminate this study at the end of the 2nd year.

STUDY OBJECTIVE

To determine the spatial and trophic relationships of wolves and deer in natural and altered habitats in Southeast Alaska.

JOB OBJECTIVES

1. To determine size, distribution, and stability of wolf packs.

2. To determine activity areas, hunting patterns, and deer-killing rates for specific packs.

3. To determine food habits of selected packs and of the overall wolf population.

4. To determine habitat composition of pack territories.[1]

5. To determine relative abundance of major prey species within selected pack territories.

6. To determine deer density relative to wolf pack territorial borders and habitat characteristics.

7. To monitor deer population trends in various habitat areas and wolf pack territories.

STUDY AREA

The study area consisted of Revillagigedo Island and the adjacent Cleveland Peninsula. Descriptions are provided in Smith et al. (1986a).

METHODS

Objective 1 - Size, Distribution, and Stability of Wolf Packs

Radiotelemetry was used to monitor wolf packs. Details of capture, handling, and monitoring techniques were presented in

[1] Due to the early termination of this project, no activities were undertaken on Objectives 4-7.

Smith et al. (1986a). However, to reduce the frequency of injury to captured wolves, foot traps were replaced with foot snares during the 1985-86 field season.

Objective 2 - Activity Areas, Hunting Patterns, and Deer-Kill Rates

Radiolocations of each collared wolf were plotted on the territory-minimum convex polygon to identify activity areas within the territory. Timing of relocations was used to interpret the significance of replicate relocations within 1 general area (i.e., use of potential den sites from late April through June).

Objective 3 - Food Habits

Wolf scats were collected on a regular basis from logging roads and trails within the range of the Town Pack and opportunistically along other logging roads, beaches, and trails on Revillagigedo Island and the adjacent mainland. In addition, den and rendezvous sites used by radio-collared wolves were visited in late summer and all scats present were collected. Scats were also collected from rendezvous sites discovered by T. Kogut, USDA Forest Service Biologist, on Prince of Wales and Dall Islands.

Attempts were made to collect scats from all parts of Revillagigedo Island. However, scats were not collected in equal proportions from various pack territories or in different seasons, and none of the collections are likely to constitute a true random sample of scats from any area. Accordingly, results of analyses should be considered as indicative of general trends, and comparisons between subsamples should be interpreted with caution.

Collected scats were individually bagged in plastic, labeled with location, date, and estimated date of deposition (for fresh scats) and then frozen. Prior to analysis, scats were oven-dried at 100 C for 24 hours to kill *Echinococcus* eggs. Scats were then weighed to the nearest gram, broken apart in a tray, and a visual estimate made of the percentage of the scat composed of various diet items (e.g., adult deer hair or bones, fawn hair, bird feathers, etc.). Hair and bone fragments were compared with a reference collection and, if necessary, hair-scale imprints were used (Adorjan and Kolenosky 1969).

Scats less than 2 cm in diameter, collected in summer, were considered pup scats. Samples from den and/or rendezvous sites were treated separately to compare diets for specific packs during early pup-rearing periods.

Two statistics were calculated for each scat subsample:

(1) Percent frequency of occurrence = number of times a diet item (e.g., deer hair) was found in the scat sample, divided by the total number of diet items found in the scats; and

(2) Mean diet items per scat = total number of diet items in subsample divided by the number of scats.

The 1st variable provides information on the relative importance of various prey types in the diet. The 2nd value is an index of variety in the diet (Kuyt 1972).

Scats were grouped into subsamples (minimum n = 20), based on the location of deposition, to provide estimates of diet composition for various wolf packs. Seasonal comparisons of summer (Apr-Sep) versus winter (Oct-Mar) diet were based on scats with known deposition dates.

RESULTS AND DISCUSSION

Objective 1 - Size, Distribution, and Stability of Wolf Packs

No additional wolves were captured and radio-collared during the 1985-86 season. On 2 occasions wolves were caught in neck snares, but managed to escape by chewing through the snare cable before we returned to check the snare. Wolf No. 2, a young male that was first captured on 13 February 1985, was recaptured and fitted with a new radio collar on 23 March 1986.

Results of radio tracking and observations of tracks supported the conclusion of Smith et al. (1986a) that a minimum of 7 wolf packs occur on Revillagigedo Island. The packs vary in size from 2 to at least 9 wolves and were found to use largely distinct territories (Fig. 1). Because pack movements were only monitored for 15 to 18 months, no firm conclusions regarding the pack's territorial stability could be made. However, some pack boundaries and use areas appeared to differ between 1985 and 1986. Descriptions of individual pack histories follow.

Town Pack:

Smith et al. (1986a) reported that this pack numbered 7 to 11 wolves in late 1984 and produced a litter of pups in 1985. During the 1985-86 winter at least 1 pack member was killed by other wolves in an apparent territorial dispute and 3 wolves were taken by a recreational trapper. At least 4-5 wolves remained in this pack subsequent to these losses, so the minimum pack size in late 1985 had to have been 8-9 wolves. Although we observed 2 members of this pack breeding in February 1986, we did not confirm the presence of pups in spring. At the end of the study this pack was estimated to consist of at least 5 wolves.

Three members of the Town Pack were radio-collared in February 1985 and subsequent relocations indicated this pack utilized a territory of approximately 150-200 km² including the drainages of the White River and Ward, Ketchikan, Mahoney, and Silvis Creeks. In December 1985 this pack made a brief incursion into the territory of the Naha River Pack near Clover Passage. During this time radio-collared wolf No. 3, a juvenile male, was killed by other wolves (presumably members of the Naha Pack). The lack of snow made it impossible to determine if other wolves were killed in this conflict. In January 1986, radio-collared wolf No. 5, an adult female, made a brief incursion into the territory of the East Chuck Pack.

Naha River Pack:

The Naha River Pack contained 6-8 wolves in late 1985. Two female pack members were taken by a local trapper in January 1986.

Reported sightings by local residents, as well as our observations, indicated this pack ranged over an area of approximately 450 km² including the drainages into Clover Passage, Mosier, Margarita, and Naha Bays, Traitors Cove, and Leask Creek (Fig. 1). No members of this pack were radio-collared, however, so actual pack boundaries were not established. The limited amount of sign observed along the beaches in this pack's territory indicates it spent much of its time inland along major lake and stream systems.

East Chuck Pack:

Smith et al. (1986a) indicated that this pack consisted of 3 to 5 wolves in 1984, including radio-collared wolf No. 2, a juvenile male. It was suspected that the pack produced pups in 1985. No direct observations of the East Chuck Pack were made prior to late November 1985; at that time, wolf No. 2 dispersed, but tracks in the snow indicated the pack still numbered about 5 wolves. Following No. 2's dispersal, contact with this pack was lost; however, 2 other members were subsequently caught by a local trapper in the vicinity of George Inlet, and tracks of more wolves were seen, indicating several pack members remained.

The 2 wolves that were trapped were an adult female and a male pup. Both trapped wolves were in extremely poor condition when caught and neither had any body-fat deposits. Although these wolves may have lost some weight while in the traps, their poor body condition suggests that wolves in this pack are food-stressed.

Wolf No. 2 was observed alone within the pack's territory several times in November 1985; he then left the territory in December. Initially, he moved to Rudyerd Island where he was observed to have killed a deer. After 2 weeks there he returned to his natal pack territory for 1 week, but was not observed with other wolves. He then moved west to Carlanna Lake in the Town Pack territory for 1 week, returned to his natal pack area, and finally moved east across Carroll Inlet and settled into the territory of the Carroll Inlet Pack.

Carroll Inlet Pack:

Smith et al. (1986a) reported that the Carroll Inlet Pack had been reduced through trapping and hunting in 1984 from 10, to 12, to as few as 2 wolves. Tracks observed on logging roads west of Thorne Arm in November 1985 indicated only 2 or 3 wolves were using the area at that time. Subsequently, wolf No. 2 moved into this territory and, based on tracks observed at the time he was recaptured, he joined up with 2 wolves; presumably these were the remnants of the Carroll Inlet Pack.

Although these 3 wolves were running together prior to the mating period in 1986, it is not known whether either of the Carroll Inlet Pack wolves were females which might have bred with wolf No. 2, or if this pack produced pups in 1986. From February through the end of June 1986, these wolves ranged over an area of approximately 160 km² (Fig. 2).

Alava Bay Pack:

Smith et al. (1986a) reported that the Alava Bay Pack consisted of 2-3 wolves, including radio-collared wolf No. 7, an adult male, in late winter 1984-85, and that there was evidence that the pack had produced pups in spring 1985. Several repeat observations of this pack in November and December 1985 confirmed that the pack had increased to a minimum of 9 wolves. Although the lack of snow at low elevations prevented tracking and hampered direct observation in 1986, at least 7 wolves remained in this pack in late February. It is not known whether additional pups were produced in spring 1986.

During late winter and spring 1985, Smith et al. (1986a) reported that this pack ranged over approximately 75-100 km² (Fig. 1). Summer movements of wolf No. 7 were also confined to this area, but beginning in fall, the pack began to heavily exploit what previously had appeared to be a buffer zone between its territory and that of the Lake Grace Pack.

In 1986, wolf No. 7 "disappeared" for several weeks but was eventually relocated 5 km northwest of his previous extreme movement. At that time he was apparently returning from an even longer extraterritorial excursion (Messier 1985). From late April until the end of the project he remained in the southern portion of the territory within 5-10 km of the 1985 den site.

Lake Grace Pack:

Smith et al. (1986a) reported that prior to birth of pups, this pack had declined from 6 or 7 in late 1984, to 3, including radio-collared wolf No. 6, an adult male. Observations in summer and early winter confirmed that at least 3 pups had been produced. No wolves from this pack were trapped or shot during the 1985-86 season and the pack remained at 6 wolves through March 1986.

Movements of wolf No. 6 in spring 1986 indicated the pack was using a den and probably had pups. However, no observations were obtained to confirm pack size at the end of the study. This pack ranged over a total of approximately 400-450 km^2 including Smeaton Island (Fig. 1). The pack moved onto Smeaton Island at least 3 times during the period in which it was monitored, including a 3-week stay in January and a 4-week stay in February-March 1986.

Northeast Pack:

Smith et al. (1986a) estimated that a total of 8 wolves occurred within this pack's territory in late 1984, although 2 of these were a distinct social group from the other 6. By June 1985, 1 member of each group had been radio-collared but each died of starvation soon after marking. One additional wolf may have been lost as a result of a trapping encounter (Smith et al. 1986a).

In September 1985, evidence was found that 4 to 6 wolves from this pack were feeding on spawning salmon (*Oncorhynchus* spp.) and beaver (*Castor canadensis*) in the vicinity of Portage Cove. Throughout the remainder of the 1985-86 field season, however, only 2 sets of single wolf tracks were observed along beaches and trails in this pack's territory. At present, the size of this pack is unknown.

Although the total area identified as being within the territory of this pack is 350-400 km^2, much of the northeastern half of this area is virtually devoid of deer, beaver, and salmon-spawning streams. We believe the area actually used by this pack is much smaller and is centered on the drainages of Portage Cove, Neets Bay, Shrimp Bay, Gedney Pass, and Behm

Canal west of Claude Point. The limited sign observed along beaches in 1986 indicates this pack must spend much of its time inland along major lake and stream systems.

Objective 2 - Activity Areas, Hunting Patterns, and Deer-Kill Rates

During late summer 1985, 2 of the 4 radio-collared packs centered their activities on major salmon spawning systems. The Town Pack was repeatedly relocated in the lower White River drainage from mid-August through early October. During that time, in excess of 120,000 salmon spawned and died in the White River (ADF&G, unpubl. data). The East Chuck Pack spent the same time period in the vicinity of 2 creeks draining into the salt chuck at the head of George Inlet. These streams each contained more than 10,000 pink and coho salmon.

On-the-ground observations in both areas used by these packs confirmed that wolves were catching spawning salmon and feeding extensively on the fish. In addition, fisheries personnel who were interviewed after stream surveys were completed reported evidence of wolves feeding on salmon along virtually every major spawning stream in the Behm Canal district. The Alava Bay Pack also made frequent visits to salmon spawning streams, but did not remain in 1 area as much as the Town or East Chuck Packs. This may reflect the relatively large number of small stream systems in the Alava Bay Pack territory, as opposed to the few large spawning streams in the other packs' ranges.

The Lake Grace Pack was the only pack that did not appear to use spawning salmon in summer. However, it made more extensive use of alpine and subalpine areas than other packs and also used a clear-cut valley that had been extensively colonized by beaver. The pack's use of high elevations was apparently associated with deer on alpine summer range.

The efficiency with which wolves located deer within their territories was demonstrated by the Lake Grace Pack. In several summers' flying along alpine ridges, we only observed deer in 2 locations within this pack's territory (Smith 1984, and unpubl. data), one of which was west of Mirror Lake. Five days after we first observed 13 deer on this ridge in early September 1985, the Lake Grace Pack was located on an apparent kill where these deer had been. The wolves remained in this area for 2 weeks, during which time we did not see deer again.

During the 1985-86 winter months, the Town Pack again made frequent use of the Ketchikan landfill as reported for the winter of 1984-85 (Smith et al. 1986a). However, the pack spent more time hunting other parts of its territory than in

1984-85. In addition, juvenile female wolf No. 4 was more frequently located apart from her mother, wolf No. 5, during this 2nd winter.

The Alava Bay Pack moved extensively throughout its territory in winter and did not concentrate its activities in any particular location. However, relocations were frequently made along stream courses where beaver dams and/or houses were evident, as well as in beach fringe areas or on points where deer densities were relatively higher.

The Lake Grace Pack was generally found during early- and mid-winter 1985-86 to be hunting relatively steep slopes along the major lakes within its range, near beaver colonies at the inlets to these lakes, or on Smeaton Island. In the latter area, the pack was apparently feeding on deer, as there is no evidence that beaver occur on this island.

In late winter of 1986, the Lake Grace Pack abandoned Smeaton Island and returned to hunting near beaver colonies at the head of Mirror Lake and along the Manzanita River. The pack also made several visits to low ridges in the southwest portion of its territory where deer tracks were occasionally observed in the snow.

In spring 1986 the Lake Grace Pack appeared to settle into a den site in the lower Manzanita River drainage. The area was similar to its 1985 den site, consisting of a stand of mature spruce trees in the vicinity of a large complex of beaver dams.

The lack of snow at most elevations used by wolves during the majority of the winter of 1985-86, combined with dense vegetation, prevented our gathering further data on hunting patterns or deer-killing rates. However, given an average pack size of 5-7 wolves, and each wolf's ability to consume 5-10 kg of deer following a kill (Mech 1970:118), the packs studied here could easily consume an entire deer (average live weight: 35-45 kg [ADF&G unpubl. data]) within hours. Thus, even under ideal conditions it is unlikely that wolves would often be found on a kill.

<u>Objective 3 - Food Habits</u>

A total of 511 scats containing 594 diet items from 13 different food sources was collected during this study (Table 1). Deposition date could accurately be determined for 271 of these scats. For the overall sample during summer, wolves fed predominantly on deer, including a high proportion of fawns. Beaver also constituted a major proportion of the summer diet (Table 1). For the Revillagigedo Island summer subsample (*n* = 196) the same general pattern prevails (Table 2).

Numerous other studies report a similar high proportion of deer fawns, or other young ungulates, in summer wolf scats (Murie 1944, Mech 1966, Pimlott et al. 1969, Carbyn 1974, Peterson 1974, Voight et al. 1976, Scott and Shackelton 1980, Hatter 1984). In fact, Hatter (1984) concluded that on Vancouver Island, black-tailed deer fawns were the major prey item for wolves from June through August. The ratio of fawn:adult remains in scats analyzed by Hatter was almost identical to the ratios from Southeast Alaska and Revillagigedo Island samples (Tables 1 & 2), so fawns may be more important than adults in the summer diet here as well.

Although many other studies report the use of beaver by wolves (Murie 1944, Mech 1966, 1970; Peterson 1974, Carbyn 1974, Theberge et al. 1978, Scott and Shackelton 1980, Hatter 1984) few have indicated use as high as found here. Those studies that do indicate levels of use of beaver, in summer, of over 20% frequency of occurrence (Pimlott et al. 1969, Frenzel 1974, Voight et al. 1976) were generally conducted in areas with very low deer populations.

As previously discussed, wolves were known to be feeding extensively on salmon during late summer, but this use was not reflected in scats. Two potential sources of bias may have caused this. First, only scats that could positively be identified as wolf scats were collected, so amorphous scats, which were found along stream banks and composed entirely of fish remains, were rejected, as they might possibly have been from bears. Second, observations and telemetry indicated that although the wolves came down to the streams to catch and feed on the salmon, they usually moved away from the stream to bed down. This movement may have been designed to avoid contact with bears and would have resulted in the wolves' defecating away from the stream banks where we searched for scats.

The winter diet of wolves in Southeast Alaska in general and Revillagigedo Island in particular, was also dominated by deer (Tables 1 and 2). However, beaver continued to represent approximately 20%, and other sources accounted for about 10% of the diet items.

Throughout much of the range of wolves in North America beavers are unavailable in winter (Mech 1970) and only Scott and Shackelton (1980) reported significant use of beaver in winter. The availability of beavers year-round in coastal regions provides an important supplement to the wolf diet and may increase wolves' ability to regulate deer populations (Van Ballenberghe and Hanley 1982).

Comparison of the diets of 5 wolf packs on Revillagigedo Island reflects regional variation (Table 3). Wolves in the Alava Bay and East Chuck Packs consumed approximately 90%

deer, whereas wolves in the Naha and Northeast Packs consumed only about 65% deer, and the Town Pack wolves, only 55% deer. Beaver constituted one-third of the diet for the Naha and Northeast Packs, and the Town Pack fed heavily on garbage from the Ketchikan landfill. The variation in diet reflects deer population density and availability of alternative food sources.

Similar patterns are reflected in scats collected from summer-use sites on Revillagigedo, Prince of Wales, and Dall Islands (Table 4). Scats from wolves on southern Revillagigedo (Alava Bay Pack) as well as on Prince of Wales and Dall Islands, where deer densities are relatively high, contained 93-96% deer, much of which was fawn hair. Scats from the Town and Lake Grace Packs' areas revealed that deer constituted less than half the diet in summer. The former pack used human garbage, and the latter pack, beaver, in nearly equal proportions to deer in the summer. These trends reflect the fact that the Town Pack's den was located near the Ketchikan landfill and that the Lake Grace Pack's den was near an area of extensive beaver colonies.

The mean number of prey items per scat ranged from 1.0 to 1.5 for various subsamples (Table 5). Comparisons between summer and winter diets of wolves on Revillagigedo Island indicate a more varied diet in summer (Table 5). It would seem logical to find a more varied diet in summer, when fish, small mammals, and birds are more available, than in winter, and to find a more varied diet where deer are less available. Comparisons between the sampled packs' diets revealed that the Town Pack had a more varied diet than any other group, both in summer and overall (Table 5). This variation was largely due to the availability of human garbage as a supplement to the usual prey items.

Scott and Shackelton (1980) reported finding only 1 prey item per scat in Vancouver Island wolf feces, but Murie (1944) found more than 1 prey item per scat in feces from wolves in interior Alaska when wolves were preying on rodents in addition to ungulates. Kuyt (1972) reported highly varied spring and summer diets for tundra wolves, particularly during periods when the primary prey species, caribou (Rangifer tarandus), was less available.

The significance, for wolves, of dietary variation, has not been assessed, but the availability of alternative sources such as beaver, salmon, and garbage should reduce this predator's dependence on deer. When other food resources are available, wolves may be able to sustain themselves with relatively low deer-killing rates, despite the small size of Sitka black-tailed deer.

CONCLUSION

Although results of this study are limited, they generally support the concepts and concerns advanced by Van Ballenberghe and Hanley (1982). Specifically, we determined that while wolves prey mainly on deer, other sources of food such as beaver, salmon, and human garbage supplement the diet and enable wolves to persist in relatively stable numbers despite low deer densities. Nevertheless, a wolf pack's territory size and the number of pack members appeared to be related to deer population density, so further declines in deer numbers or productivity due to climate or habitat alteration will probably result in fewer wolves as well.

Wolves were found to be efficient at finding localized areas with relatively high deer numbers, and packs could be expected to take advantage of artificial concentrations of deer in habitat patches created through forest management. Accordingly, timber harvests should be designed so as to minimize formation of small "islands" of old growth and to assure mobility of deer between areas as suggested by Harris (1984).

ACKNOWLEDGMENTS

Many members of the Game Division staff in Region I contributed to the development and implementation of this project. Gerry Downy contributed substantially to the wolf capture effort and his local knowledge of wolf movements was helpful in mapping pack distributions. Dick Hamlin, Jim Jakubek, and Dan Hassell piloted survey and telemetry flights with skill and keen interest in the project which made flying in the frequently poor weather conditions both safe and enjoyable. Greg Clevenger of the USDA Forest Service arranged cooperative funding and was highly supportive of the project. Skipper Ron Rusher and Assistant Boat Officer Kevin Perry of the R/V Sundance provided logistical support for the project; their help is greatly appreciated.

LITERATURE CITED

Adorjan, A. S., and G. B. Kolenosky. 1969. A manual for the identification of hair of Ontario mammals. Ont. Dep. Lands and Forest Res. Rep. (Wildl.) No. 90.

Carbyn, L. N. 1974. Wolf predation and behavioral interactions with elk and other ungulates in an area of high prey diversity. Can. Wildl. Serv. Ottawa, Ont. 238pp.

Frenzel, L. D. 1974. Occurrence of moose in food of wolves, as revealed by scat analyses: A review of North American studies. Nat. Can. 101:467-479.

Harris, L. D. 1984. The fragmented forest. Univ. of Chicago Press, Chicago, Ill. 211pp.

Hatter, I. D. 1984. Effects of wolf predation on recruitment of black-tailed deer on northeastern Vancouver Island. M.Sc. Thesis. Univ. of Idaho. 156pp.

Kuyt, E. 1972. Food habits and ecology of wolves on barren-ground caribou range in the Northwest Territories. Can. Wildl. Serv. Rep. Ser. No. 21. 34pp.

Mech, L. D. 1966. The wolves of Isle Royale. U.S. Natl. Park Serv. Fauna. Ser. No. 7. 210pp.

__________. 1970. The wolf: Ecology and behavior of an endangered species. Nat. Hist. Press. Garden City, N.Y. 384pp.

Messier, F. 1985. Solitary living and extraterritorial movements of wolves in relation to social status and prey abundance. Can. J. Zool. 63:239-245.

Murie, A. 1944. The wolves of Mount McKinley. U.S. Natl. Park Serv. Fauna Ser. No. 5. 238pp.

Peterson, R. O. 1974. Wolf ecology and prey relationships on Isle Royale. Ph.D. Thesis. Purdue Univ., West Lafayette, Ill.

Pimlott, D. H., J. A. Shannon, and G. B. Kolenosky. 1969. The ecology of the timber wolf in Algonquin Park, Ont. Dep. Lands and For. Res. Rep. (Wildl.) No. 87. 92pp.

Scott, B. M. V., and D. M. Shackelton. 1980. Food habits of two Vancouver Island wolf packs: A preliminary study. Can. J. Zool. 58:1203-1207.

Smith, C. A. 1984. Potential of Revillagigedo Island for a goat transplant. Alaska Dep. Fish and Game. Final Rep. Fed. Aid in Wildl. Rest. Proj. W-22-2. Job 12.6R. Juneau. 29pp.

__________, R. E. Wood., L. Beier, and K. P. Bovee. 1986a. Wolf-deer-habitat relationships in Southeast Alaska. Alaska Dep. Fish and Game. Prog. Rep. Fed. Aid in Wildl. Rest. Proj. W-22-4. Job 14.13. Juneau. 20pp.

Table 2. Percent frequency of occurrence of items in the diet from summer (Apr-Sept) and winter (Oct-Mar), and from total scats collected from wolves on Revillagigedo Island, Alaska, 1984-86.

Diet item	Season		
	Summer[a]	Winter[b]	Total[c]
Adult deer	42.5	71.2	55.6
Fawn deer	30.3	--	18.7
Total deer	72.8	71.2	74.3
Beaver	24.0	19.7	20.1
Bird	0.9	1.5	1.1
Wolf	0.4	1.6	0.8
Garbage	0.4	1.5	1.1
Fish	0.9	1.5	0.6
Toad	0.9	3.9	0.6
Unidentified bones	0.4	0.9	0.8
Black bear	0.9	0.9	0.6

[a] _n_ = 196 scats, 221 items.

[b] _n_ = 64 scats, 66 items.

[c] _n_ = 329 scats, 363 items.

__________, E. L. Young, C. R. Land, and K. P. Bovee. 1986b. Effects of predation on black-tailed deer population growth. Alaska Dep. Fish and Game. Prog. Rep. Fed. Aid in Wildl. Rest. Proj. W-22-4. Job 14.14. Juneau. 24pp.

__________, __________, __________, and __________. In press. Effects of predation on black-tailed deer population growth. Alaska Dep. Fish and Game. Final Rep. Fed. Aid in Wildl. Rest. Proj. W-22-4. Job 14.14. Juneau. 1986.

Theberge, J. G., S. M. Oosenbrug, and D. H. Pimlott. 1978. Site and seasonal variations in food of wolves, Algonquin Park, Ontario. Can. Field-Nat. 92:91-94.

VanBallenberghe, V., and T. A. Hanley. 1982. Predation on deer in relation to old-growth forest management in southeastern Alaska. Pages 291-296 in R. Meehan, T. R. Merrell, Jr., and T. A. Hanley, tech. eds. Proc. Symp. Fish and Wildl. Rel. in Old-growth Forests. Am. Inst. Fish. Res. Biol., Wash. D.C.

Voight, D. R., G. B. Kolenosky, and D. H. Pimlott. 1976. Changes in summer food habits of wolves in central Ontario. J. Wildl. Manage. 40:663-668.

PREPARED BY:

Christian A. Smith
Game Biologist IV

SUBMITTED BY:
David A. Anderson
Management Coordinator

APPROVED BY:

W. Lewis Pamplin /kt
W. Lewis Pamplin
Director, Game Division

Steven R. Peterson
Chief of Research, Game Division

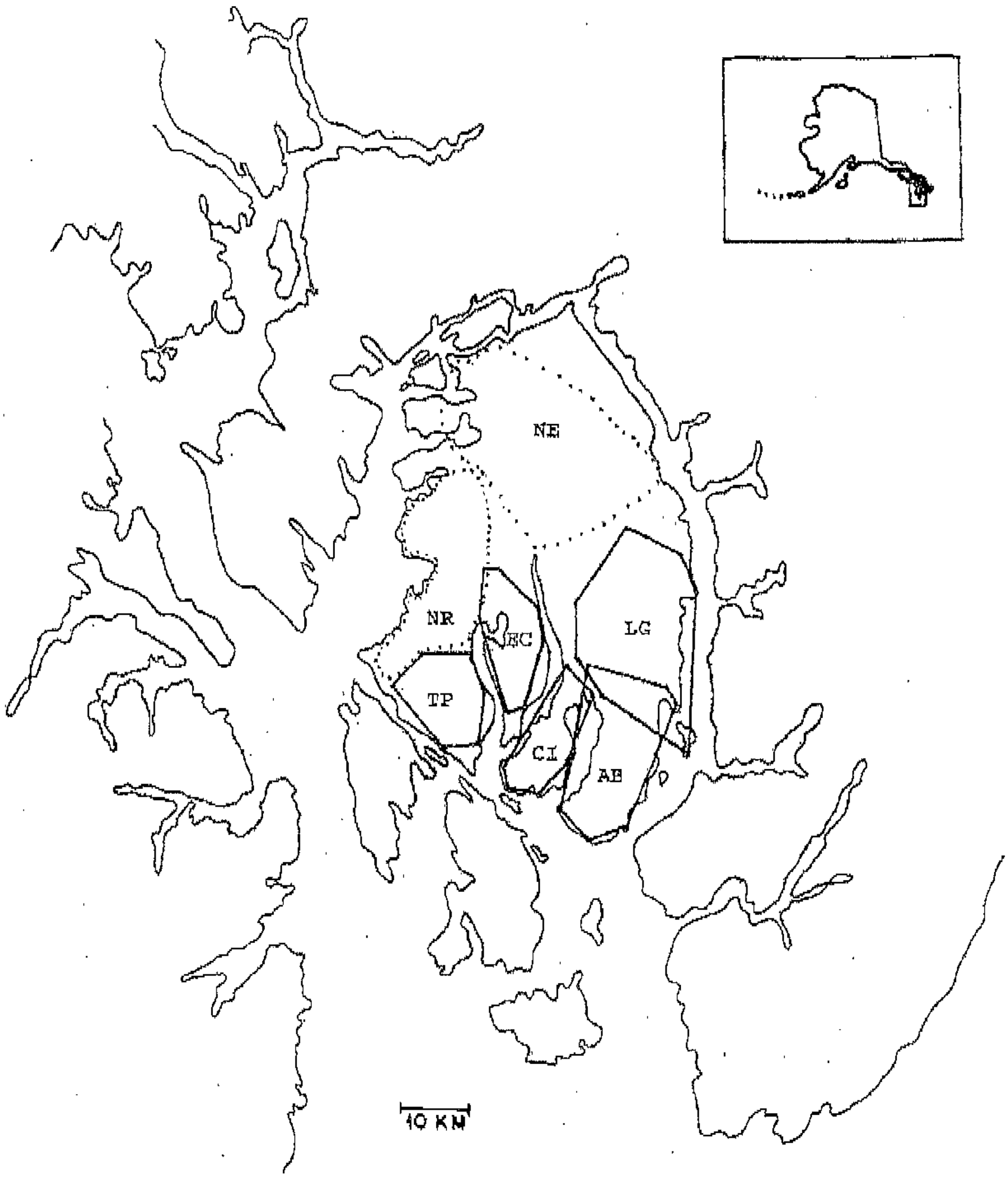

Fig. 1. Location of known (solid lines) and suspected (dotted lines) wolf pack territories on Revillagigedo Island, Alaska, 1985-86. TP = Town Pack, EC = East Chuck Pack, CI = Carroll Inlet Pack, AB = Alava Bay Pack, LG = Lake Grace Pack, NR = Naha River Pack, and NE = Northeast Pack.

Table 1. Percent frequency of occurrence for items in the diet from summer (Apr-Sep) and winter (Oct-Mar), and from total scats collected from wolves in Southeast Alaska, 1984-86.

Diet item	Season		
	Summer[a]	Winter[b]	Total[c]
Adult deer	42.1	68.5	50.2
Fawn deer	29.8	--	20.2
Total deer	71.9	68.5	70.4
Beaver	23.7	17.8	13.5
Seal	0.0	0.0	0.2
Bird	1.3	4.1	2.5
Wolf	0.4	1.4	1.2
Garbage	0.9	1.4	8.2
Porcupine	0.0	1.4	1.3
Fish	0.9	1.4	1.3
Toad	0.9	2.7	0.3
Unidentified bones	0.4	0.9	1.2
Black bear	0.9	0.9	0.3
Mustelids	0.4	0.9	0.3

[a] $\underline{n}$ = 201 scats, 228 items.

[b] $\underline{n}$ = 70 scats, 73 items.

[c] $\underline{n}$ = 511 scats, 594 items.

Table 3. Percent frequency of occurrence of items in the diet from scats collected from 5 wolf packs on Revillagigedo Island, Alaska, 1984-86.

Diet item	Wolf pack				
	Town[a]	Naha River[b]	Alava Bay[c]	Northeast[d]	East Creek[e]
Adult deer	50.9	65.1	58.8	57.9	90.9
Fawn deer	4.9	0.0	29.9	5.3	0.9
Total deer	55.8	65.1	88.6	63.2	90.9
Beaver	1.2	34.9	9.9	31.6	0.0
Bird	3.1	0.0	0.8	2.6	0.0
Wolf	3.1	0.0	0.0	2.6	0.0
Garbage	30.1	0.0	0.0	0.0	0.0
Fish	1.2	0.0	0.0	0.0	9.1
Toad	1.2	0.0	0.0	0.0	0.0
Unidentified bones	3.7	0.0	0.0	0.0	0.0
Black bear	0.6	0.0	0.8	0.0	0.0

[a] n = 124 scats, 163 items.

[b] n = 40 scats, 43 items.

[c] n = 124 scats, 131 items.

[d] n = 36 scats, 38 items.

[e] n = 21 scats, 22 items.

Table 4. Percent frequency of occurrence of diet items in scats collected at den and summer rendezvous sites for 5 wolf packs on Revillagigedo, Prince of Wales, and Dall Islands, Alaska, 1985.

Diet item	Wolf pack				
	Town[a]	Old Tom's Lake[b]	Alava Bay[c]	Bob's Bay[d]	Lake Grace[e]
Adult deer	30.5	35.3	60.6	48.2	12.8
Fawn deer	11.9	58.8	32.0	48.2	37.1
Total deer	42.4	94.1	92.6	96.4	49.9
Beaver	0.0	2.0	5.7	0.0	45.7
Fish	3.4	0.0	0.0	0.0	0.0
Garbage	39.0	0.0	0.0	0.0	0.0
Bird	1.7	2.0	0.8	0.0	1.4
Black bear	0.0	0.0	0.8	0.0	0.0
Unidentified bones	6.8	0.0	0.0	0.0	1.4
Mustelid	0.0	2.0	0.0	0.0	0.0
Seal	0.0	0.0	0.0	3.7	0.0

[a] n = 39 scats, 59 items.

[b] n = 43 scats, 51 items.

[c] n = 115 scats, 122 items.

[d] n = 26 scats, 26 items.

[e] n = 55 scats, 70 items.

Table 5. Mean number of diet items per scat in wolf feces collected in Southeast Alaska, 1984-86.

Source	Season	Mean	(n)
Town Pack	Summer	1.51	39
Old Tom's Pack	Summer	1.19	43
Alava Bay Pack	Summer	1.06	115
Bob's Bay Pack	Summer	1.00	26
Lake Grace Pack	Summer	1.27	55
Revillagigedo Is.	Summer	1.13	196
Revillagigedo Is.	Winter	1.05	64
Town Pack	Total	1.31	124
Naha River Pack	Total	1.08	40
Alava Bay Pack	Total	1.06	124
Northeast Pack	Total	1.06	36
East Chuck Pack	Total	1.05	21
Southeast Alaska	Total	1.16	511

GREENPEACE Sitka Field Office Box 6484 Sitka, Alaska 99835 907-747-7557

March 1, 2013

Alaska Board of Game
c/o ADF&G, Boards Support Section
by FAX: 907-465-6094

Subj: Comments on Proposals 178 and 178-A and the IM Operational Plan **for GMU 1A**.

Dear Board of Game members;

We request that you either disapprove Proposals 178 and 178-A for the reasons given herein or that you adopt the *substitute proposal* below. The proposals are for control of wolves on Gravina Island in Unit 1A for the purpose of deer intensive management. We incorporate by reference the comments on the feasibility assessments that we co-signed for the January Board of Game meeting (January PC-33 and January RC-13) as well as the testimonies by Larry Edwards, Paul Olson and Dave Beebe.

I. Our Recommendation and Request

We recommend and request that the Board of Game strike the content of Proposals 178 and 178-A, and substitute and approve the following:

> The Department of Fish & Game is directed to:
>
> (1) develop a program to establish a baseline of deer browse conditions on Gravina and Revillagigedo Islands and the Cleveland Peninsula, and a baseline of deer nutritional conditions in those areas, and to report the results to the Board; and
>
> (2) supply comments directly to the responsible federal or state agency, rather than through any other agency of state government, regarding proposed actions that may impair or benefit the State's game and wildlife resources or their habitat.

The Proposals and the Operational Plan do not comply with the *Board of Game Wolf Management Policy* (2011-185-BOG) or with ADF&G's 2011 *Intensive Management Protocol*. Also, the proposal is not cost effective and is likely to be generally ineffective. Reasons for these conclusions are explained below. Approving part (1) of the above substitute language will provide a way forward for understanding the deer-wolf-habitat situation in Unit-1A and particularly on Gravina Island.

Approving part (1) the substitute measure will still allow ADF&G to further develop its proposal for future consideration by the Board, would contribute to such an effort, and would also afford an opportunity for ADF&G to evaluate the alternative program we identify at the end of these comments.

Part (2) of the proposed substitute language is necessary to help ensure that the state's game, wildlife and habitat resources get the attention that they deserve from decisionmakers of development projects, toward avoiding significant impacts. Unit 1A, and Gravina Island in particular, are examples of how development decisions can cause significant game, wildlife and habitat losses that endure and affect people for decades. The relevant problem we identified in our comments and testimony for the January Board meeting is the State's "one-voice" policy. By this policy (as presently constructed), the comments of all state agencies are filtered through the Department of Natural Resources. We believe the governor has the authority to advocate whatever position he has on a particular issue or development; however, we also believe that all the facts and expert opinions need to be on the table for the public and a decisionmaker to see and evaluate. Allowing the selective filtering of such information for political reasons or through a Department of Natural Resources that has removed the word "conservation" from its mission statement is contrary to good government and the duties, under the state Constitution, of this Board and the Department. Because the problem the Proposal is addressing is one largely due to habitat loss, we believe it is important for the Board to take this step now toward minimizing future losses here and elsewhere in the state.

II. Reasons Proposals 178 and 178-A Should Be Disapproved

The Board should disapprove the proposals because although the Board is required to consider wolf control, implementing such control is discretionary and:

1. Proposals 178 and 178-A <u>are contrary</u> to the *Board of Game Wolf Management Policy (Findings 2011-185-BOG)* (herein "*Board Policy*").

A. <u>The *Board Policy* states</u>:

> "**Under no circumstances** will wolf populations be eliminated ...,
> and wolves **will always** be managed to provide for sustained yield."

(At 2, emph. added). The Unit-1A proposals would exterminate the Gravina Island wolf population, which <u>clearly</u> violates the policy. In addition the sustained yield of Gravina Island wolves would be terminated for an unknown period, also <u>clearly</u> violating the Policy. Instead, the removal of <u>only</u> as much as a "high percentage" of wolves is contemplated by the Policy. (Id.). The two proposals fail the policy.

B. <u>The *Board Policy* also states</u>:

> "Once prey population objectives have been met, wolf populations
> <u>will generally be allowed to increase to or above pre-control levels</u>."

(Id.). It is however quite possible that on Gravina Island the result of the IM project will be that an increase of wolves to the pre-control level will be biologically precluded. This is because, with the Gravina deer population likely already at "K" (carrying capacity) because of foraging damage to browse and loss of habitat from past logging (Operational Plan at 4), the increase in deer population caused by removal of predation may result in further damage to browse plants and a trophic collapse of the Gravina Island ecosystem. Or as the Operational Plan put it, the result "could be disastrous in the long term." (Id.). This is precisely what we pointed out in our comments on the Feasibility Assessment. The Unit-1A Proposals are contrary to the Board Policy's expectation that the wolf population will recover, because there is substantial risk that on Gravina Island this will not occur. Further, this risk is a failure:

> "... **to ensure** that wolf numbers remain sufficient to maintain
> long-term sustained yield harvests" of wolves.

(Id. at 3, emph. added).

2. Proposals 178 and 178-A are contrary to ADF&G's *"Intensive Management Protocol"* of December 2011 because *Principle 1* of the Protocol is violated.

These Proposals and the Operational Plan for Unit-1A **all fail to "guard against"** the potential "disastrous long term" consequence of the IM project that the latter document identifies (see above). This violates the basis of Principle 1 of *the Protocol*:

> "Management of natural systems **requires** guarding against unintended consequences."

(Protocol at 4). It is also contrary to the Protocol's guideline that:

> "Managers should **ensure** ungulate and predator populations **and their habitats** will be managed for their long-term sustainability."

(Id.). Merely identifying the unintended consequence does not satisfy the Protocol; the Plan must "guard" against it, and really "should ensure" against it. Moreover, the subject consequence for Unit-1A is quite similar to the example given in the Principle 1's *Rationale*. It is that an overabundant ungulate population, caused by reducing predation to a low level, might "damage their forage base and dramatically decline due to a lack of food." (Id.). Overabundance is a matter that is relative to the carrying capacity, and in the case of Gravina Island there is strong evidence (Op. Plan at 4 regarding forage) that even though the deer population is low it is already overabundant and the browse is degraded. Reducing predation can only worsen this situation.

Proposal 178-A (the *Intensive Management Plan*) would suspend wolf control if the deer population doubles. (IM Plan at 3, Op. Plan at 13). But what is the likely consequence of doubling the deer population, given current knowledge of the state of the browse on Gravina? None of the documents explore that key question, nor any other question regarding the impact to browse. Although "forage condition" is mentioned as a factor in the Operational Plan's sections on *Evaluation Criteria* (Sec. III, at 11) and the *Decision Framework* (Sec. IV, at 13), in fact no vegetation criteria were set and no decision-triggering vegetation thresholds were set. What is said is only that there will be vegetation monitoring, and that is insufficient. The Operational Plan does spell out: (1) criteria and thresholds regarding browse condition; (2) the protocol for determining browse condition, whether criteria are met and whether thresholds are approached or exceeded; (3) who will do the monitoring or how it will be organized; and (4) what it will cost and how the cost is allocated in the project budget. In short, there is no "operational plan" regarding the crucial element of browse condition.

3. The *Decision Frameworks* in the Operational Plans for Proposals 178, 179, 178-A and 179-A violate *Principle 4* of ADF&G's *"Intensive Management Protocol"* of December 2011.

The Decision Framework for an IM program is expected to be "transparent" and "explicit." (*Protocol* at 6, title of Principle 4), but several elements of the Decision Framework (Sec. IV) of the Operational Plan are neither.

i. The Op. Plan's threshold a) for Deer Abundance *is operative only at the end of the program, i.e. "after 5 years"*. (At 13, part of Decision Framework). The Op. Plan is not transparent or explicit about what action will or should occur if this threshold for deer abundance is achieved in mid-program, nor does it discuss the possibility of such occurrence at all. This threshold is the attainment of a doubling of deer population according to at least two of four specified indicators. Figure 1 of the Op. Plan shows that one indicator of deer abundance has recently had two years of consistent increase in the absence of wolf control. Therefore it seems possible that the population may be able double in less than five years, even in the absence of wolf control.

ii. Thresholds a) and c) concern attaining a doubling of the Gravina Island deer population. (Id.). They are not "transparent" and "explicit" about either the estimated quantity of deer that will be the basis of estimating a doubling of abundance or what number of deer will be considered to constitute a doubling. (Id.). Ultimately, however, what matters are: 1) the resulting number of deer; 2) how that number relates to winter carrying capacity; and 3) how (as the Feasibility Assessment stated) that number relates to hunter demand and (more reasonably set, we contend) deer population and harvest objectives.

iii. Collectively, the four thresholds do not cover the possible outcome that the program might successfully exterminate wolves on deer population does not double (e.g. perhaps due to severe winters). In this case threshold c) is controlling, but it contemplates only "find[ing] ways to improve the trapping program," which is nonsensical if wolves have been extirpated.

iv. Deer Abundance thresholds a) through c) are contrary to the intent of the Unit-1A wolf control program as it was presented to the public and the Board in the October 2012 Feasibility Assessment. That intent was for a five year wolf control program. These thresholds instead set up an administrative decision whether or not to suspend the control program at the end of the five years. Thus, the Department is reserving to itself the decision on extending the program, instead of making a formal proposal to the Board to do so. These thresholds are therefore improper.

Instead, the thresholds should be written to collectively provide a "decision framework" to provide a means to suspend the program early if the goal of prey doubling is attained early.

v. The content of threshold d) regarding "vegetation plots" is by no means a threshold, but rather expresses only an intent to conduct monitoring to gain insight into the deer/habitat relationship on Gravina Island. (Id.). This content belongs somewhere else in the Op. Plan, and moreover it needs to be expanded to transparently and explicitly explain the protocol that will be used for the monitoring, the metrics that will be used and how the information will be evaluated toward gaining insights.

However, the Decision Framework does need to have an effective vegetative threshold for determining whether the control program should be suspended before its termination date. It is shocking that this crucial element is missing from deer abundance thresholds, because the Op. Plan itself has pointed out that the wolf control program could result in further degradation of already degraded browse on Gravina Island, and could "be disastrous in the long term" as a result. (Op. Plan at 4). Monitoring is not a "decision framework," although it is a necessary element of such a framework. The Operational Plan needs to specify a "transparent and explicit" mechanism for ensuring appropriate action if the wolf control program further impairs deer habitat quality. Moreover, an adequate baseline needs to be established before wolf control begins, and the time and means to establish the baseline has not been provided for in the Operational Plan.

vi. The *Prey Harvest* element of the Operational Plan's *Prey Harvest Strategy* (another element of the Decision Framework) has a non-transparent, non-explicit expectation for "a 20-25% annual increase in deer numbers" if the IM program is successful. (Op. Plan at 14). The problem here is that this does not disclose any real numbers (i.e. population for Gravina Island), and the compounding interest is most likely unrealistic given current knowledge of the degraded state of the browse on the island. A 20% compounding of population over five years is a tripling of population. A 25% compounding is nearly a quadrupling. Can the crucial winter browse on the island, given the loss of this habitat to logging both recently and over recent decades, tolerate these increases in deer population without triggering the possible "disastrous long term" consequences Op. Plan's Background section discloses? (See at 4). Bear in mind that the habitat impacts much of the past logging are not yet fully realized, since canopy closure of the second growth takes 25 to 40 years. The Operational

Plan violates *the Protocol's* Principle 4 because it is not transparent, not explicit – and irrationally it does not establish a "prey harvest strategy" that is related to the obviously limited capability of Gravina's habitat.

vii. The *Prey Nutritional Index* element of the Operational Plan's *Prey Harvest Strategy* (another element of the Decision Framework) discusses an "objective" of monitoring deer body condition. (Op. Plan at 14-15). However, this subsection does not establish a decisionmaking framework for what range of actions the program will take based on the range of body condition results that may be obtained from the monitoring. This is related in part to the vegetative condition issue as discussed in item v., above, and much of the thrust of that argument applies here as well, including a need to a baseline before wolf control begins.

4. Proposals 178 and 178-A are not feasible due high cost and likely ineffectiveness.

The Operational Plan claims that a "cost efficient predator control strategy" will be used. (Op. Plan at 4). However, as we pointed out in our comments and testimony for the January Board of Game meeting, the program for Gravina Island is anything but cost efficient. In our comments (January PC33 at 11) we estimated that the elimination of the wolves on Gravina Island may result in "a population increase of 208 [deer that may] result in a harvest increase of only 9 deer. The cost per additional deer that can be expected to be harvested would exceed the range of $43,900 to $52,200, each."

The Board of Game has delayed consideration of the cost of the Unit-1A proposal until the March meeting. ADF&G has not provided any further cost discussions in the materials it has provided for the March meeting, nor has it contested our cost figures. Even as an experiment, we do not believe the cost of the proposals can be justified.

Moreover, the Board considered material from ADF&G in 2000, when deliberating on deer population and harvest objectives, which supports our contention that wolf control in Southeast Alaska is overly expensive (not "cost efficient") and likely to be ineffective:

> With the notable exception of ensuring maintenance of existing old-growth forests, **little can be done to increase deer densities in Southeast Alaska.**
>
> Wolf control efforts in the 1980s in Southeast Alaska **were found. to be expensive, time consumptive, and ineffective.**

(*Intensive Management Population Identification Worksheet*, at 2, 8 and 10, emph. added. Provided as Attachment-1).[1] From October to the present, ADF&G has not presented any documents to the public or the board that discuss these findings from the 1980s and the importance that was placed on them for the Board of Game's 2000 deliberations. In the absence of a whole record for public and the Board to consider, Proposals 178 and 178-A should be disapproved because it is apparently likely that the wolf control program will be inordinately expensive (as we already know) and ineffective.

Moreover, scarce funds in a smaller amount should instead be spent at this time for developing the baselines that we flagged above as needed, for browse quality and deer nutritional index. If any wolf control actions are taken here, they need to be based on good baselines and a solid understanding of condition of the habitat and the deer that use it – at present we have neither for Gravina Island or the proposed control area.

[1] This document was obtained through a February 2013 request to Board staff for deer-related materials that were considered by the Board in 2000.

We recommend that the Board strike the content of Proposals 178 and 178-A and substitute language directing ADF&G to develop the two baselines and report to the Board on: (1) the conditions of deer habitat, (2) the nutritional condition of the deer population on Gravina Island particularly and more broadly in Unit-1A, and (3) more particulars of the findings of the 1980s wolf control efforts. There is no emergency dictating immediate initiation of a wolf control program on the island or in Unit-1A, and a methodical scientific approach should be taken instead.

5. The deer population and harvest objectives were set much too high because of: (1) faulty modeling the objectives were based on, and (2) unusually high harvest in immediately preceding years.

As discussed in our comments and testimony for the January Board of Game meeting, the deer population and harvest objectives were set much too high by the Board in 2000. (Pages 2-5 of comments January PC33, and corrected table in January RC13, included here, as corrected in January, as Attachment-2).

As shown in the box at the bottom of Figure 2 in Attachment-2, the winter deer habitat modeling ADF&G relied upon when advising the Board in 2000 on setting deer objectives for Unit-1A gave results now known to have greatly over-estimated carrying capacity. The over-estimation for 39% for all of Unit-1A and 38% for Gravina Island. Other places important for Ketchikan hunters were also over-estimated, by 60% for Revillagigedo Island and 34% for the Cleveland Peninsula.

Because Proposals 178 and 178-A are largely driven by an impetus to meet the 2000 objectives, the only way the Board could rationally approve the Proposals would be to first reconsider the objectives through a formal process.

Two other related factors militate for disapproving the Proposals at this time. The 2000 objectives were based on harvests from several years earlier when harvests were at a peak, in a period of generally mild winters. (See Feasibility Assessment; see also Op. Plan Fig. 1). Following the closure of the Ketchikan Pulp Mill in 1997, the demographics of the area changed and the number of hunters and hunter effort decreased. From two years later, in 1999, hunter effort was fairly consistent until the hard winters of 2006/2007 and 2008/2009. (Fig. 1, noting that 1991 and 2005 are outliers). Despite the two hard winters, deer harvest began recovering in 2009 and 2010.

Also, low deer numbers should currently be expected in Unit-1A a due to the combined effects of (1) marginal to low carrying capacities naturally; (2) lower carrying capacities now due to winter habitat loss to logging; and (3) the recent hard winters. Notably, except for Duke Island, all portions of Unit-1A are markedly below the 18 deer/sq-mile threshold developed by ADF&G scientists (with others) which is a minimum for providing both for viable wolf populations and the needs of hunters.

Under the *Board of Game Wolf Management Policy* (2011-185-BOG), the paucity of suitable winter habitat creates a situation where wolf control is not a suitable solution to low deer harvest. Given the circumstances, we believe a likely outcome of a board approval of wolf control in Unit-1A is likely to be assurance of an ESA listing of the Alexander Archipelago wolf under the petition that is pending with the US Fish & Wildlife Service.

6. An alternative to wolf extermination should be considered.

The Unit-1A Operational Plan cites Smith (1983), which was not included in the References section. Noting this, we obtained a Smith document from ADF&G, which turned out to be Smith et al. (1987), *Final Report (Research): Wolf-Deer-Habitat Relationships in Southeast Alaska.* (Included as Attachment-3). The study was of radio-collared wolves on Revillagigedo Island, and tracked five packs for two years. The study was terminated three years early because of adverse weather, low densities of deer and wolf populations, budget shortfalls and personnel reductions.

An interesting aspect of the study is the Town Pack, which had a remarkably lower fawn composition in the diet (11.9%, versus the next-best 37.1% and the highest 60.6%). The percentage of adult deer in the diet was the second lowest (versus a pack that preyed heavily on beaver and had the highest non-deer diet component). Interestingly, the Town Pack's diet was 39% garbage from the Ketchikan landfill.

This suggests that an alternative way to reduce the deer and fawn components of the diet of Gravina wolves may be, as an experiment, to regularly provide food scraps at various points along or near remote parts of the Gravina road system. These partial dietary substitutions should be placed where wolves will encounter them and away from areas being frequented by deer, and should planned so wolves will have a degree of expectation among several particular places. Of course concerns would include habituation and public safety; however, the Town Pack apparently used the Ketchikan dump for years, and some accessible portions of Gravina Island are more remote than that. It may have value at least as an experiment apart from its potential as a long-term solution.

A scraps collection program with restaurants or citizens, for deposit or collection on particular days, could provide the feed. The program could have an educational component for students and the public at large, and perhaps could have a tourism aspect through viewing stations near enough to the various feeding sites for spotting scopes.

While outside-the-box, this alternative may help boost deer recovery and harvest numbers, and might possibly be able to continue at potentially little cost to the state, for decades to come. One advantage over Proposals 178 and 178-A is that the wolf population would remain in place, so if the increasing deer population does end up further decreasing browse (winter browse especially) and predation is need to control it, ending or reducing the feeding is a ready solution.

Sincerely,

Larry Edwards
Greenpeace
Box 6484
Sitka, Ak 99835
907-747-7557

Attachment - 1

Intensive Management Population Identification Worksheet

Species: Deer **Population:** Unit 1A

Brief description of the population:
This deer population inhabits the mainland and near-shore islands in Unit 1A. Densities have generally been highest on the lower Cleveland Peninsula and Gravina Island. Densities are lowest on the mainland east of Ketchikan where very limited deer hunting occurs. Buck-only harvests, with a 4-buck limit, have been in effect in the unit for the past 20 years.

Criterion #1 – Harvest:

a. Maximum average harvest for any 3 consecutive years: 788 during 1994–1996.

b. Estimated average harvest for 1991–1996: 652

Criterion #2: - Accessibility:
Most access is by boat, some by floatplane. Highway vehicles are used to access areas on the limited Ketchikan road system, and 3- and 4-wheelers are used occasionally to access areas associated with remote logging roads. Boat and airplane access is extremely weather-dependent.

Criterion #3: – Use for meat:
Alaska residents, primarily those residing within the Ketchikan Gateway Borough, use this population of deer primarily for meat and recreation.

Criterion #4 – Hunter demand:

a. Estimated or reported hunter effort: During 1991–1995, hunters spent a seasonal average of 4,534 days hunting deer. Effort data was not collected during 1996.

b. Number of applicants for permit hunts, if applicable: NA

c. Other indicators of demand: None

Is this population important for providing high levels of human consumptive use?

Department Recommendation:
Yes: __X___
No:

Board of Game Action:
Yes: __X__
No:

Intensive Management Objective Worksheet

Species: Deer **Population:** Unit 1A

(1) **Effects of weather, habitat capability, diseases and parasites:** Diseases and parasites appear to have negligible impact on deer populations in Unit 1A. Severe winter weather causes periodic declines in the deer population, especially in areas where clear-cut logging has removed old-growth forests. Among other deleterious effects, the removal of the old-growth canopy allows snow accumulation on the ground above "normal" levels, limiting the value of critical habitat to support over-wintering deer populations.

(2) **Maintenance of viable predator populations:** Brown bear predation on deer is apparently negligible. We believe that black bear predation on deer is significant where they occur at high densities. Anecdotal evidence supports the idea that scavenging of deer carcasses by brown bears, marten, and bald eagles may provide periodic food resources, but is probably not important for maintaining these populations. Deer are the mainstay of the diet of wolves in this unit.

(3) **Maintenance of habitat conditions suitable for other species in the area:** Evidence suggests that deer and mountain goats may compete for limited food resources in some limited situations. However, for current deer and goat population levels in Unit 1A, there appears to be no direct correlation in terms of population densities.

(4) **Effects on subsistence users:** The islands and the Cleveland Peninsula portion of Unit 1A are in the Ketchikan Nonsubsistence Area, and make up most of the quality deer habitat in the Unit. Subsistence use of deer in Unit 1A depends largely on deer abundance. As deer numbers increase following mild winters, hunter effort increases proportionately. Deer meat provides a considerable amount of the red meat for consumption by Unit 1A residents, as the only other available ungulates are mountain goats (common) and moose (scarce).

(5) **Cost, feasibility, and potential effectiveness of possible management actions:** With the notable exception of ensuring maintenance of existing old-growth forests, little can be done to increase deer densities in Southeast Alaska. The ADF&G needs to continue working with the US Forest Service and private landowners in an effort to maintain quality habitat. Where logging occurs it is imperative that proliferating human access be minimized by strict attention to road placement, administrative and/or mechanical road closures after logging, and regulations that ensure viable deer populations.

(6) **Land ownership patterns within the range of the population:** The vast majority of deer habitat in Unit 1A is under federal jurisdiction of the Tongass National Forest. In addition, a portion of the mainland is designated as the Misty Fjords National Monument within the Tongass.

(7) **Degree of accessibility to harvest:** Accessibility by boat is very good throughout the area. The only areas largely inaccessible are parts of the mainland away from the coast, where deer habitat is limited because of high elevations and snow and ice cover.

(8) **Other factors, if any:** Since 1990, both state and federal subsistence hunting regulations have been in effect. State regulations were adopted by the Alaska Board of Game and applied to all lands in Unit 1A. State and federal deer hunting regulations remain identical in the Unit.

Department Recommended Objectives:

Population	14781
Harvest	725

Current management objectives for Unit 1A deer are to: 1) maintain a population in excess of 45 deer per mi^2 of winter range (1.4 pellet-groups per plot); and 2) monitor deer densities using pellet-group surveys.

Board Action:

Objectives:

1. Population: 15000
2. Harvest: 700

Intensive Management Population Identification Worksheet

Species: Deer **Name of the Population:** Unit 1C

Brief description of the population:
Deer are found throughout Unit 1C, but the highest concentrations are found on three islands Douglas, Shelter, and Lincoln. Deer are also found on the mainland in very low densities due to a greater snowpack and the presence of wolves.

Criterion #1 - Harvest:

a. Maximum average harvest for any 3 consecutive years: 583

b. Estimated average harvest for 1991–1997: 467

Criterion #2 - Accessibility:
Portions of the Unit 1C mainland and Douglas Island are accessible by highway vehicle. Hunters also use boats to access the south and western sides of Douglas Island, as well as Shelter and Lincoln Islands.

Criterion #3 - Use for meat:
Considering the limited opportunities available for harvesting moose in Unit 1C, most hunters secure wild meat through the harvest of local deer. Deer hunting is also an important recreational activity for Juneau area residents.

Criterion #4 - Hunter Demand:

a. Estimated or reported hunter effort: From 1991–1995 the average number of hunters/year was 939, and these hunters combined for 3,324 hunter days. 1996 and 1997 data is only available for successful hunters, and therefore not included in the above average.

b. Number of applicants for permit hunts, if applicable: NA

c. Other indicators of demand: The deer hunter survey indicates hunters pursue deer throughout the 3-½ month season in Unit 1C.

Is this population important for providing high levels of human consumptive use?

Department Recommendation:
Yes: __X__
No:

Board of Game Action:
Yes: __X__
No:

Intensive Management Objective Worksheet

Species: Deer **Population:** Unit 1C

(1) **Effects of weather, habitat capability, diseases and parasites:** Winter weather, especially deep and persistent snow, is a critical factor in regulating deer numbers. Deep snow hinders foraging ability of deer by limiting mobility, increasing energy expenditure, and by concentrating deer at lower elevations which increases intraspecific competition. Altitude, aspect, and browse species availability can severely limit habitat quality and quantity, and high deer densities result in starvation or increased susceptibility to predation caused by the poor nutritional state of the animals (Olson, 1979). Unit 1C has both mainland and island deer habitat. Douglas, Lincoln, and Shelter islands harbor higher deer densities than the mainland because of lower snowfall, mostly undisturbed forest habitat, and lack of wolves. These easily accessible islands support most of the deer hunting effort within the subunit. The capability of the habitat to support deer in Southeast Alaska is dependent on the amount of mature forest available. Diseases and parasites do not appear to be factors limiting deer populations in Southeast Alaska.

(2) **Maintenance of viable predator populations:** Mainland deer densities are low enough that wolves rely upon a wide array of prey to subsist, and wolves in this area are not highly dependent on deer. On the islands within the subunit, wolves are virtually absent. We believe that black bear predation on deer is significant where bears occur in high densities. Anecdotal evidence supports the idea that scavenging of deer carcasses by marten and bald eagles may provide periodic food resources, but is probably not important for maintaining these populations. Changes in human harvest objectives would most likely occur on the islands, where changes in deer numbers would not have a substantial effect on predators.

(3) **Maintenance of habitat conditions suitable for other species in the area:** Long term planning to maintain large tracts of mature forest is the only way of sustaining a viable deer population. Other species that use mature forests would benefit by having habitat available to them. Deer and mountain goats compete for limited food resources in some limited situations. However, for current deer and goat population levels in Unit 1C, there appears to be no direct correlation in terms of population densities.

(4) **Effects on subsistence users:** Subsistence use of deer in Unit 1C depends largely on deer abundance. As deer numbers increase following mild winters, hunter effort and success increases proportionately. Deer meat provides most wild red meat for consumption by Unit 1C residents, with moose and mountain goats supplementing deer meat.

(5) **Cost, feasibility and potential effectiveness of possible management actions:** We believe that predation is not a substantial problem for deer in this subunit, and attempts at predator control would be extremely costly. Mainland snowfall is heavy enough that even in the absence of predators it is unlikely that deer numbers will ever increase substantially. It is not

feasible to enhance mature forest habitats, which are key to the well being of the deer herd. Retention of critical habitat is a key management strategy.

(6) **Land ownership patterns within the range of the population:** Significant private and municipal land ownership is an issue in the area, and our ability to control development on these tracts of land is limited. Douglas Island deer winter range is in private and municipal ownership and may be developed for residences and a golf course.

(7) **Degree of accessibility to harvest:** Island deer habitat in Unit 1C is easily accessible from the state's third largest city by road system, trails, and boat. Away from mainland roads and trails access is more difficult.

(8) **Other factors, if any:** If the Juneau human population continues to grow, there will likely be an increase in deer hunting effort. Given the easy access, deer in this area could be susceptible to overharvest.

Department Recommended Objectives:

Population ___6240___

Harvest ___450___

****

Board Action:

Objectives:

1. Population: ___________
2. Harvest: ______________

Intensive Management Population Identification Worksheet

Species: Deer **Population:** Unit 2

Brief description of the population:
This deer population inhabits Prince of Wales and adjacent islands. Densities have fluctuated historically, primarily in response to winter weather conditions, although predation by wolves and black bears contributes to annual mortality. Deer are known to travel between islands, as are their predators.

Criterion #1 – Harvest:

a. Maximum average harvest for any 3 consecutive years: 2,970 during 1993–1995.

b. Estimated average harvest for 1991–1996: 2,831

Criterion #2: - Accessibility:
Most hunters access deer with highway and off-road vehicles on the extensive road system found on central to northern POW Island. A few hunters access alpine lakes early in the season with floatplanes, and some travel to small offshore islands by boat.

Criterion #3: – Use for meat:
Primarily Alaska residents residing on Prince of Wales Island use this deer population for meat and recreation. Several Ketchikan residents travel to Unit 2 each season to hunt deer for meat and recreation as well.

Criterion #4 – Hunter demand:

a. Estimated or reported hunter effort: During 1991 –1995, hunters spent a seasonal average of 12,242 days hunting deer in Unit 2. Effort data was not collected during 1996.

b. Number of applicants for permit hunts, if applicable: NA

c. Other indicators of demand: None

Is this population important for providing high levels of human consumptive use?

Department Recommendation:	Board of Game Action:
Yes: __X__	Yes: __X__
No:	No:

Intensive Management Objective Worksheet

Species: Deer **Population:** Unit 2

(1) **Effects of weather, habitat capability, diseases and parasites:** Diseases and parasites appear to have negligible impact on deer populations in Unit 2. Severe winter weather causes periodic declines in the deer population, especially in areas where clear-cut logging has removed old-growth forests. Among other deleterious effects, the removal of the old-growth canopy allows snow accumulation on the ground above "normal" levels, limiting the value of critical habitat to support over-wintering deer populations. Prince of Wales Island has seen some of the more aggressive logging in Southeast Alaska, and within the next 20–30 years we anticipate deer habitat capacity to decrease substantially.

(2) **Maintenance of viable predator populations:** Wolf populations are healthy in Unit 2 and can effect deer populations at least in local areas. We believe that black bear predation on deer is significant where bears occur in high densities. Anecdotal evidence supports the idea that scavenging of deer carcasses by marten and bald eagles may provide periodic food resources, but is probably not important for maintaining these populations.Deer are the mainstay of the diet of wolves in this unit.

(3) **Maintenance of habitat conditions suitable for other species in the area:** There are no other ungulate populations in Unit 2 that deer compete with, although marten exist in the unit and have been shown to be old-growth dependent.

(4) **Effects on subsistence users:** Subsistence use of deer in Unit 2 depends largely on deer abundance. As deer numbers increase following mild winters, hunter effort increases proportionately. Deer meat provides a large proportion of the red meat for consumption by Unit 2 residents, although there is significant use of seals and some amount of use of black bears.

(5) **Cost, feasibility, and potential effectiveness of possible management actions:** With the notable exception of ensuring maintenance of existing old-growth forests, little can be done to increase deer densities in Southeast Alaska. The ADF&G needs to continue working with the US Forest Service and private landowners in an effort to maintain quality habitat. Where logging occurs it is imperative that proliferating human access be minimized by strict attention to road placement, administrative and/or mechanical road closures after logging, and regulations that ensure viable deer populations. Wolf control efforts in the 1980s in Southeast Alaska were found to be expensive, time consumptive, and ineffective.

(6) **Land ownership patterns within the range of the population:** Most of the deer habitat in Unit 2 is under federal jurisdiction of the Tongass National Forest, although private corporations own a considerable amount of land in this Unit.

(7) **Degree of accessibility to harvest:** Accessibility by boat and highway vehicles is very good throughout most of the area. Off road vehicle use is increasing by deer hunters.

(8) **Other factors, if any:** Since 1990 both state and federal subsistence hunting regulations have been in effect. State regulations were adopted by the Alaska Board of Game and applied to all lands in Unit 2. In recent years there has been a federal doe season in Unit 2 that is only open to federally qualified subsistence hunters (rural residents of Units 1A, 2, and 3).

Department Recommended Objectives:

Population __71248__

Harvest __2728__

Current management objectives for Unit 2 deer are to: 1) maintain a population in excess of 45 deer per mi^2 of winter range (1.4 pellet-groups per plot); and 2) monitor deer densities using pellet-group surveys.

Board Action:

Objectives:

1. Population: 71,000
2. Harvest: 2,700

Intensive Management Objective Worksheet

Species: Deer **Population:** Unit 3

(1) **Effects of weather, habitat capability, diseases and parasites:** Diseases and parasites appear to have negligible impact on deer populations in Unit 3. Severe winter weather causes periodic declines in the deer population, especially in areas where clear-cut logging has removed old-growth forests. Among other deleterious effects, the removal of the old-growth canopy allows snow accumulation on the ground above "normal" levels, limiting the value of critical habitat to support over-wintering deer populations.

(2) **Maintenance of viable predator populations:** Wolf populations are healthy in Unit 3 and can effect deer populations at least in local areas. We believe that black bear predation on deer is significant where bears occur in high densities. Anecdotal evidence supports the idea that scavenging of deer carcasses by marten and bald eagles may provide periodic food resources, but is probably not important for maintaining these populations. Deer are the mainstay of the diet of wolves in this unit.

(3) **Maintenance of habitat conditions suitable for other species in the area:** Evidence suggests that deer, moose, and elk may compete for limited food resources in some situations. However, for current deer, moose, and elk population levels in Unit 3, there appears to be no direct correlation in terms of population densities.

(4) **Effects on subsistence users:** Subsistence use of deer in Unit 3 depends largely on deer abundance. As deer numbers increase following mild winters, hunter effort increases proportionately. Deer meat provides a large proportion of the red meat for consumption by Unit 3 residents, although there is significant use of moose and black bears.

(5) **Cost, feasibility, and potential effectiveness of possible management actions:** Protecting old-growth forests and treating second growth clear cuts can maintain existing deer densities in Southeast Alaska. The ADF&G needs to continue working with the US Forest Service and private landowners in an effort to maintain quality habitat. Where logging occurs it is imperative that proliferating human access be minimized by strict attention to road placement, administrative and/or mechanical road closures after logging, and regulations that ensure viable deer populations. Wolf control efforts in the 1980s in Southeast Alaska were found to be expensive, time consumptive, and ineffective.

(6) **Land ownership patterns within the range of the population:** Most deer habitat in Unit 3 is under federal jurisdiction of the Tongass National Forest, although a private corporation owns a large section of north Kupreanof Island.

(7) **Degree of accessibility to harvest:** Accessibility by boat is good throughout most of the area. Highway vehicle access is good on islands with communities.

(8) **Other factors, if any:** Since 1990 both state and federal subsistence hunting regulations have been in effect. State regulations were adopted by the Alaska Board of Game and applied to all lands in Unit 3. State and federal deer hunting regulations remain identical in Unit 3.

Department Recommended Objectives:

Population	14868
Harvest	852

Current management objectives for Unit 3 deer are to: Increase populations on deer winter range (<1,500 ft elevation) to 32 deer/mi^2, measured by a mean pellet density of 1.0 pellet group/20m^2 plot.

Board Action:

Objectives:

1. Population: 15,000
2. Harvest: 900

C

7-0

Attachment – 2

Excerpt of comments PC33, as corrected by RC13, from the Jan. Board of Game meeting

• Greater SE Alaska Conservation Community • Alaska Wildlife Alliance •
• Tongass Conservation Society • Greenpeace • Center for Biological Diversity •

Alaska Board of Game
c/o ADF&G, Boards Support Section
by FAX: 907-465-4094

December 28, 2012

Subj: ***Unit 1A:*** Comments on "*Feasibility Assessment ... Black-tailed deer*"

...

II. The Deer Objectives Are Outdated and Therefore Do Not Support Wolf IM.

The current objectives for deer population and deer harvest in Unit-1A are outdated because they are based on older deer modeling which produced over-estimates of the carrying capacity of winter habitat.

A. The current deer objectives for Unit 1-A, and how they were determined.

The current deer population and harvest objectives for Unit-1A were adopted by the Board of Game in 2000, setting them at 15,000 and 700 respectively. (Assessment at 7). They are based in large part on the Forest Service's 1997 deer model, which was used to estimate the winter carrying capacity of the habitat for deer, and on harvest rates from 1994 to 1999 which were the peak years for the Unit. (Id.). The Assessment itself recognizes that these objectives are "unrealistically high." (Assessment at 7, 18). Over the past five years the Unit-1A deer harvest ranged from 154 to 309 (Assessment at 7), but this does not include illegal take which the department estimates to be around 50% of the harvest estimated from hunter surveys. (Assessment at 30, 36). Thus, the actual total harvest over the past five years likely ranged from about 230 to 460, in comparison to the 700. This approaches two-thirds of the objective.

B. Problems with the deer model results that the harvest objective was based upon.

The Board of Game, in its 2000 determination of Unit-1A deer population and harvest objectives, relied upon deer carrying capacity data from the Forest Service's 1997 deer model. (Assessment at 7, 18). The Forest Service updated its model for the 2008 Tongass Forest Plan, and the new model[1] makes significantly lower carrying capacity estimates.

---

[1] When we speak here of a "version" of the model, this encompasses the core of the model and the vegetative data and directives for some external settings that are used when carrying capacity in deer

Three corrections made to the model since 2000 were substantial:

(1) In its FY-2000 Monitoring & Evaluation Report (published April 2001),[2] the Forest Service corrected the conversion factor (called the Deer Multiplier) used to change the model's non-dimensional output to carrying capacity in deer per square mile, from 125 to 100.[3] The Deer Multiplier is based on deer pellet transect data, and is the carrying capacity of best quality habitat (of which very little exists). The older model results in over-estimated carrying capacity by 25%. From the information in the Assessment we don't know which multiplier had been used when the Board of Game set the Unit-1A objectives.

However; regarding the Deer Multiplier, Gravina Island is a special case as ADF&G itself explained to the Forest Service in 2002 regarding the Gravina Island Timber Sale Project:[4]

> "Deer model. Our concerns for sustainability of deer harvests on Gravina stem in part from the reported results of runs of the deer model for the DEIS, as well as analysis of hunter demand. The coefficients used for these runs very likely underestimate the effects of the project upon deer, leading to overly optimistic projections of true deer numbers and future availability. The model was run with a multiplier of 125 deer per square mile, as directed by the 1997 Forest Plan, although a multiplier of 100 deer per square mile has been recommended by both FS and ADF&G biologists.
>
> In the September 13 meeting, Gene DeGayner indicated that the FS intends to use a multiplier of 100 deer per square mile for habitat scores of 1.0 from this point forward, unless project-level data suggest otherwise. In general, ADF&G recommends assuming a maximum **year-round** carrying capacity of 35 to 40 deer per square mile in the best habitat. After consultation with ADF&G research biologists Matt Kirchhoff and Dave Person, **we recommend equating a multiplier of 35 deer per square mile to a score of 1.0 for the Gravina project area**, due to the lack of high-value alpine habitat, indicating a non-migratory deer population that occupies the area all year, with little seasonal variation. (See the Appendix for a more detailed discussion of application of the deer model.)"

(ADF&G Habitat Div. letter to Alaska OMB, 12 Dec. 2002, at 3 to 4. Orig. emph.). Thus, for Gravina Island, reliance on Deer Multipliers of 125 or 100 would result in over-estimations of carrying capacity of a factor of 3.57 (a 257% over-estimation) or 2.85 (a 185% over-estimation).

(2) In 2008 the Forest Service made a further correction to use of the Deer Multiplier.[5] From 1997 through 2007 the scale for the non-dimensional habitat value outputs was a range "habitat suitability index (HSI)" of from zero to 1.3. The value 1.3 represents best

---

per square mile is calculated from the model's non-dimensional output. The core of the model has not changed over the years, only the other factors in its application.

[2] USFS R10-MB-431, at 2-155.

[3] The multiplier represents the winter carrying capacity of the highest quality habitat type; however, this kind of habitat is scarce.

[4] This timber sale project was not executed. As a result of an administrative appeal of the project decision (Greenpeace et al. 2004) to the next highest level of the Forest Service, the project decision was withdrawn. However, since that time a significant amount of logging in high quality deer habitat has occurred on Gravina Island, done under timber sales by Alaska DNR and the Alaska Mental Health Trust.

[5] 2008 *Tongass Forest Plan (TLMP) FEIS*, at 3-266: "HSI values were standardized to range from 0 to 1.0, by dividing all values by 1.3, because outputs from such models represent a range from 0 to 100 percent habitat suitability, with higher values indicating higher habitat capability." Also at 3-284 in footnote 2: "Habitat capability in terms of deer density calculated using a multiplier of 100 deer persquare mile equating to a habitat suitability index score of 1.0."

quality habitat. However, the way the Deer Multiplier was used during those years, it corresponded to a value of 1.0 in that range, which is incorrect and results in a 30% over-estimation of carrying capacity. If these and the previous error were both present in the data the Board considered in setting the objectives, the total error was a 62.5% carrying capacity over-estimation.

(3) The vegetative dataset used in the 1997 deer model was later found by a Forest Service statistical study to be uncorrelated to habitat quality. (Caouette et al. 2000).[6] An adequate dataset was not used until adoption of the 2008 Tongass Forest Plan. The new dataset "results in an overall reduction in average HSI[7] values because fewer stands would be classified as high and medium volume strata and more stands would be classified as low volume strata compared to the old volume strata mapping used in the 1997 Forest Plan Revision Final EIS." (2008 Forest Plan FEIS at 3-265 to 266). This change resulted in significantly lower carrying capacity estimates by the new model, nearly everywhere in the Tongass, but the changes were not the same everywhere because the previous dataset's non-correlation to habitat quality had made the amount of error erratic.

C. The Amount of Deer Modeling Error, As Incorporated in the Unit-1A Objectives.

The 2008 corrections made by the Forest Service to its 1997 modeling of deer winter habitat carrying capacity indicate that the 1997 modeling made these over-estimations:

Fig. 1: Over-estimations of the earlier model.

Unit 1-A	**39%**	**Over-estimation**
Gravina Island	**38%[8]**	**Over-estimation**
Revillagigedo Island	**60%**	**Over-estimation**
Cleveland Peninsula	**34%**	**Over-estimation**

(See calculations in Fig. 2, next page.) But percentages don't tell the whole story. The Tongass Forest Plan has a standard and guideline of providing a deer habitat carrying capacity of at least 18 deer per square mile (where possible), in order to sustain both wolves and deer hunters. ADF&G has advocated the use of this standard and guideline (S&G), and the department played a major role in its adoption by the Forest Service. Note in Fig. 2 that according to the 1997 modeling that two major historic hunting areas for Ketchikan residents, the Cleveland Peninsula and Revillagigedo Island, scored above the S&G at 18.8 and 18.3 deer per square mile, respectively. However, according to the 2008 model for the current (2006) condition they scored well below the S&G at 13.6 and 11.7 deer per square mile. Moreover, Gravina Island was already below the S&G in 1995 at 13.0, but with the revised modeling (and when using ADF&G's recommended Gravina Island Deer Multiplier of 35) it was at 7.3 deer per square mile in 2006.

[6] Caouette, J.; Kramer, M.; & Nowacki, G. (2000). *Deconstructing the Timber Volume Paradigm in Management of the Tongass National Forest.* USDA Forest Service, Pacific Northwest Station. PNW-GTR-482. 20p. http://tongass-fpadjust.net/Documents/Caouette_eta_%202000_GTR482.pdf

[7] HSI is habitat suitability index, the non-dimensional output of the model that was mentioned in a previous footnote.

[8] **Corrected by our RC13, submitted at the board meeting.**

Fig. 2: Unit-1A Deer Model Carrying Capacities by WAA, for 1997 vs. 2008 models Edwards (23Dec12, for BoG comments)

WAA Location	WAA Number	1997 Model 1995 Carrying Capacity	2008 Model 2006 Carrying Capacity	Model Comparison 1995 Over-estimation	If Deer Mult. = 45 2006 Carrying Capacity	Land Area (sq-mi)	Land Area (sq-mi)	1997 Model Area Weighted Capacity	2008 Model Area Weighted Capacity	1997 Model Carrying Capacity	2008 Model Carrying Capacity	
Gravina	101	13	21	-38%	9.4	62.1	62	807	585	13.0	9.4	Gravina I.
Duke I.	303	19	18	3%	-	73.3	73	1393	1348	19.0	18.4	Duke I.
Revilla, east shore	404	22	12	86%	-	281.4		6191	3321			
Revilla, Thorne Arm to Behm	405	24	18	34%	-	83.4		2002	1495			
Revilla, Carroll Inlet	406	20	12	64%	-	194.6		3892	2374			
Revilla, George Inlet	407	13	15	-12%	-	64.2		835	953			Revilla Island
Revilla, Ketchikan	408	7	13	-46%	-	26.0	1,076	182	335	18.8	11.7	
Revilla, Clover to Francis	509	17	14	25%	-	105.6		1795	1431			
Revilla, Traitors to Bell I.	510	17	10	79%	-	237.1		4031	2252			
Revilla, Burroughs Bay	511	15	5	195%	-	83.3		1250	424			
Cleveland, Spacious Bay	612	20	18	13%	-	107.9		2158	1907			
Cleveland, Helm Bay	613	24	19	29%	-	71.0	358	1704	1321	18.3	13.6	Cleveland Pen.
Cleveland, Meyers Chuck	614	15	20	-24%	-	20.5		308	407			
Cleveland, base	715	15	8	92%	-	158.7		2381	1238			
Unuk River	716	3	4	-21%	-	523.8	524	1571	1980	3.0	3.8	
Chickamin & Walker Cove	717	8	4	79%	-	227.0	227	1816	1012	8.0	4.5	
Rudyerd Bay	719	4	4	-8%	-	311.9	312	1248	1354	4.0	4.3	Mainland
Smeaton Bay	821	15	9	67%	-	173.4	173	2601	1554	15.0	9.0	
Boca de Quadra	822	10	8	18%	-	608.9	609	6089	5170	10.0	8.5	
Unit 1-A total							3,414	42,251	30,460	12.4	8.9	UNIT-1A

Overall deer carrying capacity <u>over-estimations</u> of the 1997 model:

Unit-1A:	39%
Gravina Island:	38%
Revillagigedo Island:	60%
Cleveland Peninsula:	34%

Data Sources: 1997 model results from the 1997 TLMP FEIS, Table 3-112.
2008 model results and WAA land areas are from 2008 TLMP planning record document 0935 (0935.xls).

Accordingly, after assessing the improved modeling results it is unsurprising that the harvest of deer and the amount of hunter effort in Unit-1A have declined and that deer numbers are low, particularly after recent hard winters.

It is important to note that not all of the difference between the modeling of the 1995 and 2006 current conditions is due to corrections to the model. In that 11-year interim, second growth timber in clearcuts over about 25 years old entered the stem exclusion stage, which dropped their contribution to carrying capacity to essentially zero. Furthermore, the future stem exclusion condition of other second growth which was less than 25 years old in 2006 (or not yet created by clearcutting) is not reflected in Fig. 2.

The point here is that the deer modeling basis for the current deer population and harvest objectives that were set by the Board of Game in 2000 is no longer valid. An urgently needed action by the Board is to update those objectives. It is not valid to initiate a program of wolf intensive management on the basis of the outdated objectives. Moreover, if the Board acts contrary to wolves because prey is under-abundant for both wolves and meeting deer harvest objectives, we believe that is an indicator that listing the Alexander Archipelago wolf under the Endangered Species Act is warranted.

Attachment - 3

FINAL REPORT (RESEARCH)

State: Alaska

Cooperators: USDA Forest Service

Project No.: W-22-4, W-22-5, W-22-6 Project Title: Big Game Investigations

Job Title: Wolf-Deer-Habitat Relationships in Southeast Alaska

Job No.: 14.13R

Period Covered: 1 July 1984-30 June 1987

SUMMARY

Although originally scheduled to continue for 5 years, field work for this study was terminated after 2 years. Reasons for termination include limited progress on study objectives due to adverse weather; low densities of deer (Odocoileus hemionus sitkensis) and wolf (Canis lupis) populations; limited sightability of deer and wolves due to dense vegetation; budget shortfalls; and personnel reductions. Results presented here are based on relatively small sample sizes and should be considered preliminary.

The wolf population of Revillagigedo Island appears to be relatively stable, consisting of 35 to 50 wolves in 7 or 8 packs which occupy distinct territories. Additional single wolves or pairs that roam over several packs' territories may also occur. Although packs occasionally trespass on adjacent wolves' ranges, all such movements that were detected were relatively brief; at least 1 wolf was killed by other wolves while trespassing. One juvenile male dispersed from his natal pack and moved extensively before apparently establishing a bond with remnant members of another pack that had been reduced through hunting and trapping. Our data imply that vacant areas do not exist on the island and that food resources are limiting wolf numbers.

Although overall deer population densities are relatively low on Revillagigedo Island, wolves appear to be extremely efficient at locating areas where deer occur. While direct evidence of hunting patterns is limited, the distribution of relocations and results of scat analyses confirm that deer are the major food source for these wolves. Nevertheless, regional differences in diet occur on the island and other food sources such as beaver (Castor canadensis) and garbage are important for some packs. In addition, most wolves on the island appear to feed heavily on spawning salmon (Oncorhynchus spp.) in late summer and fall.

The availability of diverse food sources may enable wolves to sustain their numbers at higher levels than could be supported by deer alone. As a result, wolf predation on deer may, in turn, be increased. Nevertheless, any major reduction in deer numbers due to catastrophic winter conditions, or due to habitat alteration resulting from clear-cutting, could be expected to reduce wolf numbers or productivity.

Key words: Canis lupus, deer, food habits, habitat relationships, Odocoileus hemionus sitkensis, predator-prey, wolf.

CONTENTS

BACKGROUND

This study was initiated as a long-term investigation of interactions between wolves (Canis lupus), deer (Odocoileus hemionus sitkensis), and habitat in coastal Alaska. Of particular concern was the effect of habitat alteration, through forest management, on the spatial relationships of deer and wolves, and the influence of wolf predation on deer numbers. A previous report completed under this study (Smith et al. 1986a) reviewed pertinent literature and identified the major needs for accomplishing the study objective. Concurrent work in the Petersburg area (Smith et al. 1986b, in press) also contributed to our understanding of relationships in this study.

Unfortunately, present levels of both wolf and deer populations are too low to facilitate efficient progress on several key jobs under this study. The nature of the vegetation and climate, combined with limited accessibility of most of the study area, severely hampered attempts to capture wolves for telemetry and limited our ability to observe wolves or deer. Accordingly, it was decided to terminate this study at the end of the 2nd year.

STUDY OBJECTIVE

To determine the spatial and trophic relationships of wolves and deer in natural and altered habitats in Southeast Alaska.

JOB OBJECTIVES

1. To determine size, distribution, and stability of wolf packs.

2. To determine activity areas, hunting patterns, and deer-killing rates for specific packs.

3. To determine food habits of selected packs and of the overall wolf population.

4. To determine habitat composition of pack territories.[1]

5. To determine relative abundance of major prey species within selected pack territories.

6. To determine deer density relative to wolf pack territorial borders and habitat characteristics.

7. To monitor deer population trends in various habitat areas and wolf pack territories.

STUDY AREA

The study area consisted of Revillagigedo Island and the adjacent Cleveland Peninsula. Descriptions are provided in Smith et al. (1986a).

METHODS

Objective 1 - Size, Distribution, and Stability of Wolf Packs

Radiotelemetry was used to monitor wolf packs. Details of capture, handling, and monitoring techniques were presented in

[1] Due to the early termination of this project, no activities were undertaken on Objectives 4-7.

Smith et al. (1986a). However, to reduce the frequency of injury to captured wolves, foot traps were replaced with foot snares during the 1985-86 field season.

Objective 2 - Activity Areas, Hunting Patterns, and Deer-Kill Rates

Radiolocations of each collared wolf were plotted on the territory-minimum convex polygon to identify activity areas within the territory. Timing of relocations was used to interpret the significance of replicate relocations within 1 general area (i.e., use of potential den sites from late April through June).

Objective 3 - Food Habits

Wolf scats were collected on a regular basis from logging roads and trails within the range of the Town Pack and opportunistically along other logging roads, beaches, and trails on Revillagigedo Island and the adjacent mainland. In addition, den and rendezvous sites used by radio-collared wolves were visited in late summer and all scats present were collected. Scats were also collected from rendezvous sites discovered by T. Kogut, USDA Forest Service Biologist, on Prince of Wales and Dall Islands.

Attempts were made to collect scats from all parts of Revillagigedo Island. However, scats were not collected in equal proportions from various pack territories or in different seasons, and none of the collections are likely to constitute a true random sample of scats from any area. Accordingly, results of analyses should be considered as indicative of general trends, and comparisons between subsamples should be interpreted with caution.

Collected scats were individually bagged in plastic, labeled with location, date, and estimated date of deposition (for fresh scats) and then frozen. Prior to analysis, scats were oven-dried at 100 C for 24 hours to kill *Echinococcus* eggs. Scats were then weighed to the nearest gram, broken apart in a tray, and a visual estimate made of the percentage of the scat composed of various diet items (e.g., adult deer hair or bones, fawn hair, bird feathers, etc.). Hair and bone fragments were compared with a reference collection and, if necessary, hair-scale imprints were used (Adorjan and Kolenosky 1969).

Scats less than 2 cm in diameter, collected in summer, were considered pup scats. Samples from den and/or rendezvous sites were treated separately to compare diets for specific packs during early pup-rearing periods.

Two statistics were calculated for each scat subsample:

(1) Percent frequency of occurrence = number of times a diet item (e.g., deer hair) was found in the scat sample, divided by the total number of diet items found in the scats; and

(2) Mean diet items per scat = total number of diet items in subsample divided by the number of scats.

The 1st variable provides information on the relative importance of various prey types in the diet. The 2nd value is an index of variety in the diet (Kuyt 1972).

Scats were grouped into subsamples (minimum n = 20), based on the location of deposition, to provide estimates of diet composition for various wolf packs. Seasonal comparisons of summer (Apr-Sep) versus winter (Oct-Mar) diet were based on scats with known deposition dates.

RESULTS AND DISCUSSION

Objective 1 - Size, Distribution, and Stability of Wolf Packs

No additional wolves were captured and radio-collared during the 1985-86 season. On 2 occasions wolves were caught in neck snares, but managed to escape by chewing through the snare cable before we returned to check the snare. Wolf No. 2, a young male that was first captured on 13 February 1985, was recaptured and fitted with a new radio collar on 23 March 1986.

Results of radio tracking and observations of tracks supported the conclusion of Smith et al. (1986a) that a minimum of 7 wolf packs occur on Revillagigedo Island. The packs vary in size from 2 to at least 9 wolves and were found to use largely distinct territories (Fig. 1). Because pack movements were only monitored for 15 to 18 months, no firm conclusions regarding the pack's territorial stability could be made. However, some pack boundaries and use areas appeared to differ between 1985 and 1986. Descriptions of individual pack histories follow.

Town Pack:

Smith et al. (1986a) reported that this pack numbered 7 to 11 wolves in late 1984 and produced a litter of pups in 1985. During the 1985-86 winter at least 1 pack member was killed by other wolves in an apparent territorial dispute and 3 wolves were taken by a recreational trapper. At least 4-5 wolves remained in this pack subsequent to these losses, so the minimum pack size in late 1985 had to have been 8-9 wolves. Although we observed 2 members of this pack breeding in February 1986, we did not confirm the presence of pups in spring. At the end of the study this pack was estimated to consist of at least 5 wolves.

Three members of the Town Pack were radio-collared in February 1985 and subsequent relocations indicated this pack utilized a territory of approximately 150-200 km² including the drainages of the White River and Ward, Ketchikan, Mahoney, and Silvis Creeks. In December 1985 this pack made a brief incursion into the territory of the Naha River Pack near Clover Passage. During this time radio-collared wolf No. 3, a juvenile male, was killed by other wolves (presumably members of the Naha Pack). The lack of snow made it impossible to determine if other wolves were killed in this conflict. In January 1986, radio-collared wolf No. 5, an adult female, made a brief incursion into the territory of the East Chuck Pack.

Naha River Pack:

The Naha River Pack contained 6-8 wolves in late 1985. Two female pack members were taken by a local trapper in January 1986.

Reported sightings by local residents, as well as our observations, indicated this pack ranged over an area of approximately 450 km² including the drainages into Clover Passage, Mosier, Margarita, and Naha Bays, Traitors Cove, and Leask Creek (Fig. 1). No members of this pack were radio-collared, however, so actual pack boundaries were not established. The limited amount of sign observed along the beaches in this pack's territory indicates it spent much of its time inland along major lake and stream systems.

East Chuck Pack:

Smith et al. (1986a) indicated that this pack consisted of 3 to 5 wolves in 1984, including radio-collared wolf No. 2, a juvenile male. It was suspected that the pack produced pups in 1985. No direct observations of the East Chuck Pack were made prior to late November 1985; at that time, wolf No. 2 dispersed, but tracks in the snow indicated the pack still numbered about 5 wolves. Following No. 2's dispersal, contact with this pack was lost; however, 2 other members were subsequently caught by a local trapper in the vicinity of George Inlet, and tracks of more wolves were seen, indicating several pack members remained.

The 2 wolves that were trapped were an adult female and a male pup. Both trapped wolves were in extremely poor condition when caught and neither had any body-fat deposits. Although these wolves may have lost some weight while in the traps, their poor body condition suggests that wolves in this pack are food-stressed.

Wolf No. 2 was observed alone within the pack's territory several times in November 1985; he then left the territory in December. Initially, he moved to Rudyerd Island where he was observed to have killed a deer. After 2 weeks there he returned to his natal pack territory for 1 week, but was not observed with other wolves. He then moved west to Carlanna Lake in the Town Pack territory for 1 week, returned to his natal pack area, and finally moved east across Carroll Inlet and settled into the territory of the Carroll Inlet Pack.

Carroll Inlet Pack:

Smith et al. (1986a) reported that the Carroll Inlet Pack had been reduced through trapping and hunting in 1984 from 10, to 12, to as few as 2 wolves. Tracks observed on logging roads west of Thorne Arm in November 1985 indicated only 2 or 3 wolves were using the area at that time. Subsequently, wolf No. 2 moved into this territory and, based on tracks observed at the time he was recaptured, he joined up with 2 wolves; presumably these were the remnants of the Carroll Inlet Pack.

Although these 3 wolves were running together prior to the mating period in 1986, it is not known whether either of the Carroll Inlet Pack wolves were females which might have bred with wolf No. 2, or if this pack produced pups in 1986. From February through the end of June 1986, these wolves ranged over an area of approximately 160 km^2 (Fig. 2).

Alava Bay Pack:

Smith et al. (1986a) reported that the Alava Bay Pack consisted of 2-3 wolves, including radio-collared wolf No. 7, an adult male, in late winter 1984-85, and that there was evidence that the pack had produced pups in spring 1985. Several repeat observations of this pack in November and December 1985 confirmed that the pack had increased to a minimum of 9 wolves. Although the lack of snow at low elevations prevented tracking and hampered direct observation in 1986, at least 7 wolves remained in this pack in late February. It is not known whether additional pups were produced in spring 1986.

During late winter and spring 1985, Smith et al. (1986a) reported that this pack ranged over approximately 75-100 km^2 (Fig. 1). Summer movements of wolf No. 7 were also confined to this area, but beginning in fall, the pack began to heavily exploit what previously had appeared to be a buffer zone between its territory and that of the Lake Grace Pack.

In 1986, wolf No. 7 "disappeared" for several weeks but was eventually relocated 5 km northwest of his previous extreme movement. At that time he was apparently returning from an even longer extraterritorial excursion (Messier 1985). From late April until the end of the project he remained in the southern portion of the territory within 5-10 km of the 1985 den site.

Lake Grace Pack:

Smith et al. (1986a) reported that prior to birth of pups, this pack had declined from 6 or 7 in late 1984, to 3, including radio-collared wolf No. 6, an adult male. Observations in summer and early winter confirmed that at least 3 pups had been produced. No wolves from this pack were trapped or shot during the 1985-86 season and the pack remained at 6 wolves through March 1986.

Movements of wolf No. 6 in spring 1986 indicated the pack was using a den and probably had pups. However, no observations were obtained to confirm pack size at the end of the study. This pack ranged over a total of approximately 400-450 km^2 including Smeaton Island (Fig. 1). The pack moved onto Smeaton Island at least 3 times during the period in which it was monitored, including a 3-week stay in January and a 4-week stay in February-March 1986.

Northeast Pack:

Smith et al. (1986a) estimated that a total of 8 wolves occurred within this pack's territory in late 1984, although 2 of these were a distinct social group from the other 6. By June 1985, 1 member of each group had been radio-collared but each died of starvation soon after marking. One additional wolf may have been lost as a result of a trapping encounter (Smith et al. 1986a).

In September 1985, evidence was found that 4 to 6 wolves from this pack were feeding on spawning salmon (*Oncorhynchus* spp.) and beaver (*Castor canadensis*) in the vicinity of Portage Cove. Throughout the remainder of the 1985-86 field season, however, only 2 sets of single wolf tracks were observed along beaches and trails in this pack's territory. At present, the size of this pack is unknown.

Although the total area identified as being within the territory of this pack is 350-400 km^2, much of the northeastern half of this area is virtually devoid of deer, beaver, and salmon-spawning streams. We believe the area actually used by this pack is much smaller and is centered on the drainages of Portage Cove, Neets Bay, Shrimp Bay, Gedney Pass, and Behm

Canal west of Claude Point. The limited sign observed along beaches in 1986 indicates this pack must spend much of its time inland along major lake and stream systems.

Objective 2 - Activity Areas, Hunting Patterns, and Deer-Kill Rates

During late summer 1985, 2 of the 4 radio-collared packs centered their activities on major salmon spawning systems. The Town Pack was repeatedly relocated in the lower White River drainage from mid-August through early October. During that time, in excess of 120,000 salmon spawned and died in the White River (ADF&G, unpubl. data). The East Chuck Pack spent the same time period in the vicinity of 2 creeks draining into the salt chuck at the head of George Inlet. These streams each contained more than 10,000 pink and coho salmon.

On-the-ground observations in both areas used by these packs confirmed that wolves were catching spawning salmon and feeding extensively on the fish. In addition, fisheries personnel who were interviewed after stream surveys were completed reported evidence of wolves feeding on salmon along virtually every major spawning stream in the Behm Canal district. The Alava Bay Pack also made frequent visits to salmon spawning streams, but did not remain in 1 area as much as the Town or East Chuck Packs. This may reflect the relatively large number of small stream systems in the Alava Bay Pack territory, as opposed to the few large spawning streams in the other packs' ranges.

The Lake Grace Pack was the only pack that did not appear to use spawning salmon in summer. However, it made more extensive use of alpine and subalpine areas than other packs and also used a clear-cut valley that had been extensively colonized by beaver. The pack's use of high elevations was apparently associated with deer on alpine summer range.

The efficiency with which wolves located deer within their territories was demonstrated by the Lake Grace Pack. In several summers' flying along alpine ridges, we only observed deer in 2 locations within this pack's territory (Smith 1984, and unpubl. data), one of which was west of Mirror Lake. Five days after we first observed 13 deer on this ridge in early September 1985, the Lake Grace Pack was located on an apparent kill where these deer had been. The wolves remained in this area for 2 weeks, during which time we did not see deer again.

During the 1985-86 winter months, the Town Pack again made frequent use of the Ketchikan landfill as reported for the winter of 1984-85 (Smith et al. 1986a). However, the pack spent more time hunting other parts of its territory than in

1984-85. In addition, juvenile female wolf No. 4 was more frequently located apart from her mother, wolf No. 5, during this 2nd winter.

The Alava Bay Pack moved extensively throughout its territory in winter and did not concentrate its activities in any particular location. However, relocations were frequently made along stream courses where beaver dams and/or houses were evident, as well as in beach fringe areas or on points where deer densities were relatively higher.

The Lake Grace Pack was generally found during early- and mid-winter 1985-86 to be hunting relatively steep slopes along the major lakes within its range, near beaver colonies at the inlets to these lakes, or on Smeaton Island. In the latter area, the pack was apparently feeding on deer, as there is no evidence that beaver occur on this island.

In late winter of 1986, the Lake Grace Pack abandoned Smeaton Island and returned to hunting near beaver colonies at the head of Mirror Lake and along the Manzanita River. The pack also made several visits to low ridges in the southwest portion of its territory where deer tracks were occasionally observed in the snow.

In spring 1986 the Lake Grace Pack appeared to settle into a den site in the lower Manzanita River drainage. The area was similar to its 1985 den site, consisting of a stand of mature spruce trees in the vicinity of a large complex of beaver dams.

The lack of snow at most elevations used by wolves during the majority of the winter of 1985-86, combined with dense vegetation, prevented our gathering further data on hunting patterns or deer-killing rates. However, given an average pack size of 5-7 wolves, and each wolf's ability to consume 5-10 kg of deer following a kill (Mech 1970:118), the packs studied here could easily consume an entire deer (average live weight: 35-45 kg [ADF&G unpubl. data]) within hours. Thus, even under ideal conditions it is unlikely that wolves would often be found on a kill.

Objective 3 - Food Habits

A total of 511 scats containing 594 diet items from 13 different food sources was collected during this study (Table 1). Deposition date could accurately be determined for 271 of these scats. For the overall sample during summer, wolves fed predominantly on deer, including a high proportion of fawns. Beaver also constituted a major proportion of the summer diet (Table 1). For the Revillagigedo Island summer subsample (*n* = 196) the same general pattern prevails (Table 2).

Numerous other studies report a similar high proportion of deer fawns, or other young ungulates, in summer wolf scats (Murie 1944, Mech 1966, Pimlott et al. 1969, Carbyn 1974, Peterson 1974, Voight et al. 1976, Scott and Shackelton 1980, Hatter 1984). In fact, Hatter (1984) concluded that on Vancouver Island, black-tailed deer fawns were the major prey item for wolves from June through August. The ratio of fawn:adult remains in scats analyzed by Hatter was almost identical to the ratios from Southeast Alaska and Revillagigedo Island samples (Tables 1 & 2), so fawns may be more important than adults in the summer diet here as well.

Although many other studies report the use of beaver by wolves (Murie 1944, Mech 1966, 1970; Peterson 1974, Carbyn 1974, Theberge et al. 1978, Scott and Shackelton 1980, Hatter 1984) few have indicated use as high as found here. Those studies that do indicate levels of use of beaver, in summer, of over 20% frequency of occurrence (Pimlott et al. 1969, Frenzel 1974, Voight et al. 1976) were generally conducted in areas with very low deer populations.

As previously discussed, wolves were known to be feeding extensively on salmon during late summer, but this use was not reflected in scats. Two potential sources of bias may have caused this. First, only scats that could positively be identified as wolf scats were collected, so amorphous scats, which were found along stream banks and composed entirely of fish remains, were rejected, as they might possibly have been from bears. Second, observations and telemetry indicated that although the wolves came down to the streams to catch and feed on the salmon, they usually moved away from the stream to bed down. This movement may have been designed to avoid contact with bears and would have resulted in the wolves' defecating away from the stream banks where we searched for scats.

The winter diet of wolves in Southeast Alaska in general and Revillagigedo Island in particular, was also dominated by deer (Tables 1 and 2). However, beaver continued to represent approximately 20%, and other sources accounted for about 10% of the diet items.

Throughout much of the range of wolves in North America beavers are unavailable in winter (Mech 1970) and only Scott and Shackelton (1980) reported significant use of beaver in winter. The availability of beavers year-round in coastal regions provides an important supplement to the wolf diet and may increase wolves' ability to regulate deer populations (Van Ballenberghe and Hanley 1982).

Comparison of the diets of 5 wolf packs on Revillagigedo Island reflects regional variation (Table 3). Wolves in the Alava Bay and East Chuck Packs consumed approximately 90%

deer, whereas wolves in the Naha and Northeast Packs consumed only about 65% deer, and the Town Pack wolves, only 55% deer. Beaver constituted one-third of the diet for the Naha and Northeast Packs, and the Town Pack fed heavily on garbage from the Ketchikan landfill. The variation in diet reflects deer population density and availability of alternative food sources.

Similar patterns are reflected in scats collected from summer-use sites on Revillagigedo, Prince of Wales, and Dall Islands (Table 4). Scats from wolves on southern Revillagigedo (Alava Bay Pack) as well as on Prince of Wales and Dall Islands, where deer densities are relatively high, contained 93-96% deer, much of which was fawn hair. Scats from the Town and Lake Grace Packs' areas revealed that deer constituted less than half the diet in summer. The former pack used human garbage, and the latter pack, beaver, in nearly equal proportions to deer in the summer. These trends reflect the fact that the Town Pack's den was located near the Ketchikan landfill and that the Lake Grace Pack's den was near an area of extensive beaver colonies.

The mean number of prey items per scat ranged from 1.0 to 1.5 for various subsamples (Table 5). Comparisons between summer and winter diets of wolves on Revillagigedo Island indicate a more varied diet in summer (Table 5). It would seem logical to find a more varied diet in summer, when fish, small mammals, and birds are more available, than in winter, and to find a more varied diet where deer are less available. Comparisons between the sampled packs' diets revealed that the Town Pack had a more varied diet than any other group, both in summer and overall (Table 5). This variation was largely due to the availability of human garbage as a supplement to the usual prey items.

Scott and Shackelton (1980) reported finding only 1 prey item per scat in Vancouver Island wolf feces, but Murie (1944) found more than 1 prey item per scat in feces from wolves in interior Alaska when wolves were preying on rodents in addition to ungulates. Kuyt (1972) reported highly varied spring and summer diets for tundra wolves, particularly during periods when the primary prey species, caribou (Rangifer tarandus), was less available.

The significance, for wolves, of dietary variation, has not been assessed, but the availability of alternative sources such as beaver, salmon, and garbage should reduce this predator's dependence on deer. When other food resources are available, wolves may be able to sustain themselves with relatively low deer-killing rates, despite the small size of Sitka black-tailed deer.

CONCLUSION

Although results of this study are limited, they generally support the concepts and concerns advanced by Van Ballenberghe and Hanley (1982). Specifically, we determined that while wolves prey mainly on deer, other sources of food such as beaver, salmon, and human garbage supplement the diet and enable wolves to persist in relatively stable numbers despite low deer densities. Nevertheless, a wolf pack's territory size and the number of pack members appeared to be related to deer population density, so further declines in deer numbers or productivity due to climate or habitat alteration will probably result in fewer wolves as well.

Wolves were found to be efficient at finding localized areas with relatively high deer numbers, and packs could be expected to take advantage of artificial concentrations of deer in habitat patches created through forest management. Accordingly, timber harvests should be designed so as to minimize formation of small "islands" of old growth and to assure mobility of deer between areas as suggested by Harris (1984).

ACKNOWLEDGMENTS

Many members of the Game Division staff in Region I contributed to the development and implementation of this project. Gerry Downy contributed substantially to the wolf capture effort and his local knowledge of wolf movements was helpful in mapping pack distributions. Dick Hamlin, Jim Jakubek, and Dan Hassell piloted survey and telemetry flights with skill and keen interest in the project which made flying in the frequently poor weather conditions both safe and enjoyable. Greg Clevenger of the USDA Forest Service arranged cooperative funding and was highly supportive of the project. Skipper Ron Rusher and Assistant Boat Officer Kevin Perry of the R/V Sundance provided logistical support for the project; their help is greatly appreciated.

LITERATURE CITED

Adorjan, A. S., and G. B. Kolenosky. 1969. A manual for the identification of hair of Ontario mammals. Ont. Dep. Lands and Forest Res. Rep. (Wildl.) No. 90.

Carbyn, L. N. 1974. Wolf predation and behavioral interactions with elk and other ungulates in an area of high prey diversity. Can. Wildl. Serv. Ottawa, Ont. 238pp.

Frenzel, L. D. 1974. Occurrence of moose in food of wolves, as revealed by scat analyses: A review of North American studies. Nat. Can. 101:467-479.

Harris, L. D. 1984. The fragmented forest. Univ. of Chicago Press, Chicago, Ill. 211pp.

Hatter, I. D. 1984. Effects of wolf predation on recruitment of black-tailed deer on northeastern Vancouver Island. M.Sc. Thesis. Univ. of Idaho. 156pp.

Kuyt, E. 1972. Food habits and ecology of wolves on barren-ground caribou range in the Northwest Territories. Can. Wildl. Serv. Rep. Ser. No. 21. 34pp.

Mech, L. D. 1966. The wolves of Isle Royale. U.S. Natl. Park Serv. Fauna. Ser. No. 7. 210pp.

__________ . 1970. The wolf: Ecology and behavior of an endangered species. Nat. Hist. Press. Garden City, N.Y. 384pp.

Messier, F. 1985. Solitary living and extraterritorial movements of wolves in relation to social status and prey abundance. Can. J. Zool. 63:239-245.

Murie, A. 1944. The wolves of Mount McKinley. U.S. Natl. Park Serv. Fauna Ser. No. 5. 238pp.

Peterson, R. O. 1974. Wolf ecology and prey relationships on Isle Royale. Ph.D. Thesis. Purdue Univ., West Lafayette, Ill.

Pimlott, D. H., J. A. Shannon, and G. B. Kolenosky. 1969. The ecology of the timber wolf in Algonquin Park, Ont. Dep. Lands and For. Res. Rep. (Wildl.) No. 87. 92pp.

Scott, B. M. V., and D. M. Shackelton. 1980. Food habits of two Vancouver Island wolf packs: A preliminary study. Can. J. Zool. 58:1203-1207.

Smith, C. A. 1984. Potential of Revillagigedo Island for a goat transplant. Alaska Dep. Fish and Game. Final Rep. Fed. Aid in Wildl. Rest. Proj. W-22-2. Job 12.6R. Juneau. 29pp.

__________ , R. E. Wood., L. Beier, and K. P. Bovee. 1986a. Wolf-deer-habitat relationships in Southeast Alaska. Alaska Dep. Fish and Game. Prog. Rep. Fed. Aid in Wildl. Rest. Proj. W-22-4. Job 14.13. Juneau. 20pp.

__________, E. L. Young, C. R. Land, and K. P. Bovee. 1986b. Effects of predation on black-tailed deer population growth. Alaska Dep. Fish and Game. Prog. Rep. Fed. Aid in Wildl. Rest. Proj. W-22-4. Job 14.14. Juneau. 24pp.

__________, __________, __________, and __________. In press. Effects of predation on black-tailed deer population growth. Alaska Dep. Fish and Game. Final Rep. Fed. Aid in Wildl. Rest. Proj. W-22-4. Job 14.14. Juneau. 1986.

Theberge, J. G., S. M. Oosenbrug, and D. H. Pimlott. 1978. Site and seasonal variations in food of wolves, Algonquin Park, Ontario. Can. Field-Nat. 92:91-94.

VanBallenberghe, V., and T. A. Hanley. 1982. Predation on deer in relation to old-growth forest management in southeastern Alaska. Pages 291-296 in R. Meehan, T. R. Merrell, Jr., and T. A. Hanley, tech. eds. Proc. Symp. Fish and Wildl. Rel. in Old-growth Forests. Am. Inst. Fish. Res. Biol., Wash. D.C.

Voight, D. R., G. B. Kolenosky, and D. H. Pimlott. 1976. Changes in summer food habits of wolves in central Ontario. J. Wildl. Manage. 40:663-668.

PREPARED BY:

Christian A. Smith
Game Biologist IV

SUBMITTED BY:
David A. Anderson
Management Coordinator

APPROVED BY:

W. Lewis Pamplin/kt
W. Lewis Pamplin
Director, Game Division

Steven R. Peterson
Chief of Research, Game Division

Table 2. Percent frequency of occurrence of items in the diet from summer (Apr-Sept) and winter (Oct-Mar), and from total scats collected from wolves on Revillagigedo Island, Alaska, 1984-86.

Diet item	Season		
	Summer[a]	Winter[b]	Total[c]
Adult deer	42.5	71.2	55.6
Fawn deer	30.3	--	18.7
Total deer	72.8	71.2	74.3
Beaver	24.0	19.7	20.1
Bird	0.9	1.5	1.1
Wolf	0.4	1.6	0.8
Garbage	0.4	1.5	1.1
Fish	0.9	1.5	0.6
Toad	0.9	3.9	0.6
Unidentified bones	0.4	0.9	0.8
Black bear	0.9	0.9	0.6

[a] n = 196 scats, 221 items.

[b] n = 64 scats, 66 items.

[c] n = 329 scats, 363 items.