March 1,2013

Alaska Boatd of Game
c/o ADF8G, Boards Support Section
by FAX: 907-465-6094
Subj: Comments on Proposads 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 puppose 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 $179 \mathrm{fa}-\mathrm{A}$, and substitute and approve the following:

The Department of Fish 88 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 goveroment, 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 Also, the proposal is not cost effective and is likely to be generally ineffective. Reasons for these conclusions axe 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 ati opportunity for ADF\&G to evaluate the alternative program we identify at the end of these comments.

[^0]Part (2) of the proposed substitute language is necessary to help ensure that the state's game, wildife 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 "onevoice" 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 expext 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 hatitat 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, implernenting 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 teal "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 caiteria 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 "recuced 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 "Intens/ve 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 Platn are neither.
i. On $p .16$, the Operational Plan presents Thresholds for continuing or suspending wolf control, including categories of deer abundance and wolf abutndance. 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 progtam. This threshold instead establishes ADF6G 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 thake 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 (Jamuary 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 Froposals 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 increaze deer densities in Southeast Alaska.

Wolf control efforts in the 1980s in Southeast Alaska were found. to be expensive, time consumptiva, and ineffective.
(Intensive Management Population Identification Worksheet, at 2, 8 and 10, emph. added. Provided as Attachmenat 1 1). ${ }^{2}$ From October to the present, ADF\&G has not presented any

[^1]documents to the public or the board that discuss these fitadings 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 walf control program will be inordinately expexsive (as we already know) and ineffective.
3. The deer population and harvest objectives were set much too high because of: (1) faulty modeling
the objectlves were based on, and (2) unusually high harvest in immediate preating the objectives were based on, and (2) unusually high harvest in immediately preceding years.

As discussed it 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 hatvest 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 peals 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,


Larry Edwards
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907.747.7557

## Intensive Management Population Identification Worksheet

## Species: Deet

Populatlon: Unit IA

## Es rief description of the population:

This deer population inhabits the mainland and near-shore islands in Unit IA. Densities have generally been highest on the lower Cleveland Peninsula and Gravina Island. Densities are Lowest on the mainland east of Ketohikan where very limited deer huxting ocours. Buok-only haryests, with a 4 -buck limit, have beon in effect in the unit fon the past 20 years.

## Criterion \#t - Haryest:

a. Maximun avergge harvest fox any 3 consecutjve years: 788 durimg 1994~1996.
b. Estimated averago harvest for 1991-1996: 652

Griterton $\mathrm{H}_{2}$ - Accessibility:
Most access is by beat, some by floatplane. Highway vehicles are used to access areas on the limited Ketchlkat road system, and 3- and 4-wheelers are used ocenstonally to access areas associated with remote logging roads. Boat nai aiplane access is extremely weatherudependent.

Criterion \#3: - Usa for meat:
Alaska residents, primarily those residing within the Ketchikan Gateway Boxough, use this popuiation of doer primatily formeat and tecteation.

Criterlon \#4 - Hunker demand:
a. Estimated or reported hunter effott: During 1991-1995, hunters spent a seasonal average of 4,534 days hunting deer. Effort data was not collented during 1996.
b. Number of applicants for permit hunts, if applicable: NA
c. Other indicators of demand; None

Is thits populaton mportant for providing high levels of human consumptive use?

Department Recommendation:
$\qquad$
No:

Boand of Game Action:
Yes: X
No:

# Intensive Management Objective Worksheet 

Species: Deer Population: Unit 1 A

(1) Effects of weather, habitat capability, diseases and parasites: Diseases and parasites appear to have negligible impact on deer populations in Unit 1 A. Severs winter weather causes periodic declimes in the deer population, ospecially in areas where clear-cut logging has removed old-growth forests. Among other deleterious effects, the removal of the old-growth canopy allows snow accurnilation on the ground above "notmal" levels, limiting the value of critical habitat to support overwintering deer populations.
(2) Maintenance of viable predator populations: Brown bear predation on deer is apparently negigible. We believe that black bear predation on deer is significant where they ocour 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 notimpottant for maintaining those 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 thay compete for limited food resources in some limited situations. However, for curxent deer and goat population levels in Unit 1A, there appears to be no direct cortelation in terms of population densities.
(4) Effects on subsistence aserr: The islands and the Cleveland Peninsula portion of Unit 1 A are in the Ketchikan Nonsubsistence Area, and make up most of the quality deer habitat in the Unit. Subsistence use of deer in Unit lA depends largely on deer abundance. As deer numbers increase following mild winters, hunter effort increases proportionately, Deer meat provides a considerable anount of the red meat for consumption by Unit lA residents, as the only other available ungulates ate 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 Alask.. "The ADF\&G needs to contitnue 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.a administyative and/or mediärical road closures after logeing 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 $1 A$ is under federal jurisdiction of the Tongass National Forest. In addition, a portion of the mainland is designated as the Misty Fjords National Monurnent 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 | $\vdots$ |
| :--- | :--- |
| Harvest | $\quad 14781_{m}^{\prime}$ |

Current management objectives for IJnit 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:


# Intensive Management Population Identification Worksheet 

Species: Deer Name of the Population: Urit 1 C
Brief description of the population:
Deer ate found throughout Woit 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 gnowpack and the presence of wolves.

## Criterion \#1 * Haryest:

a. Maximum average harvest for any 3 consecutive years; 583
b. Estimated average harvest fot 1991-1997:467

## Criterian ${ }^{*} 2$ - Accessibility:

Portions of the Unit lC mainland and Douglas Island are aceessible by highway vehiole. Hunters also use boats to access the south and wettern sides of Thauglas [sland, as well as shelter and Lincoln Islands.

Criterion ${ }^{4} 3$ - Use for meat:
Considering the limited opportunities available for haryesting moose in Uoyt 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 hanter effort From 1991-1995 the average number of hunters/year was 939, and theso hunters combined for 3,324 hunter days. 1996 and 1997 data is only available for successful hunters, and therefore not included in the above ayerage.
b. Number of applicants for permit hunts, if applicable: NA
c. Other indicators of demand: The deer henter survey indicates hunters pursue deer throughout the $3 \mathrm{~m} / 2$ month season in Unit 10 .

Ls this population important for providing high levels of humn consumptive use?

Department Recomumendation:


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, especkally deep and persistent snow, is a critical factor in regulating deer numbers. Deap snow hinders foraging ability of deer by limiting mobility, increasing energy expenditure, and by concentratting deer at lower elevations which increases intraspecifio competition. Altitude, aspect, and browse species ayailability can severely limit habitat quality and quantity, and. high deer densities result in starvation or increased susceptibility to predation caused by the poor autritional state of the animals (Olson, 1979). Unit 1 C 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 fonest 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 ate virtually absent. We believe that black bear predation on deer is significant where bearg oocut 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 maintainiog these populations. Changes in human harvest objectives would most hkely 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 platuing to maintain darge tracts of mature forest is the only way of sustaining a viable deer: population. Othar 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 sititations. However, for curreint deer and goat population levels in Unit 1 C , there appears to be no direct cortelation 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 1 C residents, with möose änd nountain goats suppietnentitug dear 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 attermpts 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 ate key to the well being of the deer herd. Retention of oritical 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 ablity 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 accesibility to harvest: Island deer tabititat in Unit 1C is easily accessible from the state's thitd largest city by road system, trails, and boat. Away from mainland roads and trails accesa 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 $\quad 6240$
Haryest . 450


## Board Action:

Objectives:

1. Population: $\qquad$
2. Harvest: $\qquad$

# Intensive Management Population Identification Worksheet 

Species: Deer
Population: Unit 2

## Brief deseription of the population:

This deer population inhabity Prince of Wates and adjacent islands, Densities have fluctuated historically. primarily in response to winter weather conditions, although predation by woives and black bears contributes to annual mortality. Deer art known to travel between islands, as ate their predators.

## Criterion \#l $-\mathrm{Hax}^{\boldsymbol{\gamma}} \mathrm{C}$ est:

a. Maximum average harvest for Rny 3 consecutive years: 2,970 during 1993-1995.
b. Estimated average harvest for 1991-1956: 2,831

Criterion \#2: - Accessibillty:
Most hunters access deer with lighoway and offrioad vehioles on the extensive road system fount on central to homthern 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 forment:
Primarily Alagka rebidents regiding on Prime of Walas Island use thith deer population for meat and recteation. Several Ketchikan residents travel to Unit 2 each season to hunt dear for meat and recreation as well,

## Criterion \#4 - Kimater demend:

a. Estimated or repoted hunter effort: During 1991-1995, hunters spent a seasonal average of 12,242 days hurting deer in Unit 2. Effort data was not collected during 396 ,
b. Number of applicants for permit hunts, if applicable: NA
c. Other indioators of demand: None

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

Departhent Recommendation:

$$
Y \operatorname{Yes}, \quad X
$$

No:

Board of Game Action:
Yes: $\quad \mathrm{X}$
No:

# Intensive Management Objective Worksheet 

Species; Deer<br>Population: Unit 2

(1) Effects of weather, habitat capability, diseases and parasites: Diseases and paresites appear to have negigible impact on deer populations in Unit 2. Severe winter weather causes periodic deolines in the deer population, especially ity 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" lovels, limiting the value of critical habitat to support overwintering 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 injlocal areas, We believe that black bear predation on deer is significant where bears oceur in high densities. Anecdotal cvidence supports the idea that scavenging of deer carcasses by marten and bald eagles may provide periodic food resources, but is probably not important for malntaining 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 wogulate populations in Unit 2 that deer compete with, although marten exist in the untit 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 ant 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, lititle can be done to increase deer densities in Southeast Alaska. The $\mathrm{ADF} \dot{\mathrm{B}} \mathrm{G}$ needs to continue working with the US Forest Service and private londowners in an effort to maintain quality habitat. Where logging occurs it is imperative that proliferating human access be minimized by strict attention to road placoment, administrative and/or mechanical road closures after logging, and reguations that ensure wiable deer populations. Wolf control efforts in the 1980 sin Southeast Alaska wore found to be - expenive, time consumptive, and deffectue.
(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 priyate 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 beets in effect. State regulations were adopted by the Alaska Board of Gary and applied to all lands in Unit 2, In recent yeats there has been a federal doe season in Unit 2 that is only open to federally qualified subsistence hunters (rural residents of Units $1 \mathrm{~A}, 2$, and 3).

## Departonent Recommended Objectives:

Population
Harvest $71248=$
2728.

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

## Board Action:

Objectives:

> ives: 1. Population: $\frac{71,00 c}{2 . \text { Harvest: }} 77000$

# Intensive Management Objective Worksheet 

Species: Deer

Population: Unit 3
(1) Effects of weather, habitat capability, disenses and parasites: Disenses and parasites appear to have negligible impact on deer populations in Unit 3. Severe winter weather causes perdodic declines in the deer population, especially in areas where clear-cut logging has removed oldngrowth forests, Atnong other deleterious effects, the removal of the oldngrowth canopy allows snow accumulation on the ground above "nomal" levels, limuting the value of critical habitat to support overwintering deer populations.
(2) Maintenance of viable predator populations: Wolfpopulations 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 wnit.
(3) Maintenance of habltat 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 deet in Unit 3 depends largely on deer abundance. As deer numbers increase following mild wintets, huater effort increases proportionately. Deer meat provides a large proportion of the red meat for consumption by Unit 3 residents, although there is significent use of moose and black. bears.
(5) Cost, feasibility, and potential effectiveness of possible management actions: Protecting old-growth forestr and treating second growth clear cuts can maintain existing deet densities in Southeest Alaska. The ADF\&G needs to continue working with the US Fotest 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 vieble deer populations. Wolf control efforts in the 1980 in Southeast Alaska were found to be erperasive, time consumptive, and ingeffective.
(6) Land ownership patterns within the range of the population: Most deer habitat in Unit 3 is under federal jurisdiction of the Tongess National Forest, although a ptivate 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
Harvest

14868
852
Current management objectives for Unit 3 deer are to: Increase populations on deer winter range ( $<1,500$ ft elevation) to 32 deer $/ \mathrm{mi}^{2}$, measured by a mean pellet density of 1.0 pellet group $/ 20 \mathrm{~m}^{2}$ plot.

## Board Action:

Objectives:

$7-0$

## Attachment - 2

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

# - Greater SE Alaska Conservation Community * Alaska Wildife Alliance * <br> - Tongass Conservation Society * Greenpeace - Center for Biological Diversity 

Alaska Board of Game
c/o ADFFig, Boards Support Section
by FAX: 907-465-4094
Subj: Unit 3: Comments on "Feasibility Assessment ... Black-tailed deer"

## III. The Deer Objectives Are Outdated and Therefore Do Not Support WoIf 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 ware determined.

The current deer population athd 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 Boart 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 ${ }^{2}$ 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 Gaune set the Unit-3 objectives.
(2) In 2008 the Forest Service made a further correction to use of the Deer Multipliet. ${ }^{4}$ From 1997 through 2007 the scale for the non-timensional 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 ifncorrect and results in a $30 \%$ overestimation 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 Plati. The new dataset "results in an overall reduction in average HSI ${ }^{5}$ 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 mon-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.?

[^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-astimations of the earlier model.

| Unit 3 (overall) | $20 \%$ | Over-estimation |
| :--- | :---: | :---: |
| "Treatment Area" | $12 \%$ | Over-estimation |
| Western Kupreanof Isl. | $11 \%$ | Over-estimation |
| Kuiu Island | $\mathbf{1 6 \%}$ | Over-estimation |
| Wrangell-Etolin-Zarembo, <br> etc. | $\mathbf{4 2 \%}$ | 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 S86G 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 curtent 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 velid 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 exough that habitat availability is not a factor.
"Unit 3 deer are at such low density that populations are not currently limited by the availabillity 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 1 l- year interim. The model estimates that canopy closure occuts in 25 -year old second-growth, at which point the winter habitat velue drops to near zero, and somo stands reached that age during the interim between this two model runs.
Fig. 2: Unil-3 Deer Model Carrying Capacities by WAA, for 1997 vs. 2008 models
Edwards (2rDect2, for BoG cornments)

|  |  | 1997. <br> Mode! | 2008 <br> MadeJ | Model Gomparison |  |  | 1997 <br> Mode: | 2008 <br> Moclei | 1997 <br> Hodel | $2008$ Mortel |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| WAA Location | WAA Qumber | 1995 <br> Carrying <br> Caparify | 2006 <br> Carning <br> Capacity | 1995 Over-estimation | Land Area ( $s q-m i\}$ | Land Area (sq-mi) | AreaWeigbled Capaciy | AreaWeighted Capacity. | Garrying Capacity | Carrying Capacity |  |
| N Etolin Island | 1901 | 23 | 16.0 | $44 \%$ | 207.2 |  | 4766 | 3315 |  |  |  |
| Deer Island | 1902 | 25 | 16.2 | 54\% | 14.9 |  | 373 | 241 |  |  |  |
| Wrangell island | 1903 | 18 | 12.2 | 48\% | 176.9 | 774.5 | 3184 | 2158 | 21.5 | 15.2 | Wrangell $/$ |
| Stikine isiands | 1904 | 25 | 16.7 | 50\% | 36.2 | 77.5 | 905 | 605 |  |  | Etolin Area |
| Zarembo ksland | 1905 | 19 | 14.8 | 28\% | 180.9 |  | 3437 | 2677 |  |  |  |
| S. Etolin Island | 1910 | 25 | 17.3 | 45\% | 158.4 |  | 3960 | 2740 |  |  |  |
| Mifkof Island | 2007 | 17 | 14.3 | 13\% | 170.2 |  | 2893 | 2434 |  |  |  |
| Wrewodski 1sland | 2008 | 50 | 26.6 | 88\% | 16.6 |  | 830 | 442 |  |  | "Treat- |
| Bohemia | 5135 | 12 | 13.2 | $-9 \%$ | 56.6 | 542.5 | 1039 | 1143 | 17.0 | 15.4 | ment ${ }^{\text {ax }}$ |
| Mission Peaks / Scott Peak | 5136 | 20 | 13.7 | 46\% | 93.6 |  | 1872 | 1282 |  |  | Area |
| Petersburg Creek | 5137 | 19 | 16.0 | $19 \%$ | 79.0 |  | 1501 | 12 E 4 |  |  |  |
| Lindenberg Peninsula | 5138 | 11 | $\uparrow 7.1$ | -36\% | 95.5 |  | 1062 | 1650 |  |  |  |
| wi. Kupreanof Island | 5130 | 26 | 19.1 | 36\% | 144.5 |  | 3757 | 2760 |  |  |  |
| S. of Kake | 5131 | 19 | 17.10 | 12\% | 109.8 |  | 2086 | 1867 |  |  | West |
| Kake | 5232 |  | 14.7 | -52\% | 57.9 | 639.3 | 405 | 851 | 19.5 | 17.6 | Kupreariof |
| Westside Duncan Cana! | 5133 | 18 | 16.6 | 8\% | 168.3 |  | 3029 | 2794 |  |  | Istand |
| SW Kupreanof Island | 5134 | 28 | 18.8 | 6\% | 158.8 |  | 3176 | 2985 |  |  |  |
| Nud Kuilu Island | 5012 | 27 | 20.9 | 29\% | 225.8 |  | 6097 | 4719 |  |  |  |
| Bay of PillarsfPort Camden | 5013 | 29 | 23.8 | 22\% | 99.0 |  | 2871 | 2356 |  |  |  |
| E. Kuiu | 5014 | 36 | 29.1 | 24\% | 62.5 | 765.5 | 2250 | 1813 | 28.5 | 24.5 | Kuiu |
| Tebenkof Bay | 5016 | 36 | 30.2 | $19 \%$ | 108.4 |  | 3502 | 3274 |  |  | Island |
| Aflak 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\% | $29 . \mathrm{B}$ | 29.8 |  |  | 51.0 | 20.6 | Coronation |
| UWIT-3 TOTAL |  |  |  |  |  | 2751.7 | 60081.5 | 49983.9 | 21.8 | \$18.2 |  |
| Overall deer carrying capacity over-estimations of the 1997 model: |  |  |  |  |  |  | . |  |  |  |  |
|  | Wrangell Etolin Are |  |  | 42\% |  |  |  |  |  |  |  |
|  | "Treatment Area" |  |  | 12\% |  |  |  |  |  |  |  |
|  | West Kupreanof |  |  | 11\% |  |  |  |  |  |  |  |
|  | Kuiu lstand . |  |  | 16\% |  |  |  |  |  |  |  |
|  | Coronation Is land |  |  | $188 \%$20\% |  |  |  |  |  |  |  |
|  | ALL OF UNIT-3: $20 \%$ |  |  |  |  |  |  |  |  |  |  |

Data Sources: 1997 model results are from the 1997 TLMP FEAS, Table 3-112.
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 reffect 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, sacond 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 dear 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).


#### Abstract

"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 abillty of the habitat in Unit 3 to support deer will decllne, 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 dear 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 2, 2).

The message here is clear that ADF\& 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 detemined 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 xole 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 primatily on the food aspect. What winter mortality studies have beet done on deer in the area, for example looking at bone marrow, and hat 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 perbaps indicate a rapid up-trend coming in the deer population? The harvest estimates (to the extent they cat 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 2.7 x 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 exadication would occur, have acre-fot-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 duxing that period. The acre-for-acre production of the two islatnds appears to be catching back up quickly. This is shown in our Figure 3, which applies data from Assessment Tables 6, 785 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 thete is a decline. During the buildup 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 tole in creating the current situation of low population and low harvests.

[^3]
## Attachment - 3

FINAL REPORT (RESEARCH)

| State: | Alaska |  |
| :---: | :---: | :---: |
| Cooperators: | USDA Forest Servige |  |
| Frojeet No.; | $\frac{W-22-4}{W-242-5}$ Froject Title: | Big_Game Investigations |
|  | W-22-6 Job Title: | Wolf-Deer-Habitat |
| Job No.: | 14.13R | Relationships in |
|  | 14.13R | Southeast Alaska |
| Period Covered: 1 July 1984-30 June 1987 |  |  |

## SUMMARY

Although originaliy scheduled to continue for 5 years, field work for this stugy was terminated after 2 years, Ressons for termination include limited progress on study objectives due to adverse weather; low densities of deer (Odocoilaus hemtonde sitkensis) and wolf (Canis lupis) populations; limited eightabilitty of deer and wolves due to dense vegetation; budget shortfalla; and personnel reductions: Results pregented here are based on relatively small sample sizes and should be considered preliminary.

The wolf population of Revillagigedo Island appeaxs to be relatively atable, consisting of 35 to 50 wolves in 7 or 8 packs which occupy distinct territories. Adaitional bingle wolves or pairs that roam over geveral packs' terintories may also ofcur, Although packs occasionally trespass on adjacent wolves' ranges, all such movemente 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 remmant members of another pack that had been reduced through hunting and trapping. Our data imply that vacant areas do not exist on the ishand and that food rem sources are limiting wolf numbers.

Although overall deer population densities are relatively low on Reyillagigado Tgland, wolves appear to be extromely efficient at locating areas where deer occur. while direct evidence of hunting patterns is limited, the distribution of relocations and results of scat axalyses contim that deer are the major food source for these wolves. Nevartheless, regional differences in diet occur on the ishand 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 fead heavily on epawning saimon foncorhynchus spp,l in late summer and fall.

The avallabilaty of diverse zood sources may enable wolves to sustain their numbers at higher levels than could be supported by deer alone. Az a result, wolf predation on deer may, in turn, be inoreased. Neverthelesa, any major reduction in deer numbers due to oatastrophic winter conditions, or due to habitat alteration resulting from olearmoutting, could be expected to reduce wolf numbers or productivity.

Key worda; Canis lupus, deer, food habita, häbitat relationw ships. odocoileus hemiomut siturensis, predatormprey, wolf.

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## BACKGROUND

This study was initiated as a loxg-term investigation of interactions between wolves (Canis lupus), deer (Odocoileus hemionus sitiensis), and habitat in coastal alaska. of particular boncern was the affect 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 a1. 1996a) reviewed pertinent literatura and identified the majow rieeds for accomplishing the study objective, Concurrent work in the Petersburg area (Smith et al. 198bb, in press) also contributed to ouz understanding of relationshipe in this study.

Unfortunately, present ievele of both wolf and deer populations are too low to facilitate offioient progress on several key jobs under this study. The nature of the vegetation and cyimate, combined with limfted accegeibility of
most of the study area, severely hampered attempts to eapture wolves for telemetry and immited our ability to observe wolves or deet. Acoordingly, it was deciaed to terminate this atudy at the end of the 2nd year.

STUPY OBJECTIVE
To determine the spatial and trophic relationships of wolves and deer in ratural and altered habitats in goutheast maska,

JOB OBJECIIVES

1. To determine size, distribution, and stability of wolf packs.
2. To detexmine activity aseas, hunting patterne, and deer-kidling rates for specific packs.
3. To detemime food habits of seleoted packs and of the overall wolf population.
4. To determine habitat composition of pack territorias. ${ }^{1}$
5. Wo determine relative mbundande of major prey mpeoies withan selected piack territorieg.
6. To determine deer density relative to wolf pack tatrixtorial boxders and habitat characteristica.
7. To monitor deer population trends in various habitat areas and wolf pack terxitories.

STUDY AREA
The study axen consisted of Revillagigedo Island and the adjaont cleveland. Peninsula. Descriptions are provided in Smith et al. (1986a).

## METHODS

Objective 1 - Size, Distribution, and stability of Wolf Packs
Radiotelemetry vas usea to monttor wolf packs. Details of capture, handling, and monitoring techniques were presented in

[^4]Gmith et a1. (1986a). However, to reduce the frequency of injury to captured Fotves, foot traps were replaced with foot snares during the 1985-86 field season.

Objeative 2 - Activity Areas, Hunting Patterns, and Deer-Kj.11 Rated

Radiolocations of each aollared wolf were ploted on the territory-minjmum convex polygon to identify activj.ty areas within the territory. Timing of relocations was used to interpret the signifioance of repicate ralooations within 1 general area (i.e., use of potential dan sites from late April through June).

## Objective 3 - Eoce Habits

Wolf scats were collected on a regular basis from logging roads and trails withith the range of the rown Pack and opportunistically along other logging roads, beaches, and trails on Revillagigedo Island and the adjacent mainland. In, addition, den and rendeayous sites used by radio-collared wolves were visj.ted in late sumer and all scats present ware colleoted, soatp were also colleated from rendezvous sites discovered by T, Kogut, USDA Foreat Servioe Biologist, on Prince of Wales and pall Islands.

Attempts were made to collect scats from all parts of Revillagigedo Island. However, scats were not oollected 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 araa. Accordingly, results of analyses should be considered as indicative of general trends, and comparisons between subsamples should be interpreted. with caution.

Collected geats were individually bagged in plastic, labeled with location, date, and estimated date of deposition (for fresh scate) and then frozen. Prior to analysis, scats ware oven-dried at 100 for 24 hours to kill Echinoooccus eggs. seats were then weighed to the neareat gram, broken apart in a tray, and a visual estimate made of the pericentage of the seat composed of various diet items (e.g.r aiult deer hair or bones, fawn hatr, bird feathars, etc.). Hair and bone fragrents were dompared with a reference collection and, if necessary, hair-scale imprints were used (Adorjan and Kolenosky 1.969).
scats less than 2 dm in diameter, collected in sunner, were considered pup scats. Sumples fram den and/or rendezvous sites were treated beparately to compare diets for specifio packs durinç early pup-rearing periods.

Two statistics were calculated for each scat subsample:
(1) Percent frequency of occurrence a number of times a diet item. (e.g., deer hair) wats found in the scat sample, divided by the total number of diet items found in the scate; and
(2) Mean diet 1 tems per scat $=$ total number of diet items in subsample divided by the number of scatp.

The lost variable provides information on the relative importance of variout 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 compostuion for various wolt paeks. Seasonal domparisons of sumar (Apr-Sep) verbus whnter (Optmar) diet were based on soats with known deposition dates.

## RESULTS AND DISCUSSION

Objective - Size, Distribution, and Stability of Wolf packs
No additional wolves were captured and xadio-collared during the $1985-38$ season. On 2 occasions wolves were adught 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 kas first" captured on 13 February 1985, was recapturea 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 all. (1.986a) 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 monthe, no firm conclusions regarding the pack's texritorial stability cotuld be made. However, some pack boundaries and use areds appeared to diffex between 1965 and 1986. Desariptiona of individual pack histories follow.

## Rown Pack:

Smith at al. ( 1986 g) reported that this pack numbered 7 to 11 wolves in late 1984 and produced a litter of pups in 1985. During the $1985-06$ winter at least 1 pack member was killed by other wolves in an apparent territorial dispute and 3 wolves were taken by a reoreational trapper. At least $4-5$ wolve日 remained in this pack subsequent to these lospes, so the
mindmum 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 dia not confirm the presence of pups in spring. At the end of the study this pack was estimated to conaist of at least 5 wolves.

Three members of the Town Pack were radio-collared in February 1985 and subsequent relocations indiatated this pack utilized a territory of approximately $150-200 \mathrm{~km}^{2}$ includine the drainagea of the White River and Ward, Ketchikan, Mahoney, and Silvis Creeks. In December 1985 this pack tuade a brief tncursion into the territory of the Naha River Pack near Clover pasaage. During this time radio-collared wolf No. 3, a juvenjle male, was killed by other wolves (presumably members of the Naha Fack). The lack of Enow made it impossible to determine if other wolves were killed in this contlict, 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 Fack contained $6-8$ wolves in late 1985. Two female pack members were taken by a local trapper in January 1986.

Reported sjehtings by jocal residente, as well as our observations, indicated this pack ranged over an area of approximetely $450 \mathrm{~km}^{2}$ including the drainages into clovar pasagge, Mostax, Margarita, and Naha Baya, Thaitora Cove, and Leask Creek (Fig, 1). No members of this pack were radiocollarea, however, so actual pack boundaries were not establishad. The limited amount of gign observed alang the beaches In this pack's tersitory indicates it spent much of its time inland along major lake and shream. gystems.

East Chuck pack:
Smith et al. (1986a) indicated that this pack consisted of 3 to 5 wolver in 1984; including radiomcollared wolf No. 2, a juverile male. It was auspected that the pack produced pups in 1985. No disect observations of the East Chuck Pack were made prior to late November 1985; at that time, wolit No. 2 dispersed, but tracks in the snow indicated the pack gti.ll numbered about 5 wolves. Following No. 2 's dispersal, contact with this pack was lost; however, 2 othex members wexe subsequently aaught by a local trapper in the vicinity of Geonge Inlet, and tracks of more wolves were seen, indicating geveral pack members remained.

The 2 wolves that were trapped were an adult female and a male pup. Bath trapped wolves wexe in extremely poor condition when caught and neither had any boty-fat deposits. Although
these wolves may hava lost some weight while in the traps, their poor body condition $\varepsilon u g g e s t s$ that wolves in this pack are food-etressed,

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

## Carroli Inlet Pack:

Smith et al, (1986日) reported that the Cairoll Inlet Pack had been reauced through trapping and hunting in 1904 from 10 , to 12, to as ferf as 2 wolves. Tracks observed on logging roads west of Thorne Arm in November 1985 indicated onily 2 or 3 wolves were using the area at that time, Subsecuaritly, wolf No, 2 moved into this territory and, based on track 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 wexe manint 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 wo. 2 , or 'if", thta pack produced pups in 1986. From Februaxy through the end of June 1986 , these wolves ranged


## Alaya Bay Pack:

Sinith et al. (1986a) reported that the Alava Bay Pack'consigm tea of $2-3$ wolver including radiomcollared wolf No. 7, an adult male, in late winter 1984-85, and that. there was evidence that the paci had produced pups in spring 1985. Geveral repeat observations of this pack in November and December 1985 confirmed that the pack had increased to a minimur of 9 wolveg. Although the lack of snow at low ejevations prevented tracking and hampered direct observation in 1986, at least 7 wolves, remained in this pack in late February $1 t^{\prime \prime}$ is not'. known whether adaitionad pups.were produced in spring 1986.

During late winter and ppring 1985, Smith et al. (1986a) reported that this pack ranged over approximately $75-100 \mathrm{~km}^{3}$ (Fig. 1), Sumer movements of wolit No. 7 were also confined to this area, but beginning in fall, the pack began to heavily exploit what previously had appearea to be a buffer zone between its territory and that of the Lake Gxace Pack.

In 1986, wolf No. 7 "disappared" for several weeks but was eventually relodated 5 km northwast of his previous extreme movement. At that time he was appareatly returning from an even longex extrateriatorial excursion (Messiax 1985). From late April until the end of the project he remained in the southern fortion of the territory within $5-10 \mathrm{~km}$ of the 1985 den site.

## Lake Grace Pack:

smith et al. (1986a) reported that prior to birth of pups, this pack had decined from 6 or 7 in late 1984, to 3 , incluđ̂ing radio-collased wolf No. 6, an adult mele. observations in sumner and early winter confirmed that at least 3 pupe had been produced. No wolves from this pack were trapped or shot ouryng the $1985-86$ seapork and the pack remained at 6 wolves throuth 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 atudy, This pack ranged over a total of approximately $400-450 . \mathrm{km}^{2}$ including smeaton Isiand (Fig. I). The pack moved onto Smeaton Island at least 3 times during the period in which it was monttored, including a 3 -week stay in January and a 4 -week stay in Fobruary-March 1986.

## Northeast Fack:

Smith et al. (1986a) estimated that a total of 8 wolves cocurred within this pack's territory in late 1984, although 2 of these were a distinct social group from the other 6. By June 2985, 1 mamber of each group had been radiomoollared but each died of statvation soon after marking. One adaitional wolf may have been lost as a rebult of a trapping encounter (Smith et al. 1986a).

In September 1985, evidence was found that 4 to 6 wolves firom this pack were feeding on spawning salmon (Oncorhynohus spp.) and beaver (Castor canadensis) in the vicinity of Portage Cove. Throughout the remander of the 1985-86 fie1d season, however, only 2 sets of sixgle wolf tracks were observed along beaches and tradis in this pack's territory. At present, the size of that pack is unknown.

Although the total area faentified as being within the territory of this pack is $350 \sim 400 \mathrm{~km}^{2}$, much of the northeastern half of this area is virtualiy devoid of deer, bedver, and salmon-spawning stxeams. We believe the area actusaly used by this pack is much smaller and is centered on the drainages of Portage Cove, Neets Bay, Shrimp Bay, Gedney Pass, and Bekm

Canal west of claude Point. The limited sign. observed along beaches in 1986 indicates this pack mugt gpend much of its time inaland along major lake and stream systems.

Objactive 2 - Activity Areas, Hunting Patterms and DaerKill Rates

During late summer 1985, 2 of the 4 radio-collarea packs ontered their activitias on major saimon spawning syptems. The Town Fack was repeatediy relocated in the lower White River drainage from mid-August through early ootober. . During that time, in excess of 120,000 salmon spawned and ajed in the White. river (ADF\&G, umpubl. data): The East chuck Fack spent the same time period int the vicinity of 2 creeks draining into the salt ohuck 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 spawaing salmon and feeding extensively on the fish. In : eddition, fisheries personnel who were intarviawed after stream surveys were completed reported evidence of wolves feeding on salmon along virtually every majox spawning etrean in the Behm Canal district. the Alaya, Bay Pack also made frequent viaits to salmon spawning stieams, but didanot remain in larea as much as the Town or East Chuok pecks. This may reflect the relatively large number of small stream systems in the AJava Bay Pack terxitory, as opposed to the few large. spawning streams in the other packs' raxges.

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 prad 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 efficjency with which wolves looated deer within their territories was dmonstrated by the take Grace pack. In several sumera' 2 ying: along alpine ridgeg, we only observed deer in 2 locations within this pack sterritory (Smith 1984 , and unpubl. datal, one of which was west of Mirror jake. Five days after we firsti observed 13 dear on this ridge in early September 1985, the Lake Grace Pack was Located on an apparent kill whers these deer had beer. The wolves remained in this area for 2 weeks, during which time we did not see deer again.

During the 1985-85 winter, montha, the rown Pack again made frequent use of the Ketchitan landifill da reported, for the winter of 1984-85 (3mith et sl. 1986a). However, the pack spent more time hunting other parts of its territory than in

1984-85. In adattion, juvenile female wole No. 4 was more fxequently located apart from hes mothex, wolx No. 5, during thin 2nd winter.

The Alava Bay Fack moved axtengively throughout itg territory in winter and did not concentrate its activities in any particular location. However, relocationg wexe frequently mate along stream courses where beaver dame and/ox houses were evident, as well as in beach fringe areas or on points where deer densities were relathvely higher.

The Lake Grace Pack wa ${ }^{\text {Gamerally found during early and }}$ mid-winter 1985-86 to be hunting relatively steep slopes along the major lakes rithin its range, hear beaver oolonjes at the inlets to these lakes, or on Smanton Island. In the latter area, the paok was mpparently feeding on deer, an thare ig no evidence that beavex oceux on this island.

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

In gpring 1986 the Lake Grace Fack appeared to settle into a den site in the lower Manzanita River erainage. The area was similar to its 1985 den site, congisting of a. stand of mature tpruce trees in the vicinity of a large complex of beaver dame.

The lack of anow at most elevationg used by wolves during the majority of the winter of $1985-86$. combined with dense vegetation, prevented oni Gathering further data on hunting patterns or deer-kiliithg ratea, fowever, given an average paok size of 5-7 wolves, and each wolf's ability to ocnmme $5-10 \mathrm{~kg}$ of deer following a kild (Mech 1970:118), the packs studied here could easily consume an entire deer (averame live weight: $35-45 \mathrm{~kg}$ (ADF\&G unpubl. data]) within hours. Thus. even under ideal conditions it is unlikely that wolves would often be found on a kill.

## Objective $3 \rightarrow$ Food Habits

A total of 511 scats oontaining 594 diet itomb from 33 difm erent food sourceg war colleoted during thjs atudy (Table 1). Depogition date could accurately be tetermined for 271 o世 these scats. For the overali sample during summer, wolven fed tpredominknty on deer, including 5 hagh proportion of fawna. Beaver also ponstituted a major proportion of the summer diet (tiable 1). For the Revillagigedo Igland 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 197A, Voight et al, 1976, Scott and Shackelton 1980, Hatter 1984). In fact. Hatter (1984) concIuded 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 geats analyzed by katter was almost identteal to the ratios from Southeast Alaske and Revillagigedo Island samples (Tables 182 ), so fawns may be more important than adults in the summer aiet here as well.

Although many other studies report the use of beaver by wolves (Murie 1944, Mech 1966, 1970; Peterson 1974, Carbyn 1974, Thebexge 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 208 frequency of oceurrence (Pimlote et al, i969, Frenzel 1974, Voight et ał. 1976i' were generaily conducted in areas with very low deer populations.

As previously discussed, wolves were known to . be feeding extensively on salmon during late sumer, but this use was not reflected in scats. Two potential sources of bias may have caused thin. First, only scatg that could positively be identified as wolf soats were collected, so amorphous scats, which were found along stream banke and composed entirely of fish remains, were rejected ${ }_{r}$ as they might possijly have been from bears. Second, observations and telemetry indicated that although the wolves dame down to the streams to atath and feed on the galmor, they usually moved away from the stream to bed down. This movement may have been designed to avoid contaot with bears and would have wesulted in the wolves' defecating away from the stream banks where we searched for soats.

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

Throughout much of the xange of wolves in Noxth America beavers are unavailable in winter (Mech 1970) and only scott and Shackelton (2980) reported significant use of beaver in winter. The avaflability of beavers year-round in coastal regions provides an important supplement to the wolf diet and may increase wolves' ability to regulate dees populations (Van Bellenbergha und Hanley 1982).

Comparison of the diets of 5 wolf packe on Revidlagigedo IsIand refjeats regional variation (Table 3). Wolves in the Alava Bay and East Chuok Packs consumed approximately 90\%
deer, whereas wolves in the Naha and Northeast Packs consumed only about 658 deer, and the Town Padk wolves, only $55 y^{\circ}$ deer. Beaver constituted one-third of the diet for the Naha and Northeast Packs, cht the Town Pack fed heavily on garbage from the Ketchikan landfitl. The variation in diet refneots deer population density and availability of alternative food
sources.

Similar patterns are retlected in biats colleoted from summeruse sites on Revillagigedo, Prince of Wales, and Dall Islands (Table 4), Scats from wolves on southemn Revillagigedo (Alava Bay Pack) as well as on Frince of Wales and Dali Islands, where deer densities are relatively high, contained 93-96\% deer, much of which was fawn hais. scats from the Town and Lake Grace Packs' areas revenled that deer oonstituted less than half the diet in summer. The former pack used human garbage, and the latter paok, 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 landilil and that the Jake Grace Pack'g den was near an area of exteneive beave colonies.

The mean number of prey items per scat ranged fron 1.0 to 1,5 for various subsamples (Table 5). Comparisons between gummer 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 mantals, and birds are more available, than in winter, and to finô a more varied diet where deer are Iess avajlable. Comparisons between the gampled packs' diets revealed that the Town Pack had a more varied diet than any other group, both in summer and overali (Table 5). This variation was largely aue to the availability of human garbage as a supplement to the usual prey items.

Scott and shackelton (1980) reported finding only 1 prey itern
per scat in vancouver: Island wolf fedes per scat in Vancouver: Island wolf feces, but Murie (1944) found more than 1 prey item per scat in feoes from wolves in interior Alaska when wolven were preying on rodents in addition to ungulates. Kuyt (1972) reported highly varied spring and sumber aiets for tundra wolves, partioularly during periods when the primary prey apecies, caribou (Rangifer tarandus), was less available.

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

Although results of this study are ilmited, they generally support the concepts and concerna advanced by Van Ballenberghe and Hanley (1982). Specificelly, we determimed that while wolves prey mainly on geer, 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 denajties. Nevertheless, a wolf pack's territory size and the number of pack members appeared to be related to deer population density, so further declunes in deer numbers or productivity aue to cimate or hạbitat alteration will probably result in fewer wolves as well.

Wolves were found to be efficient at finding localized"areas with relattvely high deer numberis, and packs could be expected to take advantage of artaficial concentrations of deex in habitat patches created through forest mangement. Accoratngly, efmber harvests should be designed so as to minimize formation of small "isliande" of old growth and to "iestire tobility of deer between areas as aggésted:by Harris (1984).

## ACKNOWLEDGMENTS

Many members of the Game Ditioton statif in Region I ontributed to the development and implementation of this project. Gerry Down contributed gubgtantially to. the wolf apture effort and his local knowledge of wolf movements was helpful in mapping pack distributions. Diok Hanitr", Jim Jakubek, and Dan Hassell piloted survey and telemetiy flitghts with skill and keen interest in the project which made flying in the frequently poor weather condtions both safe and erjoyable. Greg Clevenger of the USDA Forest Service arranged cooperative funding and was highly supportive of the project. Skipper Ron Rusher and Asbistant Boat offleer Kevin Perry of the $\mathrm{k} / \mathrm{V}$ sundence provided logistical support for the project; their help is greatiy apprecidted.

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Table 2. Percent fxequency of occurrence of theme in the diet from aumper (Apr-Sept) and winter (oct-Mar), and from total scats collected from wolyea on Reviliagigedo Iahand, Alabka, 1984 -86.

| Diet item | Season |  |  |
| :---: | :---: | :---: | :---: |
|  | Summer ${ }^{2}$ | Winter ${ }^{\text {b }}$ | Total ${ }^{\text {c }}$ |
| Adult dear | 42.5 | 71.2 | 55.6 |
| Eawn dear | 30.3 | $\rightarrow \rightarrow$. | 18.7 |
| Total deer | 72.8 | 71.2 | 74.3 |
| Beaver | 24.0 | 19.7 | 20.1 |
| Bird | 0.9 | 1.5 | 1.1 |
| Nolf | 0.4 | 1.6 | 0.8 |
| Gerbege | 0.4 | 1.5 | 1,1 |
| Fish | 0.9 | 1.5 | 0.6 |
| Tosd | 0.9 | 3.9 | 0.6 |
| Unidentified bonee | 0.4 | 0.9 | 0.8 |
| Black bear | 0.9 | 0.9 | 0.6 |

a $n=196$ scats, 221 items.
b
吂 -64 seates 66 itemg.
${ }^{c}$ m $m 329$ scats, 363 itams.



Fig. I. Location of known (solid lines) and suspected (dottad lines) wolf park territorias on Revillagigedo Islandi, Alabka, 1985-86. TE = Town Pack, EC = East Chuck Fack, CI = Carroll Inlet Pack, $\mathrm{AB}=$ Alava Bay Pack, LG $=$ Lake Grace Pack, NR a Naha River Pack, and $N E=$ Northeast Pack.

Table 1. Percent fifpgungy of acourrence for 1 temp in the diet from sumber (AprwSep) and winter (oct-Mar), and from total satts collected from rodveg in Southeast Alaska, 1984-8f,

| Diet dram | Sesson |  |  |
| :---: | :---: | :---: | :---: |
|  | Summer ${ }^{\text {a }}$ | Winter ${ }^{\text {b }}$ | Total ${ }^{\text {c }}$ |
| Adult depr | 42.1 | 68.5 | 50.2 |
| Fown dear | 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 |
| Forcupine | 0:0 | 1.4 | 1.3 |
| F1sh | 0.9 | 1.4 | 1.3 |
| Toad | 0.9 | 2.7 | 0,3 |
| Uxidentified bonts | 0.4 | 0.9 | 1.2 |
| Black bear | 0.9 | 0.9 | 0.3 |
| Mustelids | 0.4 | 0.9 | 0.3 |

${ }^{5} \underline{n}=201$ scats $_{3} 228$ items.
b In 70 scats, 73 fitems:
c $\quad=511$ geata; 594 items.

Tabie 3. Percent frequency of occurrence of itemg in the diet from geats coliactad from 5 wolf packs on Revillagigedo Tatand, Alagka, 1984-86.

| Diet Item | Wolf patek |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Town ${ }^{\text {a }}$ | $\mathrm{Naha}^{\mathrm{b}}$ River | $\begin{gathered} \text { Alavac } \\ \text { Bay } \end{gathered}$ | Northeast ${ }^{\text {d }}$ | Enst ${ }^{\text {E }}$ Creek |
| Adult deer | 50.9 | 65.1 | 58.8 | 57.9 | 90.9 |
| Frwn deex | 4.9 | 0.0 | 24.9 | 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 |
| Flah | 1,2 | 0.0 | 0.0 | 0.0 | 9.1 |
| Toad | 1.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| Uridentified bones | 3.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| Blatck bear | 0.6 | 0.0 | 0.8 | 0.0 | 0.0 |
| a g - 124 scats, 163 ftem. |  |  |  |  |  |
| b咅 -40 ecata, 43 土tamb. |  |  |  |  |  |
| $c_{\underline{n}}=124$ scata, 131 ttema. |  |  |  |  |  |
| d $\underline{\underline{n}}=36$ seats. 38 items. |  |  |  |  |  |
| e $\underline{n}=21$ scata, |  |  |  |  |  |

Tabig 4. Percent finequency of occurrence of diet iteme in enate colleated at den and sumer rendezvous aites for 5 wolf packs on Rovillagigedo, Prince of Males, and Dall Islands, Alaska, 1985.

| Diet itemill | Holf pgok |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Town ${ }^{3}$ | $\begin{aligned} & \text { Old Tom's } \\ & \text { Lake } \end{aligned}$ | $\begin{gathered} \text { Alava }{ }^{C} \\ \text { Bayy } \end{gathered}$ | $\begin{gathered} \text { Bob's } \\ \text { Bay } \end{gathered}$ | $\begin{aligned} & \text { Lake } \\ & \text { Grace } \end{aligned}$ |
| Adult deez | 30.5 | 35.3 | 60.6 | 48.2 | 12.8 |
| Fant deer | 11.9 | 58.8 | 32.0 | 48.2 | 37.1 |
| Total deez | 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 |
| BLTd | 1.7 | 2.0 | 0.8 | 0.0 | 1.4 |
| Black bear | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 |
| Wnidentified bones | 6.8 | 0.0 | 0.0 | 0.0 | 1.4 |
| Mustelıd | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 |
| Seal | 0.0 | 0.0 | 0.0 | 3.7 | 0.0 |

an ${ }^{n} 39$ scata, 59 1tema.
b $n=4$ scats, 51 1tems.
¢
$\mathrm{d}_{\underline{n}}=26$ acatr, 26 itens.
en $=55$ scats, 70 items.

| Source | Serson. | Mean | ( E ) |
| :---: | :---: | :---: | :---: |
| 'Town Pack | Summer | 1.51 | 39 |
| O1d Tom'a Pack |  | 1.19 | 43 |
| Alava Bay Pack | Stumer | 1.06 | 115 |
| Bob's Bay Pack | Suminer | 1.00 | 26 |
| Lake Grace Pack | Sumber | 1.27 | 55 |
| Revillagigedo İ** | Sunmet | 1.13 | 196 |
| Revillagigedo Is. | Winter | 1.05 | 64 |
| Town Pack | Total | 1.31 | 124 |
| Naha RIver Fack | Total | 1.08 | 40 |
| Alava bay Pack | Total: | 1.06 | 124 |
| Northeast Fack | Total | 1.06 | 36 |
| East Chuck Rack | Total | 1.05 | 21 |
| Southeast Alsetes | Total ${ }^{\text {a }}$ | 1.16 | 511 |

Maxch 1, 2013

Alaska Board of Game
c/o ADF\&GG, 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 Olsox and Dave Beebe.

## I. Our Recommendation and Request

We recommend and request that the Board of Game strike the content of Proposals 178 and $178-\mathrm{A}$, 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 babitat.
The Proposals and the Operational Plan do not comply with the Board of Game Wolf Management Policy (2011-185-BOG) or with ADFsG'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, wildife and habitat resources get the attention that they deserve from decisionmakers of development projects, toward avoiding simnificant impacts. Unit. 1A, and Gravina Island in particular, are examples of how development decisions can cause significant gaxne, 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 "onevoice" 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 maission 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, ixplementing such control is discretionary and:

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

## A. The Board Policy states:

${ }^{\text {a }}$ Under no circumstances will wolf populations be elimixated ..., 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 clearly violates the policy. In addition the sustained yield of Gravina Island wolves would be terminated for an unknown period, also clearly violating the Policy. Instead, the removal of only as much as a "high percentage" of wolves is contemplated by the Policy. (Id.). The two proposals fail the policy.

## B. The Board Policy also states:

"Once prey population objectives have been met, wolf populations will generally be allowed to increase to or above pre-control levels."
(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 mumbers 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 habitate will be managed for their long-term sustainability."
(Id.). Merely identifying the unintended consequence does thot 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 canying 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 Flan at $3, \mathrm{Op}$. 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 Ftamework). 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 externinate 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 insighte.

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 etsuting appropiate action if the wolf control program further impairs deer habitat quality. Moreover, an adequate baseline tneeds 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 closute 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 capabillity 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 restults 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 thanst 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 out comments and testimony for the Januaxy 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 8 G has not provided any futher 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, Hittle can be done to increase deer densities in Southeast Alaska.
> Wolf control efforts in the 1980 s 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 1980 s 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 Isiland or the proposed control area.

[^5]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 particulatly and more broadly in Unit-1A, and (3) more particulars of the findings of the 1980 s 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 overestimation for $39 \%$ for all of Unit-1A and $38 \%$ for Gravina Island. Other places important for Ketchikan bunters were also over-estimated, by $60 \%$ for Revillagigedo Island and $34 \%$ for the Cleveland Peninsula.

Because Proposals 178 and 178-A are latgely driven by ani 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 harvesta 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 decteased. From two years later, in 1999, hunter effort was fairly consistent until the bard 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-la 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 ADF86G 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 pau'city of suitable winter habitat creates a situation where wolf control is not a suitable solution to low deer harvest. Given the circurnstances, 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 carly 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 thenn 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 particulat days, could provide the feed. The program could have an educational component for students and the public at large, and perbaps 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 recovety 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
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Box 6484
Sitka, Ak 99835
907-747-7557

## Attachment - 1

## Intensive Management Population Identification Worksheet

Species; Deer
Brief description of the population:
This deer popuiation inhabits the maininge and near-shore islands in Unit IA. Densities have generaily boen highest on the fower Cloveland Peninsula and Grayina Island. Densititos are lowest on the mainiand east of Ketchikan whare very himited detor hunting occurs. Buck-only kirvests, with a 4-buck limit, heve been in effect in the units for the past 20 years.

## Criterion \#1-Harvest:

4. Maximum average haryest for any 3 conoecutive years: 788 during 1994-1996.
b. Estimated average harvest for 199]...1996: 652

Criterion 42: - Accessibility;
Most access is by boat, some by floampane. Highway velicles are used to access aroas on the limited Ketchikat road system, and 3" and 4-wheelers are used ocoasionally to access areas associated with remote logging roads. Boat and airplathe occess is extremely weather-dependent.

Criterion ${ }^{2} 3$ - Use for meat:
Alasky residents, primarily those resiting witbin the Ketchikan Gateway Borough, use this population of deer primotily for meat and tecteation.

Criterion \#4 - Hunter demand:
a. Estimated or reported bunter effort: During 1991-1995, hunters spent a seasonal average of 4,534 days hunting deer. Effort data was not collected duting 1996.
b. Number of applicante for permit hunts, if appliaable: NA
c. Other indiontors of demand: None

Is this population important for propiding high levels of human consuraptive use?

Deparment Recommendation:

$$
\text { Yes: } X
$$ 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 oauses 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 accumbilation on the ground above "nomal" levels, limiting the value of critical habitat to support overwittering deer populations.
(2) Mairtenance of viable predator populations: Brown bear predation on deer is apparently negligible. We believe that black bear predation on deet is significant where they ocour at high densities. Anecdotal evidence supports the idea that seavenging 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 areat Evidence suggests that deer and mountain goats may compete for limited food resouroes in some limited situations. However, for current deer and goat population levels in Unit 1 A , there appears to be no direct correlation in terms of population densities.
(4) Effects on subsistence users: The islands and the Cleveland Peningula portion of Undt 1 A are in the Ketchikan Nonsubsistence Area, and tnake up most of the quality deer habitat in the Thit, Subsistence use of deer in Unit 1 A depends latgely on deet abundance. As deer numbers increase following mild winters, hunter effort ithcreases proportionately. Deer meat provides a considerable arnount of the red meat for consumption by Unit LA residents, as the only other avatlable ungulates are momtain goats (common) and moose (scarce).
(5) Cost, feasibility, and potential effectiveness of possible management actions: With the notable exception of ethouing naintenance 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 oceurs it is imperative that prolifetating human access be minimized by strict attention to road placement administrative ..... and/or mediantical soad clowures after loggitig, 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 $1 A$ is under federal juristiction of the "Tongass National Forest. In addition, a pottion of the mainland is designated as the Misty Fjords National Monument within the Tongass.
(7) Degree of accessibility to harvest: Accessibility by boat is yery 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 actopted by the Alaska Boarcl of Game and applied to all lands in Unit 1A. State and federal deer hunting regulations remain identical in the Unit.

## Department Recommended Objectives:



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

## Board Action:

Objectives:


# Intensive Management Population Identification Worksheet 

## Species: Deer

Name of the Population: Unit IC

## 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 foutd on themainland in Yery law densities due to a greatar snowpack and the presence of wolves.

## Criterion \#t - Harvest:

a. Maximum average haryest for any 3 consecutive years: 583
b. Estimated 日vergge harvest for 1991-1997: 467

Criterion ${ }^{2} 2$-Accessibility:
Fortions of the Unit $1 C$ mainland and Douglas Island are accessible by highway vehicle, Hunters also use boats to aceess the south and western sides of Denglas Island, as well as Sheiter and Litncoln Efiands.

Criterion +3 - Use for mat:
Considering the limited opportunities ayailable for haryesting moose in Unit IC, most hunters secure wild meat through the harvest of local deer. Deer hunting is also an important recreational activity for Juneadu area residents.

## Criterion $\mathrm{H}_{4}$ - Hunter Demand:

a. Estimated of reported hunter effort From 1991-1995 the average number of hunters/year was 939 , and these bunters combined for 3,324 hunter days. 1996 and 1997 data is only ayailable for successflui hunters, and therefore not included in the above average.
b. Number of applicants for parmit hunts, if appicable: NA
e. Other indicators of demand: The deer hunter survey indicates hunters pursue deer throughout the $3-1 / 2$ month season in thit $t \mathrm{C}$.

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

Department Recomtnendation:

$$
\text { Yess: } \quad X
$$

No:

Board of Game Action:
Yes:
No:

# Intensive Management Objective Worksheer 

Specieg: Deer

Population: Unit 1 C

(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 elavations which increases intraspecific competition. Altitude, aspect, and browse species availability can severaly limit habitat quality and quartity, and high deer densities result in starvation or increased susceptibility to predation caused by the poor nutritional state of the animals (Olson, 1979). Unit $1 . C$ has both mainland and island deer habitat. Douglas, Lincoln, and Sheltert 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 limoiting 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. Arecdotal 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. Chandes in human harvest objectives would most likely oceur on the islands, where changes in deer numbers would not heve a substantial effect on predators.
(3) Maintenance of habitat conditions suitable for other species in the areat Longtarm plannixg to maintain large tracts of mature forest is the only way of sustaining a viable deer population; Other species that use mature forests would benerit 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 popuiation levels in Unit 1C, there appears to be no direct cotxelation in terms of population densities.
(4) Effects on subsistence users: Subsistence use of deer in Unit 1C depends largely on deer abuudance. As deer numbers increase foilowing mild winters, hunter effort and success increases proportionately. Deer meat provides most wild red meat for consumption by Unit 1 C residents, with moose and nountain gats supplementing deet 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 uplikely that deer numbers will ever increase substantially. It is not
feasible to enhatice 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: Signifionnt private and munticipal land ownership is an issue in the avea, 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 1 C 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 $\quad \underline{6240}$
Harvest 450
Board Action:
Objectives:

1. Population: $\qquad$
2. Harvest: $\qquad$

# Inteusive Management Population Identification Worksheet 

Spectes: 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 iglands, as ate their predatoxs,

## Criterion \#l - Haryest:

a. Maximum average harvest for any 3 consecutive years: 2,970 during 1993-1995.
b. Estimated average harvest for 1991-1996; 2,831

Criterion $\begin{gathered}\text { t2: } \\ \text { - Accessibility: }\end{gathered}$
Most hunters access deor with highway and offwoad vehicles on the extensive road system found on central to nothern POW Island, A few hunters access alpite lakes early in the season with floatplanes, and some travel to smatl offichere isiands by boat.

Criterion $\#$ \#3: - Use for meat:
Pritharily Alaska residenta residing on Prince of Walas Island use thia deer population for meat and recreation. Several Ketchikan residents travel to Unit 2 each season to hunt deer for marand recreation as well.

## Criterion \#4 - Hunter demand:

a. Estimated of reported hunter effort: During 1991-1995, hunters spent a seasonal average of 12,242 days hunting dear in Unit 2. Effort data was nof collacted during 1996.
b. Number of applicants for permit hututs, if applicable: NA
c. Other indicators of demand: None

Is this population innportant for providing high Ievels of human consumptive use?

| Depatment Recommendation: | Board of Game Action: |
| :---: | :---: |
| Yes: $\underset{X}{X}=$ | Yes: X |
| No: | No: |

# Intensive Management Objective Worksheet 

Species: Deet

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 periodie declines in the deer population, ospecially in areas where clear-cut logging has removed old-growth forests. Among other deleterious effects, the removal of the old-gtowth canopy allows snow accumulation on the ground above "normal" levels, limiting the value of critical habitat to support overwintering 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 inglocal areas. We believe that black bear predation on deer is significant where bears oceur in high densities. Apecdotat 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 increages 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 Glack 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 densitics in Southeast Alaska. The ADF\&G needs to continue working with the US Forest Service and private landowners in an effort to ntaintain 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, Woff control efforts in the 1980 s 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 arnouxt of land in this Unit.
(7) Degree of accessibility to harvest: Accessibility by boat and highway vehicles is very good throughont 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 fecteral doe season in Unit 2 that is only open to federally qualified subsistetce hunters (rural residents of Units $1 \mathrm{~A}, 2$, and 3).

## Department Recommended Objectives:

Population
Harvest
$+71248$
2728

Current management objectives for Unit 2 deet are to: 1) maintain a population in excess of 45 deer per $\mathrm{mi}^{2}$ of winter tange ( 1.4 pellet-groups per plot); and 2 ) monitor deet 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 patiodic declines in the deer population, especially in areas where cleat-eut logging has removed old-growth forests, Among other deleterious effects, the removal of the old-growth canopy allows snow accumulation on the ground above "nomal" levels, limiting the value of critical habitat to support overwintering deer populations.
(2) Maintenance of viable predator populations: Wolf populations are healthy in Unit 3 and can effect deex populations at least in locel arees. We believe that black bear predation on deer is significant where bears occur in high dexsities. 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, axd elk may compete for limited food resources in some situations. However, for current deer, moose, and elk population levels in Unit 3, there appeats to be no direct correlation in terms of popalation densities.
(4) Effects on subsistence users: Subsistence use of deer in Unit 3 depends largey on deer abundance. As deer numbers inctease following mild winters, lunter 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 inoose 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 Southerst Alaska. The ADF\&G needs to continue working with the US Forest Service and private landowners in an effort to maintain quality habitat. Whare logging occurs it is imperative that proliferating human access be minimized by strict attention to road placement, administrative and/or mechanical road cloṣures after logging, and regulations that ensure viable deer populations. Woff control efforts in the 1980 s in Southeast Alaska were found to be expeasive, time consumptive, and ineffective.
(6) Land ownership patterns within the Pange of the population: Most deer habitat in Unit 3 is under federal jurisdiction of the Tongass National Forest, although a private corporation owrse 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 Recomunended Objectives:

Population
14868
Harvest
852
Current management objectives for Unit 3 deer are to: Increase populations on deer winter range ( $<1,500 \mathrm{ft}$ elevation) to 32 deer/ mi ${ }^{2}$, measured by a neman pellet density of 1.0 pellet group $/ 20 \mathrm{~m}^{2}$ plot

## Board Action:

Objectives:


## Attachment - 2 <br> Excerpt of comments PCS3, as corrected by RCI3, from the Jan. Board of Game meeting

# - Greater SE Alaska Conservation Community • Alaska Wildife Alliance - <br> - Tongass Conservation Society " Greenpeace - Center for Biological Diversity - 

Alaska Board of Game<br>c/o ADF $\mathrm{s}_{\mathrm{s}} \mathrm{G}$, Boards Support Section<br>by FAX: 907-465-4094<br>December 28, 2012

Subj: Unit 1A:" Comments an "Feasibility_Assessmentw... Black-tailed deer"

## f1. The Deer Objectives Are Outdated and Therefore Do Not Support Wolf IM.

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

## A. The current deer objectives for Unit t-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 cstimate the winter carrying capacity of the habitat for deer, and on harvest rates frome 1994 to 1999 which were the pealk yeats for the Unit. (Id.). The Assessment itself recognizes that these objectives are "untealistically high." (Assessment at 7, 18). Over the past five years the Unit1 A deet harvest ranged from 154 to 309 (Assessment at 7), but this does trot include illegal talke 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 ftom the Forest Service's 1997 deer model. (Assessment at 7, 18). The Fotest Service updated its model for the 2008 Tongass Forest Plan, and the new moded makes significantily lower carrying capacity estimates.

[^6]Three corrections made to the model since 2000 were substantial:
(1) In its FY-2000 Monitoring \& Evaluation Repont (published April 2001) ${ }^{2}$ the Forest Service cormected the conversion factor (called the Deer Multipliet) 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 cartying capacity of best quality habitat (of which very little exists). The older model results im over-estimated carrying capacity by $25 \%$. From the ixfommation in the Assessment we don't know which multiplier had been used when the Board of Game set the Urit-1A objectives.

However; regarding the Deer Multiplier, Gxavina Island is a special case as ADF\&G itself explained to the Forest Service in 2002 tegatding 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 avaliability. 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 Kirohhoff and Dave Ferson, 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. ernph.). Thus, for Gravina Island, reliance on Deer Multipliers of 125 or 100 would result in over-estinations of carrying capacity of a factor of 3.57 (a $257 \%$ over-estimation) or 2.85 (a $185 \%$ overestimation).
(2) In 2008 the Forest Service made a further correction to use of the Deer Multiplier. 5 Ftom 1997 through 2007 the scale for the non-dimenstonal 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 thodel 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 canying capacity of the highest quadity habitat type; however, this kitad 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 Gervice, the project decision was withdrawn. However, since that time a significant amount of logging in high quality deer habitat has occutred on Gravina Island, done under timber salea by Alaska DNR and the Alaska Mental Health Trust.
52008 Tongass Forest Plan (TLMP) FEIS, at 34266: "HSI values ware standardized to range from 0 to 1.0 , by dividing all valtaes by 1.3 , because outputa 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 dect persquare mile equating to a habitat suitability index score of 1.0 ."
quality habitat. However, the way the Deer Multiplier was used cuxing those years, it corresponded to a value of 1.0 in that range, which is incorrect and results in a $30 \%$ overestimation 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 reductioti 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 Flan Revision Final EIS." (2008 Forest Plan FEIS at 3-265 to 266). This change resulted in significantly lower carrying capacity estixnates by the new model, neatly everywhere in the Tongass, but the changes were not the same everywhere because the previous dataset's noncorrelation 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:

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

| Unit 1-A | $39 \%$ | Over-estimation |
| :--- | :---: | :---: |
| Gravina Island | $38 \%$ | Over-estimation |
| Revillagigedo Island | $60 \%$ | Over-estimation |
| Cleveland Pexinsula | $\mathbf{3 4 \%}$ | 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 ( $\mathrm{S} \& \mathrm{G}$ ), and the department played a major tole 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 $\$ \& G$ at 13.6 and 11.7 deet per square mile. Moreover, Gtavina Island was already below the S 8 G in 1995 at 13.0, but with the revised modeling (and when usithg ADFsG's recommended Gravina Island Deer Multiplier of 35) it was at 7.3 deer per square mile in 2006.

[^7]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
Ectuards (23Dec12, for BoG comments)

|  |  | $\begin{gathered} 1997 \\ \text { Model } \end{gathered}$ | 2008 <br> Hodel | Mode] Comparison | $\begin{aligned} & \text { If Deer } \\ & \text { Mult. }=45 \end{aligned}$ |  |  | $1997$ <br> Model | $\begin{aligned} & 2008 \\ & \text { Model } \end{aligned}$ | $\begin{gathered} 1997 \\ \text { Modiel } \end{gathered}$ | 2008 <br> Model |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| WAA Location | WAA Number | $\begin{gathered} 1995 \\ \text { Carrying } \\ \text { Capacity } \end{gathered}$ | $\begin{gathered} 2006 \\ \text { Carrying } \\ \text { Capacity } \end{gathered}$ | $\begin{gathered} 1995 \\ \text { Over-estimation } \end{gathered}$ |  | Land <br> Area <br> (sq-mi) | Land <br> Area <br> ( sq -mi) | Area Weighted Capacity | Агеа Weighted Capacity | Carrying Capacity | Carrying Capacity |  |
| Grawina | 101 | 13 | 21 | -38\% | 9.4 | 62.1 | 62 | 807 | 585 | 13.0 | 9.4 | Gravina 1. |
| Duke I. | 303 | 19 | 18 | 3\% | - | 73.3 | 73 | 1393 | 1348 | 19.0 | 18.4 | Duke 1. |
| Revilla, east shore | 404 | 22 | 12 | 86\% |  | 231.4 |  | 6191 | 3321 |  |  |  |
| Revilla, Thorne Arm to Behim | 465 | 24 | 18 | 34\% | - | 83.4 |  | 2002 | 1495 |  |  |  |
| Revilla, Carroll Inlet | 406 | 20 | 12 | 64\% | - | 194.6 |  | 3892 | 2374 |  |  |  |
| Revilla, George Islet | 407 | 13 | 15 | -12\% |  | 64.2 |  | 835 | 953 |  |  | Revilla |
| Revilla, Ketchikan | 408 | 7 | 13 | -46\% | - | 26.0 | 1,076 | 182 | 335 | 18.8 | 11.7 | Island |
| Revilla, Clover to Francis | 509 | 17 | 14 | 25\% | - | 105.6 |  | 1795 | 1431 |  |  |  |
| Revilla, Traitors to Bell 1. | 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 | 190.7 |  |  |  |
| Cleveland, Helm Bay | 613 | 24 | 19 | 29\% | - | 71.0 |  | 1704 | 1321 |  |  |  |
| Cleveland, Meyers Chuck | 614 | 15 | 2 D | -24\% | - | 20.5 | 358 | 308 | 407 | 18.3 | 13.6 | Pen. |
| 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\% | - | $31+.9$ | 312 | 1248 | $\uparrow 354$ | 4.0 | 4.3 | Mainland |
| Smeaton Eay | 821 | 15 | 9 | 67\% | - | 173.4 | 173 | 2601 | 1554 | 15.0 | 9.0 | Mamand |
|  |  |  |  |  |  |  | 609 | 6089 | . 5170 | 10.0 | 8.5 |  |
|  |  |  |  |  |  |  | 3,414 | 42,251 | 30,460 | 12.4 | 8.9 | OWIT-1A |
| Overall deer carrying capacity over-estimations of the 1997 moder: |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Unit-1 |  |  | 39\% |  |  | $\cdots$ |  |  |  |  |  |
|  | Grawin | a Island: |  | 38\% |  |  |  |  |  |  |  |  |
|  | Revilla | gigedo Isl | and: | 60\% |  |  |  |  |  |  |  |  |
|  | Clevel | and Penins | ula: | 34\% |  |  |  |  |  |  |  |  |

Data Sources: 1997 model resulfs from the 1997 TLMP FEIS, Table 3-112.


Accordingely, 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 cutrent deer population and harvest objectives that were set by the Board of Game in 2000 is no longer velid. An urgently theeded action by the Board is to update those objectives. It is not valid to initiate a program of wolf intemsive 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.

FINAL REPORT (RESEARCH)

| State: | Alaska |  |  |
| :---: | :---: | :---: | :---: |
| Cooparatore: | USDA Forest Service |  |  |
| Frojeet No.: | W-22-4 | Project ritle: Joh Title: | Big Game Investiogationg |
|  | W-22-5 |  |  |
|  | W-22-6 |  | Wolf-Deas-Habitat |
| Job No.: | 14.13R |  | Relationshiop in |
|  |  |  | Southeast Alaska |
| Period Covered | : 1 Ju1\% 1984-30 June 1987 |  |  |

## STMMARY

Although originally scheduled to continue for 5 years, field work for this etudy was terminated after 2 years. Reasons for termination include limited progress on etudy objectives due to adverse weather; $10 w$ densities of deer lodocoileus hemionus gitkensis) and wolf (Canis lupic) popuiations; limited sightability of dex ant wolves dine to dense vegetation budget shortfalle; and personnel reductions. Results presented here are based on relatively small sample sides and should be considered preliminary.

The wolf population of Revillagisedo Island appears to be Lelatively stable, consisting of 35 to 50 wolveg in 7 or 8 paaks which occupy distinct territoriss. Additional single wolves or pairs that roam over aeverad packs' teríitories mey also occur. Although packs occasionally trespasg on adjacent Wolves' ramges, all such movements that were detected were relatively brief; at leagt 1 wolf was killea by other wolves while trespassing. One juvenile male dispersed from his natal pack and moved extensively before apparemtly esteblishing a bond with remant members of amother pack that had ben reduced through huxting and trapping. Our data imply that vacant areas do not exiat on the isiand and that food resourcer ame limiting wolf numbers.

Although overall deer population densities are relatively low on Ravillagigedo island, wolvee appear to be axtremely efficient at locating areas where deer ocour. while direct evidence of hunting patterns is limitea, the distribution of relocations and results of soat andlyses confinm that deer are the major food source for these wolves ${ }^{\text {for }}$ Notertheless, regional diffexences in diet occur on the island and other food sourcea such as beaver (castor canadensis) and garbage are important for some packs, In addition, most woives on the island appear to feed keavily on spawning salmon foncorhymchus spp, ) in late suttmer and fall.

The availabllity of duverem food sources may enable wolves to sustain their numbers at hagher levels than could be supported by deer alone. Ag a result, wolf predation on dear may, In turn, be inereased. Nevertheless, any major reduction in deer numbers due to catagtrophic winter conditiona, or due to habitat alteration resulting from clearwoutting, could be expected to reduoe wolf numbers or productivity.

Key words: Cands lupurg, deer, food habyts, habitat relationships, odocoileus hemionus sitkensis, predator-jprey, wolf.

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## EACKGROUND

This study was initiated ag a long-term investigation of interdetions between wolves (Cenjs lupus), deer (Odocoileus hemionus sitkensig), and habitat in coastal Alaska. of pantiouTar concerr 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 ompleted under this study (Smith et al. 1986a) reviewed pertinent literature and identified the major reeds for accomplishing the study objective. Concurrent work in the Petersburg area (Suith et ai. 1986b, in press) also contributed to our underetanding 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 limjted our ability to observe woives or deer. Accordingly, it was decided to terminate this getudy at the end of the 2nd year.

## gIUDY OBJECTIVE

To determine the spatial and trophic relationships of wolves and deer in ratural and altered habitats in Southeast Alapka.

JOB OBJECTIVES
i. To determine size, distribution, and stability of wolf packs.
2. To determine activity areas, hunting paterne, and deer-icilling rates for spedific packs.
3. To determine food habits of seleated packs and of the overall wolf population.
4. To determine habitat composition of pack territories. ${ }^{2}$
5. To determine relative abundance of major prey species within seleoted 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 wolt pack territories.

STUDY AREA
The study area consisted of Revillagigedo Island and the adjacent Cleveland Peninsula. Deseriptions are provided in Smitrh et al. (1986a).

## METHODS

Objective I - Size, Distribution, and stability of Wolf Packs
Raciotelemetry was used to monitor wolf packs. Details of capture, handing, and monitoring techniques were presented in

[^8]Smith et a1. (19日6a) However, to x"educe the frequency of injury to captured wolves, foot traps were replaced with foot snares during the 1985-86 field season.

Objective 2 - Aetivity Areas, Hunting Pattexns, and Deer-Ki,21 Ratas

Radiolocationg of a日ch collared wolf were plotted on the territory-mindmum convex polygon to identify activity areas within the territory. Timing of relocations was used to interpret the sionificance of replicate relocations withju 1 general area (i.e., use of potential den aitea fyom late April through June).

Objective 3-E00d Habits
Wolf scate were colleated on a regular basis from logging roads and trails within the range of the rown Pack and opportunistically along other logging roads, beaches, and trails on Revillagigedo Island axd the adjacent mainland. In, addition, den and rendezvous sites used by radiomollared wolves were visited in late summer and all soats present were colleoted. seats were also collected from rendezvous sites discovered by T. Kogut, USDA Forest Service Biologist, on Prince of Wales and pall is 1mnds.

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

Collected scats were individually baggad in plastie, labeled with location, date, and estimated date of deposition (for fresh scats) and then frozen. Frior to analysis, scats were oventatied at 100 C for 24 hours to kill Echinonoccus 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. a adult deer hatr or bones, fawn hair, bird Eeathers, etc.). Hair and bone fragments were compared with a reference collection and, if necessary, hair-scale imprints were used (Adorjan ana Kolenosky 2969).

Soats less than 2 cm in diameter, colleoted in sumer, were considered pup soats, Samples from den and/or rendezvous sites were traated aeparately to compare diets for specific packs duting earty pup-rearing periods.

Two statistics were caleulated for each seat gubsample:
(1) Fercent frequency of odcurxence $=$ number of times a diet 1 tem (e.gn, deer hair) was found in the scat sample, divided by the total number of diet items found in the seate; and
(2) Mean diet items per soat $=$ totah number of diet items in subeanple divided by the number of \$cats.

The lgt variable provides information on the relative importance of various.prey types in the diet. the 2nd value ia an index of variety in the diet (Kuyt 1972).
Soatr were grouped into subsamples fanimum $n=20$, babed on the location of deposition, to provide owtimates of diet composition for various wolf packs. Seasonal comparisons of summer (Apr-Sep) versug wintex (Oct-Mar) diet were based on soats with known depogition detes.

## RESULTS ANO DISCHSSION

## Objective i- Size, Distribution, and stablitty of Wolf Packe

No additional wolves were oaptured and radio-collazed during the $1985-86$ season. on 2 occasions wolves were daught in neck snaxes, but managed to esoape by chewing through the snare cable before we returned; to chedk the snaze: Wolf Vo. 2 a a young male that was firgt captured on 13 February 1985, was seddptured and fitted with a new radio collar on 23 Mareh 1986.

Results of ranjo tracking and observations of tracks supported the conclusion of sxith et al: (1.986a) that a minimum of 7 wolf packs occur on Revillagigedo IsJand. The packa vary in size from 2 to at least 9 wolvas and wexe found to use largely distinct territories (Fig. 1). Becalse pack movements were only mondtored for 15 to 18 months, no firm conclinions regarding the pack's territortal stability could be mada, However, some pack boundaries and uae areas appeared to differ between 1995 and 2986. Descriptions of individual pack histories follow.

## Town Pack

Smith et al. (1986a) reported that this pack numberad 7 to 11 wolves in late 1984 and produced a litter of pups in 1985. During the 1985 m 6 G wintet at leagu I pack member was killed by other wolves in an apparent territorial dispute and 3 wolves were taken by a reeteational trapper. At least $4-5$ wolves remained in this pack subsequent to these losses, so the
minimum pack gize in late 1985 had to have been $8-9$ wolves. Although we observed 2 members of this pack breeding in Febuuary 1986, we did not confirm the presence of pups in grying. At the end of the atudy this pack was estimated to consist of at laast 5 wolves.

Three memberg of the Town Pack were radio-collared in February 1985 and subsequent relocations indicated this pack utilized a ternitory of approsimately $150-200 \mathrm{~km}{ }^{2}$ including the drainages of the White River and Ward, Ketchikan, Mahoney, and Sjivis Creeks. In December 1985 thins pack made a brief incursion into the territory of the Naha River Pack near clover Paseage. During this time radiomeollared wolf No. 3 , a juvenile male, was killed by other wolves (presumably members of the Naha Packi. The lack of snow made dt impossible to determine if othex wolves were killed in this confliot. In Jaruary 1986 , radiomcollared wolf No. $S$, an adult female, made 2 brief incursion into the tersitory of the Eagt Chuck Pack.

Naha River Pack:
The Naha River Pack contaned 648 wolves in late 1985. Two female pack mambers were taken by a local trapper in Jmmajy 1986.

Reported sightings by local residents, as well as our observations, indicated this pack renged ovex an area of approximately $450 \mathrm{~km}^{2}$ including the drainages into Clover Passage, Mosier, Margarita, and Naha Bays, Traitora Cove, and Leask Creek (Fig. 1). No membets of this pack were radiocollaxed, however, so, actual pack boundaries were not estab1ished. The 1imited amomnt of gign observed along the beachen in this pack's territory indioateg it spent mueh of its time inland along major lake and gtream pystems.

## East Chuck Pack:

Smith et al. (I986a) indicated that this pack consisted of 3 to 5 wolves in 1984, incluaing radiomcollased walf No. 2 , a juvenile male. It was suspected that the pack produced pups in 1985. No direot observations of the Eagt Chuck Pack were made paior to late November 1985 ; at that time, wolf No. 2 diepexsed, but tracks in the snow indicated the pack gtill numbered about 5 wolves. Following No. 2 's dispersal, contant with thim pack was lost: howevex, 2 other members were subsequentily caught by a local trapper in the vioinity of Geosge InJet, and tracks of more wolves were seen, indicating several pack members remained.

The 2 wolves that wexe txapped were an adult female and a mala ptip, 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 trapa, 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 d985; he then left the territory in December. Initially, he moved to Rudyerd Island where he was obgerved to have killed a deem. After 2 weeks there he returned to hiq netal pack territory fox 1 week, but was not observed with other wolves. He then moved west to Carlanna Eake in the Town Fack texxitory for 1 week, returned to his natal pack area, and finaly moved east across Carroll Iniet and settled into the territory of the Carroll. Inlet pack.

## Carroll Iniet Fack:

Smith at d. (1986a) reported that the Carrolil 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 wegt of Thorne Arru 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 traoke observed at the time he was recaptured, he joined up with 2 wolves; presumably these were the remants of the Carroll Inlet Pack,

Although these 3 wolves were running togethex prior to the mating period in 1986, it is not known whether either of the Carroll Inlet Pack woivee tere females which might have bred wtth wolf No. 2, or "if"thats pack produced pups in 1986. From February through the end of June 19日6, these wolves ranged over an area of approximately $160 \mathrm{~km}^{2}$ (Fig. 2).

## Alava Bay Pack:

Smith et al. (2986a) repcired that the Alava Bay Pack consisted of $2-3$ wolves, including radio-coliared wolf No. 7, an adulet male, in late winter 1984-85, and that there was evidence that the pack had produced pups in spring 1985. Several repeat observationg of this pack in November and December 1985 confirmed that the pack had inereased to a miximum of 9 wolver. Although the lack of snow at low elevatians prevented tracking and hampered direat obeervation in 1986, at least 7 wolvem remained in this pack in late Eebruary. It is not"known whether additional pups were produced in spring 1986.

During late winter and gpring 1985, Emith et al, (1966a) repoxted that this pack ranged over approximately $75-100 \mathrm{~km}{ }^{2}$ (Fig. I). Summer movements of wolf No. 7 wexe हlso confined to this area, but beginaint 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 Fack.

In 1986, wolf Na, 7 "disappeared" for several weeks but was eventually relocated 5 kn northwest of his previous extreme movement. At that time he was apparentiy returning from an aven Ionger extraterritorial excussion (Messier.1985). From late April until the end of the profect he remained in the Bouthern portion of the territory within $5-10 \mathrm{~km}$ of the 1985 aen site.

## Lake Grace Pack:

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

Movements of wolf No. 6 in spring 1986 indioated 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 pabk ranged over a total of approximately $400-450 . \mathrm{km}^{2}$ including Smeaton Igland (Fig. 1). The pack moved onto Smeaton Island at least 3 times during the period in which it was monitored, inciuding a 3 -week stay in January and a 4 -week stay in February-March 1986.

## Northeast Pack:

Stuith et al. (1986a) estimated that a total of 8 wolves ocourred within this pack's territoxy in late 1984, although 2 of these were a distinot social group from the other 6. By June 1985, 1 member of each group had been radiomcollared but each died of starvation soon after maxking. One adaitional wolf may have been lost as a result of a trapping encounter (Smith et al. 2986a).

In September 1985, evidence was found that 4 to 6 wolves from this pack were feeding on spawning salmon (Oncorhynohus spp.) and beaver (Castor canadensig) in the vioinity of portage Cove. Throughout the remainder of the 1985-86 field season. bowever, only 2 gets of single wolf tracks were observed along beaches and trajis in this pack's territory. At present, the size of this pack is unknown.

Although the total area identified as belng within the territory of this pack is $350-400 \mathrm{~km}$, much of the northeastern half of this axea is virtually devole of deer, beaver, and salmonmpawning streams. We believe the axea actually used by this pack is much mmaller and is centered on the araimaqes of Portage Cove, $\begin{aligned} & \text { Veets Bay, Shrimp Bay, Gedney Pass, and Behm }\end{aligned}$

Canal west of claude point, The limited sign observed ajong beaches in 1986 indimates this pack must spend mueh of its time inland along major lake and stream systems.

Objective 2 - Activity Areas, Hunting Patterns, and DeerKill 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 lawer Whdte River drainatge from mid-Auguat through early october. . During that time, in excess of 120,000 sajmon spawned and died in the White. River (ADF\&G, unpubl. data) The East Chuck Pack spent the same time period in the vicinjty of 2 creeks draining into the ealt chuok at the head of George Inlet. These streams each contained more than 10,000 pink and coho salraon.

On-the-ground observations in both areas used by these packs confixmed 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 or andmon along virtually. every major spawning stream in the Behm Cansi district. The Aiava. Bay Pack also made fyequent visits to salmon spawning streansa but dianot remain in 1 area as much as the Town or East Chuck Facks. This may reflect the relatively large number of small stream syetems in the Alava Bay Pack territory, as opposed to the few large. spawning streams in the other paaks' ranges.

The Lake Grape Faok was the only pack that did not appear to use spaming salmon. in, summer. However, it made more extensive use of aipine ana subalpine areas than other packs and also used a plear-cut vajley that had baen extensively colonized by beaver. The pack's use of high elayations 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 sumbers' Elying, along alpine ridges, we only observed deer in 2 locations withith this pack"s texritory (smith 1984, and unpubl. datal o one of which was west of Mirror Lake. Eive days after we first observed 13 deer on this riage. in early September 1985, the Lake Grace Rack wat located on an apparent kilh whers 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 landilil as reported for the winter of 1984-85 (Smith et al. 1986a). However, the pack gpent more tirte hunting other parts of its terrifory than in

1984~85. In addition, fuvenile 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 terxitory in winter and dia not concentrate its activities in any particular location. However, relocations were freçuntly 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 Fack was generally found during exrly- and midminter 1985-86 to be hunting relatively steep slopes along the major lakes within its range, near beaver colonies at the inletes to these lakes, of on Smeaton Island. In the latter area, the padk was apparently feeding on dear, 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 colonieg 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 ocasionally observed in the snow.

In Gpring 1986 the Lake Grace Pack appeared to gettle into a den site in the lower Manzanita River arainage. The area was similar to its 1985 den site, consisting of a stand of mature spruce trees in the vioinity of a large omplex of beaver dams.

The lack of snow at most elevations used by wolves during the majority of the winter of $2985-86$, combined with dense vegetation, prevented oux gathering further data on hunting patterns or deer-killing rates. However, given an average pack size of 5-7 wolveg, and each wolf's ability to consume $5-10 \mathrm{~kg}$ of deer following a ki. 11 (Mech $1970: 118$ ), the pack studied here could easily consume an entire deer (average live weight: $35-45 \mathrm{~kg}$ (ADF\&G thpubl. datal) within hours. Thug, even under daeal conditions it is unlikely that wolves would often be found on a kill.

## Objectiva 3-Foot Habits

A total of 511 soats oontaining 594 diet items from 13 different food sources was oollected during this stiady (Table i). Deposition ate could accurately be determined for 271 of these scats. For the overall sample during summet, wolves fed predominantiy on deer, including a high proportion of fawns. Beaver also constituted a major proportion of the summer adet \{Table 1). For the Revillagigedo Ialand summer subsample ( $\mathrm{m}=296$ ) the same general pattern prevails (Table 2).

Numerous other studies report a similar high propostion of dear fawns, or other young ungulates, in summer wolf scata (Murie 1944, Mech 1966. Pimlott et al. 1969, Carbyn 1974, peterson 1974, Voight et al. 1976, scott and Shackeltion 1980, Hattar 1984). In faot, Hatter (1984) concluded that on Vancouver Island, black-tailad deer fawns were the major prey item, for wolves from June through August. The ratio of fawniadult rematns in scats analyzed by Hatter wss alinost identical to the ratios from Southeast Alagka ana Revillagigedo Island eamples (Tables 1 \& 2), so fawns may be more im portant than adulta in the sumper diet here as well.

Although many other studies report the use of beaver by wolvas (Murie 1944, Mech 1966, 1970; Peterson 1974, Carbyn 1974, Theberge et al. 1978, scott and Shackelton 1980, Hatter 1984) few have indicated uae as high as found here. Those sturies that do indicate levels of uge of beaver, in summer, of over 20\% frequency of ocourrenge ( PImIott et al, 1969, Frenzel 1974, Voight et al. 2976 ) were generaily conducted in areas with very low deer populations.

As previously aiscussed, woives were known to be feeding extensively on salmon turing late summer, but this usie was not reflected in scats. Two potential sources of bias may have caused this. First, only soats that could positively be identified ag wolf satts were ooliected, so amorphous scats, which were found along stream banks and composed entirely of fish remains, were rejected, as they might possibly have been Irom bears. Second, observationa and telemetry indicated that although the wolves came down to the streams to oatch and feed on the galmon, they usually moved eway from the stram to bed kown. This movement may have been designed to avoid contact with bears and would have resulted in the wolves ${ }^{\text {a }}$ defecating away from the stream banks where we searched for soats.
The winter diet of woives in southesst. Alaska in general and Revillagigedo Island in partioular, was also dominated by deer (Tables 1 and 2). However, beaver continued to represent approximately 20\%, and other sources accounted for about log of the diet items.

Throughout much of the range of wolves in North America beavers are unavailable in winter (Mech 1970) and only seotet and shaokelton (I980) reported significant use of beaver in winter. the avallability of beavers year-round in coastal regions provides an important supplement. to the wolf diet mat may increase wolves ability to regulate deer populations (Van Ballenbexghe 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 axe reflected in scats collected from summeruse 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, whete deer densities are relatively high, contained $93-96 \%$ deer, much of which was fawn halr. Soats from the Town and Lake Grace Packs' areas revealed that deer constituted kess 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. Phese trends refleot the fact that the Town Rack'a den was located near the Ketchikan landill and that the Lake Grace Pack's den was near an area of extensive beaver colonieg.

The mean number of prey items per scat tanged 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 bires are more available, than in winter, and to find a more varied diet where deer ase 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 anc overall (Table 5). This variation was largely due to the availability of human garbage as a supelement to the qual prey items.

Scott and Shackelton (1980) reported Finding onl.y l prey item per scat in Vancouver Tsland wolf feces, but Murie (1944) found more than 1 prey item per scat in feces from wolves in interior Alaska whem wolves were preying on rodents in addition to ungulates. Kuyt (1972) reported highly varied spring ana summer diets for tundra wolves, particularly during periods when the primary prey species, caxibou (Rangifer tarandus), was less evailable.

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

Although results of this study axe limited, they generally support the concepts and conoerns advanced by van Eallenberghe and Henley (1982). Specifically, we determined that while wolves prey mainiy 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 degpite low deer dersjties. Nevertheless, a wolf pack's territory size and the number of pack members appeared to be related to deer population density, so further Qeclineg in deer numbers or productivity due to cilmate or hablitet aiteration wini probabily rebule in Eewer wolves as well.

Wolves were found to be efficient at finding localized areas with relatively high deer numbers, and paike could be expected to take advantage of artificial concentrations of deer in habitat patches created through forest management. hacordingly, tirnber harvests should be designed ao as to minfmiae formation of small "tslands" of old qrowth and to aissire mobllity of deer between areas at suggested by karris (1984).

## ACKNOWLEDGMENTS

Many members of the Gant Diviston staff quigion I contribm wted to the development and implementation of this project. Gerry Dowhy contributed substantially to the wolf capture effort and his local knowiledge of wolf movements was helptul int mapping pack distributions. Dick Haminn, Jim Jakubek, and Dan Hassell piloted survey and tolemetiry flighte with skill and keen interest in the project which made flying in thie frequently poor wieather onditions both safe and erioyable. Greg Clevenger of the USDA Forest Service airanged cooperative funding and was highly supportive of the project. skipper kon Rusher ard Assistant Boat Offieer Kevin Perry of the $R / V$ Gundance provided logistical support for the project their halp is gxeatly appreciated.

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Table 2. Fereent frequency of occurtence of tams in the dyet from gummer (Apr-Sapt) and wintat (oct-Mar), and from totel scats collected Erom woives on Revillagigedo Lsland, Alaska, 1984-86.

| Diet ittm | Season |  |  |
| :---: | :---: | :---: | :---: |
|  | Surmex ${ }^{\text {a }}$ | Winter ${ }^{\text {b }}$ | Total ${ }^{\text {c }}$ |
| Adult dear | 42.5 | 71.2 | 55.6 |
| Fewn 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 |
| Walf | 0.4 | 1.6 | 0.8 |
| Garbage | 0.4 | 1.5 | 1.1 |
| Fish | 0.9 | 1.5 | 0.6 |
| toed | 0.9 | 3.9 | 0.6 |
| dridentified bones | 0.4 | 0.9 | 0.8 |
| Black bear | 0.9 | 0.9 | 0.6 |
| ${ }^{\mathrm{a}}$ ㅍ -196 gcats, 221 items. |  |  |  |
| ${ }^{\mathrm{b}} \mathrm{n}=64$ seats, 66 1temg, |  |  |  |
| ¢ it $^{\text {c }} 329$ gcate; 363 items. |  |  |  |


[^0]:    1 We neglected to add this item in our recommendations regarding Proposals 178 and $178 \cdot \mathrm{~A}$, for Unit-1A, so please consider them added through this note.

[^1]:    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.

[^2]:    x 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 extertual 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, oniy the other factors in its application.
    2 UsFS R10-MB-431, at 2-155.
    ${ }^{3}$ The multiplier represents the winter carryitng capacity of the highest quality habitat type; however, this lind of habitat is scarce.
    ${ }^{4} 2008$ Tongass Forest Plan (TL-MP) 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 radige 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."
    ${ }_{5}$ Caoulette, 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; //tonkass-
    fpadjust.net/Documents/Caotnette 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.

[^3]:    10 A term coined by ADF\&G research biologist Dave Person.

[^4]:    I Due to the early termination of this project; no activities were undertaken on objectjves 4-7.

[^5]:    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.

[^6]:    : When we speal here of a "version" of the model, this eacompasses the core of the model and the vegetative data and directives for some extetalal settings that are used when carrying capacity in deer

[^7]:    ${ }^{6}$ Caouette, J.; Kiramer, 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://tongessfpadjust.net/Documents/Cacuette_eta_\%202000 GTR482.pdf ${ }^{7}$ HSI is habitat suitability index, the non-dimensional output of the model that was mextioned in a previous footnote.

[^8]:    1. Due to the arly termination of this project, no activities were undertaken on Objectives 4-7.
