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Research Progress Report

# EVALUATION OF METHODS FOR ASSESSING DEER POPULATION TRENDS IN SOUTHEAST ALASKA

by
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SUMMARY

Systematic surveys of fecal pellet groups are widely used as an index to population distribution, census, and trend. Yet the relationship between the respective densities of fecal pellet groups and Sitka black-tailed deer (Odocoileus hemionus sitkensis) is not known. The primary objective of work conducted during this report period was to experimentally quantify that relationship.

In August 1986, 13 Sitka black-tailed deer were captured on Admiralty Island and transported to a small island in Auke Bay. The island, which had no resident deer prior to the transplant, was characterized by typical, high-quality deer winter range. All deer were fitted with mortality-sensing radio collars so that the loss of any individuals (by death or emigration) could be noted.

The population declined steadily through the fall, winter, and spring. Deer density on the island averaged 14.5 deer/km$^2$ (38.7 deer/mi$^2$) between the time deer were released and the time pellet-group density was measured (i.e., 264 days later). Using standardized pellet-group survey techniques, the pellet-group density averaged 0.99 pellet groups per 20-m$^2$ plot (95% CI: 0.87-1.12). When we compared that to the mean deer density over the same time period, we found that deer density was approximately equal to the observed pellet-group density times 39. This conversion factor is approximate, and it will vary depending on prevailing environmental conditions (habitat and weather) in different areas.

The objectives, methods, and results of the Alaska Department of Fish and Game's (ADF&G) deer pellet-group surveys from 1981-87 are described in a separate report (Kirchhoff and

Pitcher 1988); the strengths and weaknesses of pellet-group surveys for specific management and research applications are also discussed. With appropriate precautions, pellet-group data currently being collected appear adequate for assessing population trends within individual Value Comparison Units (VCU), or watersheds, and can be used to make valid general comparisons among most VCUs.

Key Words: black-tailed deer, Odocoileus hemionus sitkensis, browse, old growth, pellet-group counts, population assessment, Southeast Alaska.

CONTENTS



## BACKGROUND

This study addresses the need to develop a method or combination of methods for effectively monitoring changes in deer population size and trend from site to site and year to year for individual planning areas within the region. Emphasis is placed on the pellet-group count technique. Literature review and background information are reported in Pitcher and Kirchhoff (1986) and elsewhere in this report (<u>see</u> Objective 1).

<u>Objective 1: Prepare a written report documenting the objectives, methods, and results of the current deer monitoring program</u>.

In 1981 ADF&G initiated a region-wide program to assess deer pellet-group density on selected Value Comparison Units (VCU) throughout Southeast Alaska. A report has been completed documenting the objectives, methods, and results of this program (Kirchhoff and Pitcher 1988). Pellet-group data appear adequate for assessing population trends within individual VCUs and may be used to make general comparisons among VCUs. We caution against placing undue significance on small differences in pellet-group densities. Defecation rates, pellet-group persistence, pellet-group visibility, and winter deer distribution may vary slightly from year to year and area to area; these factors introduce confounding variation. Future reports covering deer pellet-group-monitoring activities will be produced on an annual basis.

Objective 2: Establish a population of known size on a small island in Southeast Alaska.

Deer population densities that have been computed from pellet-group densities are uncertain because defecation rates and pellet-group disappearance rates are variable or unknown and an unknown percentage of pellet groups are missed by field crews during sampling. These problems can be circumvented by measuring pellet-group density (using typical effort and accuracy) in a finite area where the number of deer is a known factor. The observed relationship between pellet-group density and deer density may then be extended to other areas in Southeast that exhibit similar habitat and weather conditions.

The area selected for this study was Portland Island, a small, 0.40-$km^2$ (0.15 $mi^2$) island in Auke Bay near Juneau. The entire island is forested with western hemlock (Tsuga heterophylla) and Sitka spruce (Picea sitchensis) old-growth, primarily volume classes 4 and 5; i.e., 8-30 MBF/acre (Fig. 1). Relief is low, with a maximum elevation of 20 m (65 ft.). Portland Island is relatively isolated, lying approximately 4 km from Admiralty Island, 4 km from the mainland, and 3 km from the nearest small island (Fig. 2). Although deer were reported on Portland Island in the mid-1970's, field reconnaissance prior to the release found no deer inhabiting the island.

On 20-21 August 1986, 13 deer (i.e., 7 males, 6 females) were captured by net gun from a helicopter in alpine habitat on Admiralty Island. The deer were immobilized with an intramuscular injection of ketamine hydrochloride (Vetalar, Parke-Davis, Detroit Mich.) and xylazine hydrochloride (Rompun, Haver-Lockhart, Shawnee, Kans.) and transported to Portland Island by helicopter. There, bucks were given vasectomies by a Department veterinarian to ensure that the island population would not increase and, consequently, become unknown. All deer were fitted with mortality-sensing radio transmitters so that the loss of any individuals, either by swimming off the island or dying naturally, could be noted. The island was closed to deer hunting.

Periodically throughout the year, deer were relocated primarily from skiffs and occasionally from aircraft. Within 5 days of release, 1 buck had returned to Admiralty Island; throughout that fall, others (mostly bucks) also returned. By 1 November, only 6 deer (5 females, 1 male) remained on the island. When pellet-group densities were measured 8.5 months after the transplant, the population was down to 4 female deer. By 1 July there were no deer on the island.

Of the 13 deer released, 3 died on the island. One buck died within 12 hours of release, presumably from capture-related complications. The 2nd buck was in very poor physical condition when it died in late October. A 3rd female deer was found dead on 31 December from undetermined causes; she appeared to be in good physical condition at the time of death.

Of the 10 deer that swam off the Island, eight made it safely to land. Two deer were found drowned near Shelter Island shortly after pellet-group crews had intensively sampled the Island, suggesting that our activity may have prompted them to swim under less-then-desirable conditions. Of the deer that made land, five returned to Admiralty Island; two to Douglas Island; and one to Coghlan Island; this deer was also seen on the mainland.

To calculate the residence time of each deer on the island, I assumed an individual deer had left the island (or died) midway between the date it was last located and the date it was discovered missing (or dead). The calculated length of residency of each deer is displayed in Table 1.

A total of 1,538 deer-use days accumulated on Portland Island between the release date (21 August) and the date when pellet groups were counted (12 May). That amount of use is equivalent to 5.8 deer spending the entire 264-day period on the island. This "population" of 5.8 deer represents a density of 14.5 deer/km$^2$ (38.7 deer/mi$^2$) over the time period studied.

The pellet groups deposited on the island were censused on 12 May 1986; a series of 10 transect lines running from shore to shore, perpendicular to the long axis of the island, and at uniformly spaced 60-m intervals were used. The transect starting points were described and permanently marked with numbered aluminum tags. Sampling methods used were identical to standardized ones used on pellet-group transects around the region. A complete description of standard field methods is provided in Kirchhoff and Pitcher (1988).

A total of 381, 1- x 20-m plots were sampled; the mean pellet-group density was 0.99 pellet groups per plot (95% CI of 0.87-1.12). By relating the known deer density to the 95% CI for pellet-group density, we found that each pellet group counted on a typical 1- x 20-m plot represented between 12.9 and 16.6 deer/km$^2$ (34.5-44.5 deer/mi$^2$).

Objective 3: Quantify biases associated with the pellet-group census technique.

Individual observers tend to count different numbers of pellet groups, depending on individual attentiveness, search time per plot, visual acuity, and varying decision criteria. During the spring pellet-group surveys in 1987 and 1988, field crews worked in 2-person teams; individuals alternated counting and line-pulling duties every 5 plots. The null hypothesis is that the pellet-group means are independent of the observer.

In the spring (1987 and 1988), plots were randomly selected by the line-puller, and both team members carefully reexamined them to determine the number of groups missed. This procedure was carried out on 5-10% of all plots counted. The null hypothesis is that pellet-group means are independent of search intensity (i.e., a significant number of groups are not missed with typical effort).

No analyses have been conducted to date. The 1987 and 1988 data sets will be combined, and analyses will be completed in the next reporting period. An analysis of the strengths and weaknesses of pellet-group surveys as a trend-monitoring technique is included in Kirchhoff and Pitcher (1988).

Objective 4: Quantify pellet-group deterioration rates.

Deer densities calculated from pellet-group counts require knowledge of (1) the average number of pellet groups deposited per deer per day, (2) the length of time pellet groups persist in recognizable form, and (3) the area used by deer during the time period under consideration. Of these, pellet-group persistence is probably the most important factor affecting counts in Southeast Alaska. Although previous work in forested environments in Southeast suggests that 6 months is a reasonable "life" for a pellet group (Fisch 1979, Rose 1982, Schoen and Kirchhoff 1983), a great deal of variability exists, ranging from over 2 years in some habitats on Vancouver Island (Harestad and Bunnell 1987) to less than 3 months in some habitats in Prince William Sound (H. Griese, ADF&G Biologist, Cordova, pers. commun.). In general, pellet groups decay more slowly when frozen, covered with snow, exposed to the drying effects of sun and wind, and/or shielded from driving rain.

Had deer stayed on Portland Island longer, we planned to document pellet-group persistence by regularly monitoring cleared and uncleared plots. The time in which the difference between the two types of plots becomes insignificant is the "life" of a pellet group. Because all deer left the Island shortly after the transects were established, this segment could not be completed.

Some anecdotal evidence, however, was obtained. Twelve pellet groups were marked in the forest on Portland Island during the first week of September. These pellet groups were still visible on 14 May, nearly 9 months later. Traces of about half the pellet groups could still be found 12 months after they were marked; however, it is doubtful field crews would notice groups in like condition. The longer-than-expected persistence of pellet groups on Portland Island may be due to the relatively low annual precipitation common to Auke Bay (i.e., 147 cm [58 in]); Selkregg n.d.). The finding (i.e., pellet groups deposited in a range of forest types on North Admiralty Island persisted for approximately 7 months) of Schoen and Kirchhoff (1983) are probably most applicable for the region as a whole. More research on pellet-group persistence across a range of precipitation and temperature regimes in Southeast Alaska is recommended.

Objective 5: Evaluate the impact of a known-density deer population on existing forage supplies.

Browse utilization surveys are commonly used as an index to range condition and animal abundance (Jensen and Scotter 1977, Telfer 1981). Interpretation, however, can be difficult because the degree of utilization observed is both a function of the number (density) of deer and the amount of forage available (including nonbrowse species). The introduction of deer to Portland Island afforded an opportunity to estimate the amount of forage on the Island before the introduction and to monitor subsequent changes in forage composition, biomass, and browse utilization over time.

Biomass estimation:

A series of 100 permanently marked points was established with numbered stakes spaced at 17-m intervals along a transect running the length of Portland Island. A 30- x 60-cm plot frame, with the long axis having a north-south orientation, was placed at each marked point, and the percentage of the plot area covered by each understory species was estimated. Biomass estimates for herb-layer species were computed from these cover estimates (Alaback 1986). Biomass of shrub species was calculated from basal diameter measurements of stems rooted in each plot (Alaback 1986). Alaback's regression equations are currently being revised to incorporate additional data (P. Alaback, pers. commun.). When those equations are complete, biomass estimates by species will be calculated and incorporated in the next progress report.

Browse utilization:

The effects of deer browsing on *Vaccinium* were monitored on a randomly selected sample of plants. Four quadrants bounded by north-south and east-west azimuths were located at each of the 100 sample points. The nearest *Vaccinium* plant over 40 cm tall in each quadrant was located and flagged, and the species, height, and basal diameter of each plant, as well as its distance to the sample point, was recorded. Measurements were discontinued at sample points where Vaccinium were rare (i.e., when the distance to the nearest plant in any one quadrant exceeded 15 m). Flagged plants were to be revisited at the end of each year, and the number of stems browsed, terminal diameter of each browsed stem, and length of each browsed stem (i.e., distal from lignified growth) were to be noted; however, the marked plants showed little evidence of browsing when examined in August 1987, and collection of further measurement data was deemed unwarranted. Given the high forage availability on Portland Island and the relatively low deer density, we concluded the effect of deer foraging on Vaccinium was minimal. Because no deer remained on the island after 1 July 1987, further work on this job segment is not possible.

Twig weight-diameter relationships:

To develop the relationship between the consumed biomass and terminal-stem diameter and/or stem length, 33 Vaccinium plants were collected from the island. Plants were selected to represent a range of species, heights, basal-stem diameters, and vigor. The species, age, basal-stem diameter, height, total wet weight, total dry weight, and wet and dry weights of the stem-only and leaf-only components of each plant were measured. Wet weights were collected from frozen specimens; dry weights were taken after the plants had been oven-dried at 50 C for 24 hours.

Ten stems (distal from lignified growth) were randomly selected and clipped from each plant. Small plants with fewer than 10 stems were used in their entirety. All stems were cut into 3 equal lengths, and the basal diameter, wet weight, and dry weight of each segment were recorded. Currently, 16 of the 33 plants collected have been processed and the preliminary analyses have been run. The last 17 plants will be processed in the next report period. Species-specific regressions will be developed and presented in the next report.

Deer exclosure:

To preserve some of the original (i.e., preintroduction) vegetation for future comparative work, a 0.01-ha (10 x 10 x 2 m high) deer exclosure was constructed near the middle of Portland Island in an area representative of an old-growth hemlock forest. The deer exclosure will be maintained in the event that additional deer are transplanted in the future.

As a sidenote to this objective there was one unusual observation worth mentioning. Within 1 month of their release on Portland Island, the deer had noticeably browsed mature devil's club (Oplopanax horridum) and skunk cabbage (Lysichiton americanum) plants over major portions of the island. Fully mature skunk cabbage leaves were consumed down to the thick midrib wherever the plant was found. Devil's club was not as extensively browsed, but in some small 0.5-ha patches, virtually every mature leaf within reach had been stripped from the plants and eaten. Elsewhere in Southeast Alaska, we had not observed such intensive use of mature devil's club and skunk cabbage plants in midsummer, especially where abundant forbs and Vaccinium are available (i.e., Portland Island).

Objective 6: Evaluate the relationship between deer pellet density and hunter effort and success.

Hunter success (i.e., per unit of effort) may be a reliable indicator of population size and trend, at least for areas that are regularly hunted. Relationships between pellet-group data and hunter effort and success were evaluated in 3 areas around Southeast for which both types of data existed: (1) Nakwasina Passage, (2) Gravina Island, and (3) Shelter Island. Pellet-group data and hunter harvest statistics for each of these 3 areas are presented in Table 2.

Comparisons over time within a given area are the most meaningful, because other factors influencing hunter success (e.g., modes of access, habitat types, hunter characteristics, seasons, and bag limits) are controlled. Although data are limited, we found that increases in pellet-group density (and presumably deer) were not accompanied by increased harvest success in two of the 3 study areas; however, pellet-group data may have been inordinately high in 1985 (Table 2) because late snowfall prevented the sampling of the upper-elevation winter range.

While we compared study areas, we found that Nakwasina had the highest pellet-group density and the highest harvest per unit of effort among the 3 areas. Although Shelter Island had a higher deer density than Gravina Island in both 1984 and 1985, hunters had a higher success rate on Gravina Island in 1985 than those hunting on Shelter Island. The differential is additionally unexpected because Gravina Island has a bucks-only season, while Shelter Island has an either-sex season.

As long as winters remain mild, we can expect deer numbers and hunter success and effort to remain high. Pellet-group data, as well as hunter harvest data, will continue to be collected in all 3 areas, although this will possibly occur at a reduced intensity until deer numbers change.

Objective 7: Report Writing

This study, originally scheduled to run through 30 June 1992, will be curtailed because of loss of deer from Portland Island. Jobs in progress will be completed during the 1 July 1987-30 June 1988 report period, and a draft final report will be prepared by 1 January 1989. A new problem analysis and study plan will be prepared by 30 June 1989.

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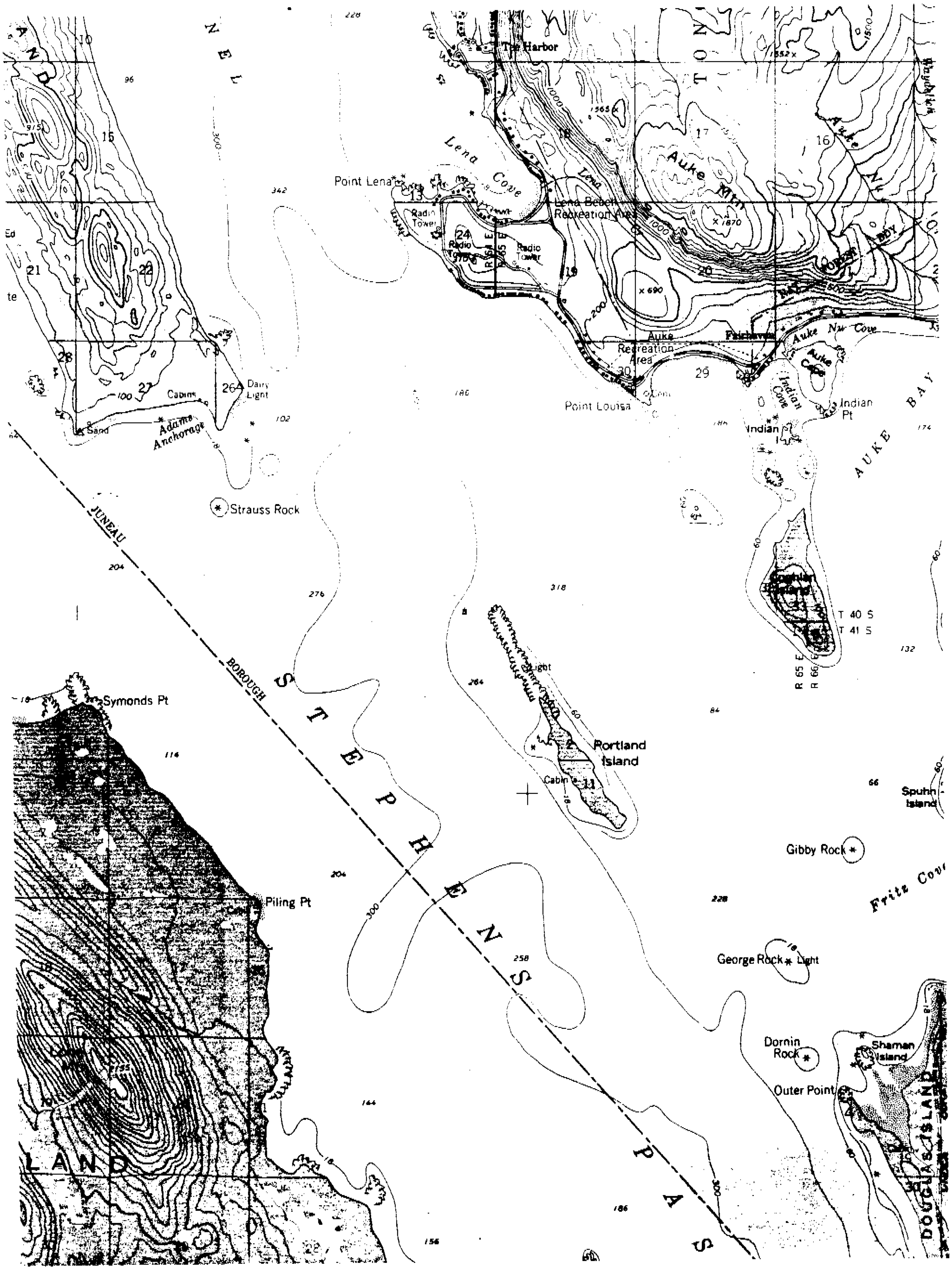


Figure 1. Location of Portland Island relative to other land masses.

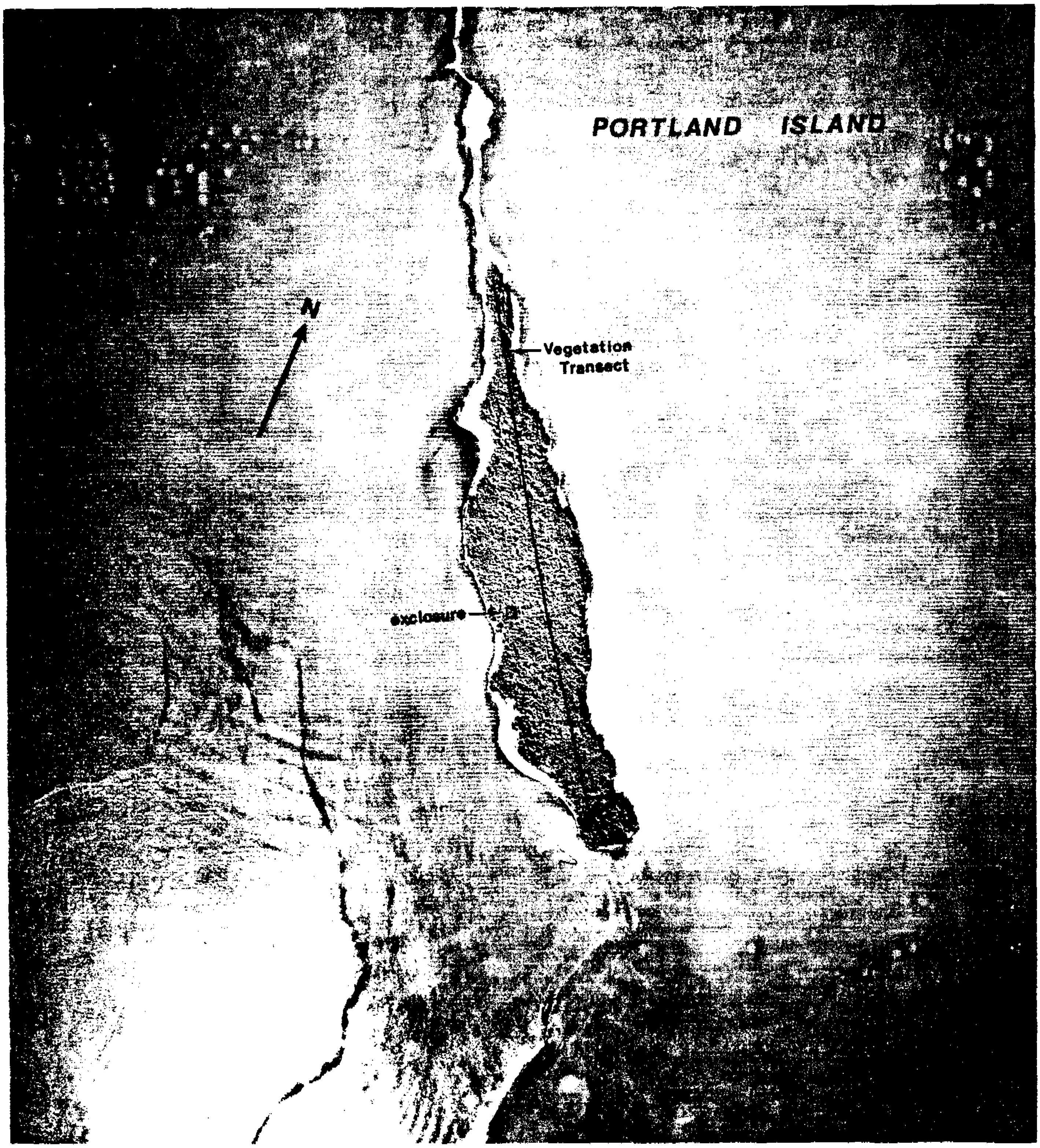


Figure 2. Portland Island, showing location of vegetation transect and deer exclosure.

Table 1. Calculated length of residency of 13 deer on Portland Island, Juneau, 1986-87.

| Deer No. | Sex | Last located | First missing (or died) | Days on Island[1] |
|---|---|---|---|---|
| 150.590 | M | 8-21-86 | 8-22-86 (died) | 0 |
| 150.500 | M | 8-21-86 | 8-25-86 | 3 |
| 150.540 | M | 8-25-86 | 9-11-86 | 13 |
| 150.150 | F | 9-11-86 | 9-13-86 | 22 |
| 150.750 | M | 9-13-86 | 9-26-86 | 30 |
| 150.800 | M | 9-26-86 | 10-07-86 | 42 |
| 150.760 | M | 10-07-86 | 10-30-86 (died) | 59 |
| 151.490 | F | 12-08-86 | 12-31-86 (died) | 120 |
| 150.730 | M | 2-23-87 | 5-01-87 | 193 |
| 150.710 | F | 5-01-87 | 7-01-87 | 264[2] |
| 150.780 | F | 5-01-87 | 7-01-87 | 264[2] |
| 150.600 | F | 5-01-87 | 7-01-87 | 264[2] |
| 150.570 | F | 5-01-87 | 7-01-87 | 264[2] |
| | | | total deer days: | 1,538 |

[1] Number of days from date of release to a date midway between last location on island and first location off island (or death).

[2] Maximum number of days, up 12 May 1986 when pellet-group transects were counted.

Table 2. Mean pellet-group density per plot and mean deer harvested/hunter day at Shelter Island, Nakwasina Passage, and Gravina Island, 1984 and 1985.

| Area | Year[1] | Pellet Group Mean | Pellet Group (95 % CI) | Deer per Hunter Day Mean | Deer per Hunter Day (95 % CI) |
|---|---|---|---|---|---|
| Shelter | 1984 | 1.82 | 1.67-1.97 | 0.29 | 0.15-0.43 |
| | 1985 | 2.20 | 2.02-2.37 | 0.23 | 0.11-0.35 |
| Nakwasina | 1984 | 3.92 | 3.67-4.17 | 0.50 | 0.36-0.64 |
| | 1985 | 3.50 | 3.26-3.76 | 0.62 | 0.40-0.84 |
| Gravina | 1984 | 1.23 | 1.13-1.32 | 0.09 | 0.01-0.17 |
| | 1985 | 1.40 | 1.30-1.50 | 0.33 | 0.15-0.51 |

[1] Pellet density data are staggered back one year to allow comparisons with appropriate deer hunter statistics (e.g., 1985 pellet data collected in 1986).

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