Evaluation of Methods Utilized to Estimate Deer Harvest in Alaska[1]

by

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Introduction

From 1969 through 1974 personal hunter interviews and mandatory hunter report cards were used by personnel of the Alaska Department of Fish and Game to estimate the annual harvest of Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) in southeast Alaska.

The Department estimated annual deer harvests from 1959 through 1968 by hunter interview only. In 1969 the Department initiated a "mandatory" harvest report program for hunters of deer and several other big game species. The program consisted of the issuance of species tags to all hunters who were required by regulation to mail in results of their hunting effort. The program had many problems, one of which was that hunters were issued reports for species they did not intend to hunt. Beginning in 1971 individual deer harvest reports were issued. Both the deer harvest report program and the hunter interview were continued simultaneously in order to assure data continuity. Consequently, an opportunity was created to compare 2 independent methods for estimating annual harvest. The purpose of this paper is to document results obtained from each method, examine each method's benefits and shortcomings, and discuss their management implications and potential.

Personal hunter interview--At the conclusion of each deer season, state personnel tabulated total numbers of resident license sales per town. Biologists or technicians then interviewed a 10 percent sample of hunting license holders in selected communities. Surveys were conducted where large numbers of interviewees were readily available, such as in post offices, government offices, or "on the street." Since 1959, the interviews were always conducted in 5 major southeast Alaska communities (Juneau, Ketchikan, Petersburg, Wrangell, and Sitka) and on occasion in smaller communities when time and manpower permitted.

Interviewees were selected by asking the question: "Did you purchase a hunting license this past year?" If the individuals answered "no" they were not interviewed further nor were they considered part of the sample. If they answered "yes," the following question was asked: "Did you hunt deer this past season?" If they answered "no," they were counted as a nonhunter. If they responded "yes," the interview was continued by asking the following questions:

      (1) "How many days did you hunt and where did you hunt?"

      (2) "Did you kill a deer?"

      (3) If so, "What was the sex of the kill?" and

      (4) "Where did you take it?"

At the conclusion of the interviews, area biologists computed percentages of active hunters, nonhunters, hunter success, deer per hunter, and days hunted per deer killed. These percentages were then directly applied to total license sales to estimate total number of hunters and total deer harvested by each community. Hunter interviews for southeast Alaska annually cost about $2,000 and required a minimum of 25 man-days of personnel time.

Mandatory harvest report cards--Prior to each deer hunting season, hunters were required by regulation to obtain harvest tickets which they were to punch immediately after harvesting a deer. Affixed to the punch card was a pre-addressed, stamped report card upon which each hunter was required to report hunt results and to mail the card in at the conclusion of the season.

Hunters were given 45 days after the conclusion of the season to send in their reports. At the end of the period, each nonreporting hunter was sent a reminder letter. Report holders were then given another 45 days to respond. At the conclusion of this time period, all returns on hand were keypunched and entered into a computer. Report cards or reminder letters received after this time period were not included.

Established computer programs summarized the harvest by specific location and game management unit. Estimates of total harvest and harvest per community were hand tabulated by applying the percent of respondents who hunted and deer harvested per hunter to total reports issued. Early computer-based analyses were not conducted on a community basis and so data were hand tabulated by utilizing zip codes of responding hunters; thus, some recording errors were possible. About 2 percent of the harvest data were not identifiable to individual communities. These data were used in this analysis, however, by assuming that the percentages of identifiable community data also applied to the data of unidentifiable origin. The harvest report system for southeast Alaska annually costs the Department approximately $12,000 and requires about 50 man-days of personnel time.

Comparisons of total annual deer harvest estimates, based on reports versus inter-
views for 1969 through 1974, indicated that both estimates provided the same annual
trend for total deer harvest (fig. 1). However, the hunter interview estimates were
considerably higher than the harvest report figures. Differences range from a 68 per-
cent higher estimate in 1969 to a 9 percent higher estimate in 1972. Overall for the
study period, the interview provided a 38 percent higher estimate of deer kill.

Comparisons by community of annual southeast Alaska deer harvest statistics for
1969 through 1974 revealed that, for individual communities, the hunter interview esti-
mates of various statistics were higher than those provided by harvest reports (table
1). The only exception occurred for actual deer kills reported by respondents on both
survey methods. This exception was expected, since the deer harvest report was an
attempt at total enumeration whereas the interview was a 10-percent sample of licensed
hunters. Deer harvest report response rates during the study period averaged 71
percent, excluding 1973 when reminder letters were not sent.

The relationship between estimates of annual deer harvested per community, as
derived from the 2 survey methods, was assessed with a correlation analysis. The 2
estimates were significantly correlated ($r = 0.92$, $\underline{P} < 0.01$), with interview estimates
being considerably higher than those of the harvest report. The magnitude of the dif-
ferences between the 2 methods appeared greater for the larger communities sampled.

Numbers of total hunters per community as estimated from the 2 methods were
compared. A significant correlation ($r = 0.88$, $\underline{P} < 0.01$) existed, with the hunter
interview providing the larger estimate. Differences between the 2 estimates did not
appear to be related to size of communities sampled. A Chi-square analysis of annual
reporting successful to unsuccessful hunters per town for each method was performed in
an attempt to determine whether each method was sampling the same hunter population.
Significant differences ($\underline{P} < 0.01$) were detected for Ketchikan-1970, Petersburg-1970,
Wrangell-1970, and Sitka-1974. Differences in 1970 are believed due to the use of an
untrained interviewer. No explanation can be given for the difference in the Sitka-
1974 data. All other ratios were not significantly different ($\underline{P} > 0.01$), indicating
that both methods were sampling from the same hunter population.

Numbers of hunting licenses sold and harvest reports issued per community for
1973 and 1974 were significantly correlated ($r = 0.9$, $\underline{P} < 0.01$). Number of hunting
licenses sold was higher than number of harvest reports issued per community. These
data are of significance because they provide the basis for projecting total numbers
of hunters and total estimated deer harvest. If each method had provided a similar
deer-harvest-per-hunter value, the interview estimates would be higher due to the
baseline data from which the estimate is calculated.

Estimated harvests per hunter per community as derived from each method were
significantly correlated ($r = 0.87$, $\underline{P} < 0.01$). The hunter interview estimates of deer
harvested per hunter had a significantly higher variance ($F = 2.3$, 19 df, $\underline{P} < 0.05$)
than the harvest report estimates. Since the data collected on deer harvest from 1969
through 1973 indicated a considerable discrepancy between the 2 methods, an effort was
made during the 1974 interview to acquire the name of each hunter interviewed so that
individual report responses could be compared. Hunters were asked their name after
the interview was concluded.

Data from hunters interviewed were divided into: (a) report holders who stated
they hunted and (b) those who stated they had not hunted. Four hundred and twelve
individuals were interviewed for the 1974 hunting season, of which 223 (54 percent)
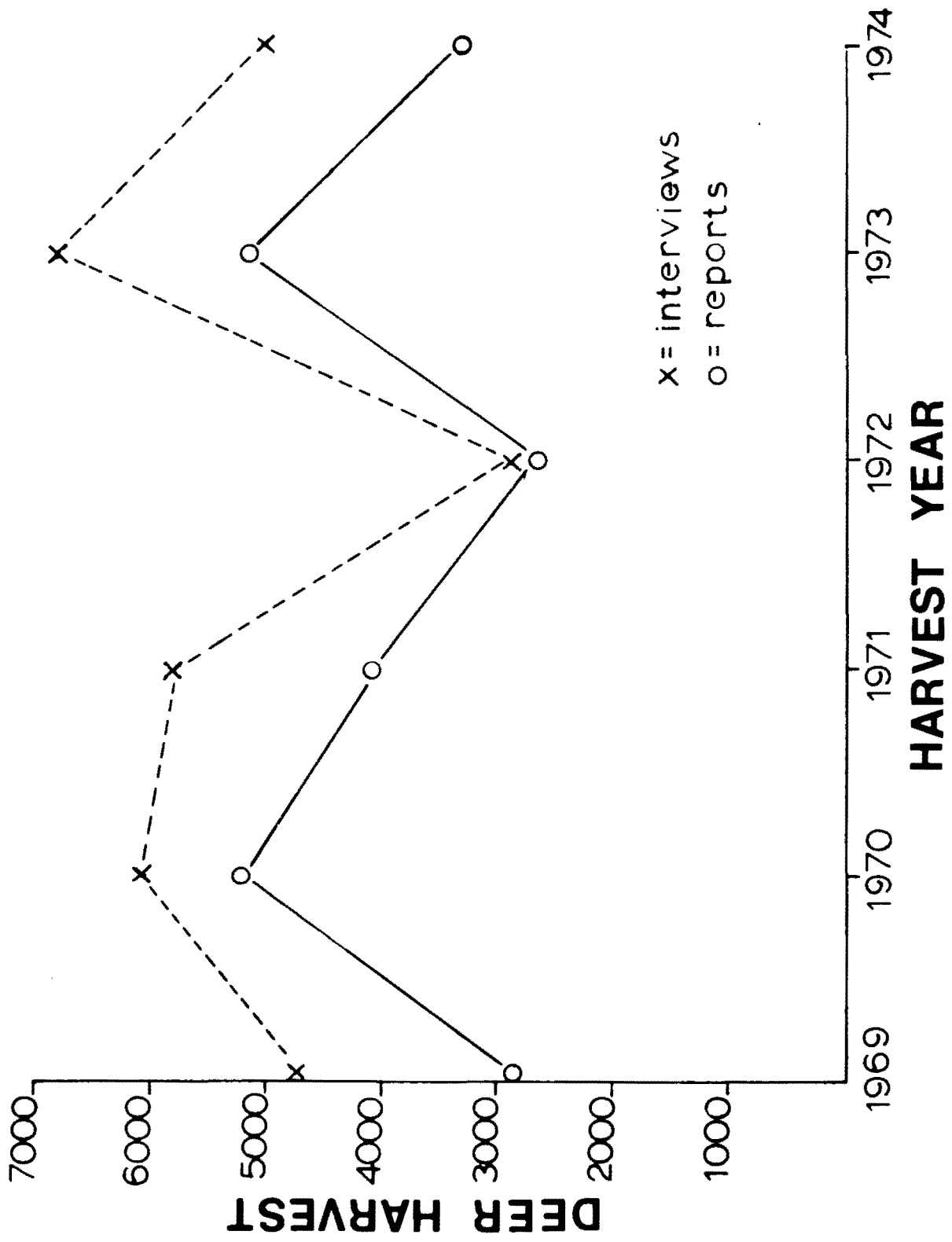responded that they had hunted. Of the reported hunters, 203 (91 percent) had

Figure 1. Estimated annual southeast Alaska deer harvest derived from interviews versus reports, 1969 through 1974.

Table 1. Comparison of deer harvest statistics as obtained from 2 survey methods [interview (Int.) and report (Rep.)] for selected southeast Alaska communities, 1969 through 1974.

Year	License sales	Harvest reports issued	Percent doe harvest		Percent who hunted		Estimated number of hunters		Estimated deer per hunter		Estimated total deer harvest	
			Int.	Rep.	Int.	Rep.	Int.	Rep.	Int.	Rep.	Int.	Rep.
-- Juneau --												
1969[b]	2,580	a	56	a	66	a	1700	1279	.61	.42	1037	537
1970	3,120		49		54		1680	992	1.20	.92	2016	913
1971[c]	3,286		49		62		2037	1296	.90	.78	1833	1011
1972	3,253		47		51		1659	1215	.50	.53	830	644
1973[d]	4,053	2,689	48.3	48.7	58.4	66.0	2367	1771	.77	.98	1823	1735
1974	3,687	2,586	40.7	36.3	53.4	63.1	1969	1627	.61	.61	1201	993
-- Ketchikan --												
1969[b]	2,060	a	36	a	78	a	1610	1326	1.21	.66	1948	875
1970	2,160		35		74		1600	1178	1.10	.9?	1760	1096
1971[c]	2,216		28		74		1640	1180	.70	.66	1148	779
1972	1,912		44		64		1224	814	.40	.34	490	277
1973	2,245	1,593	27.6	28.5	76.0	72.2	1706	1149	.64	.62	1092	712
1974	2,089	1,488	42.9	23.9	69.0	64.9	1437	963	.36	.38	517	366
-- Petersburg --												
1969[b]	780	a	43	a	79	a	620	575	.51	.52	316	273
1970	820		27		70		570	484	1.39	.61	792	295
1971[c]	794		35		75		596	427	.85	.90	507	384
1972	666		33		66		440	266	.30	.50	132	133
1973[d]	788	453	48.1	40.7	57.5	53.9	453	244	1.13	1.11	512	201
1974	709	445	44.7	29.7	53.8	46.3	381	205	.88	.85	335	174

Table 1. (continued)

Year	License sales	Harvest reports issued	Percent doe harvest		Percent who hunted		Estimated number of hunters		Estimated deer per hunter		Estimated total deer harvest	
			Int.	Rep.	Int.	Rep.	Int.	Rep.	Int.	Rep.	Int.	Rep.

-------------------------------------- Sitka --------------------------------------

Year	License sales	Harvest reports issued	Int.	Rep.	Int.	Rep.	Int.	Rep.	Int.	Rep.	Int.	Rep.
1969[b]	810	a	52	a	75	a	610	743	.80	.60	490	446
1970	1,080		42		76		820	812	2.10	1.31	1720	1064
1971[c]	1,025		48		81		830	824	1.70	1.33	1411	1096
1972	879		45		86		756	761	1.40	1.19	1058	906
1973[d]	1,297	1,060	42.7	31.3	83.1	81.4	1091	867	2.45	1.76	2673	1526
1974	1,265	1,119	44.4	33.5	84.6	79.3	1070	831	1.91	1.43	2044	1188

-------------------------------------- Wrangell --------------------------------------

Year	License sales	Harvest reports issued	Int.	Rep.	Int.	Rep.	Int.	Rep.	Int.	Rep.	Int.	Rep.
1969[b]	500	a	44	a	86	a	430	378	.59	.48	254	181
1970	500		64		70		350	381	.40	.95	140	362
1971[c]	592		25		55		326	242	.39	.40	127	97
1972	558		45		53		296	171	.31	.35	92	60
1973[d]	655	446	33.3	00.0	35.0	43.6	229	194	.57	.27	131	52
1974	581	485	33.3	24.4	46.0	43.5	267	211	.62	.30	116	63

-------------------------------------- Other[e] --------------------------------------

Year	License sales	Harvest reports issued	Int.	Rep.	Int.	Rep.	Int.	Rep.	Int.	Rep.	Int.	Rep.
1969[b]	590	a		a		a	470	713	1.52	.72	700	513
1970	590						389	1005	1.34	1.46	521	1467
1971[c]	603						513	710	1.50	1.00	770	710
1972	739						473	644	.60	.97	284	625
1973[d]	830	1,063			63.4		516	664	1.11	1.31	573	870
1974	1,602	1,102			53.0		953	581	.82	.95	781	552

Table 1. (continued)

Year	License sales	Harvest reports issued	Percent doe harvest		Percent who hunted		Estimated number of hunters		Estimated deer per hunter		Estimated total deer harvest	
			Int.	Rep.	Int.	Rep.	Int.	Rep.	Int.	Rep.	Int.	Rep.
			------------------------------- Totals -------------------------------									
1969[b]	7,320	a	a	a	a	a	5440	4964	a	a	4745	2825
1970	8,270						5409	4852			6019	5197
1971[c]	8,516						5942	4679			5796	4077
1972	8,007						4848	3871			2886	2645
1973[d]	9,867	7,310					6362	4889			6804	5166
1974	9,933	7,225					6077	4418			4994	3336

a - Data by community for 1969 through 1972 not available due to computer programming difficulties.
b - Multi-species tickets initiated.
c - Single-species tickets initiated.
d - No reminder letters were went.
e - Hunter interviews were not conducted in other communities, harvest estimates calculated by using averages of major communities.

possessed harvest reports. Of those that had possessed reports, only 159 (78 percent) returned them. Overall, this gave the harvest reports a 71-percent sample of actual hunters, assuming the interview data were accurate. One hundred eighty-nine individuals were interviewed who stated they had not hunted. Of that figure, 83 (44 percent) had possessed harvest reports with 66 (80 percent) of these individuals having returned them. Ten of the interviewed individuals, who stated they had not hunted, reported on the harvest report card as having hunted.

It was apparent that the successful hunters who did not possess harvest reports, and those who did but failed to return them, accounted for some of the discrepancies between the 2 methods. According to these data, about 9 percent of the successful hunters interviewed may not have possessed reports while 29 percent of the successful hunters who did possess them failed to return them. These 2 groups combined account for 28 percent of the reported deer harvest, according to interviews. Conversely, 8 percent of the successful hunters who sent in their reports stated during the interviews that they had not hunted deer. Their reported kills account for 6 percent of the total harvest according to the reports.

Individual responses of hunters who participated on both surveys during 1974 were compared. No significant differences were detected for total deer harvested ($t = 0.01$, 63 df, $P > 0.05$), total doe harvest ($t = 0.22$, 63 df, $P > 0.05$), or total days hunted

(t = 0.08, 97 df, P > 0.05). These data indicate that when hunters did respond on each survey method they provided similar data.

Mean days hunted per deer harvested from 1971 through 1974 as derived from each method were significantly correlated (r = 0.82, P < 0.01). Percent doe harvest percentages for 1973 and 1974 were not significantly correlated (r = 0.45, P > 0.01). The data indicate that interviewed hunters report a higher percent doe harvest than that provided on reports.

There was a significant correlation (r = 0.91, P < 0.01) between the percentage of interviewees and the percentage of harvest report respondents who reported hunting in 1973 and 1974. These data indicate that each method may provide an adequate representation of the percentage of the potential hunter population that actually hunted for deer.

Discussion

Traditionally the 3 basic methods of determining big game kill have been check station records, hunter report cards and random sampling, either by mail or personal interview [Hunter and Yeager, 1949]. Mandatory harvest reports have been used by many conservation agencies at one time or another; in recent times most have changed over to a random mail survey [Eberhardt, 1969]. A few states have used personal interviews [Hunter, 1949]; however, due to increasing numbers of hunters and a need for more accurate figures this method has been found unsuitable.

Data provided by this study indicate that both the harvest report and hunter interview provide the same annual trends for total deer harvest in southeast Alaska. The hunter interview estimates were, on the average, 38 percent higher than those provided by the harvest report. Differences between the results acquired from the 2 methods may have been due to a combination of the following: issuance of multi-species tags in 1969 and 1970, initially poor acceptance of the report program by the hunting public, use of different baseline data, poor organization of computer programs, non-randomness of interviews, and non-compliance with report program, and probably a large number of biases associated with each method. In addition, since both estimates were hand tabulated, some recording errors were possible. Report data provided since 1972 appear to be more accurate and there appears to be a greater public acceptance of the program.

The hunter interview was intended to provide a random sample of hunters from each community; however, there appears to be a considerable amount of difference between communities in the way the interview was conducted. Interviews conducted in such places as post offices, grocery stores, state office buildings, and "on the street" are not random and thus could consistently result in a non-representative sample. Furthermore, there was a tendency for interviewers to avoid female and juvenile hunters.

McDonald and Dillman [1968] conducted a 3-year survey of response and nonresponse biases associated with random sample surveys by means of mail questionnaires. Their studies indicated that there were prestige biases involved. That is, some individuals who report not killing actually did kill. These same types of biases appear to be present in both of the methods compared in this study. The exact extent of the bias, however, will remain unknown since there is currently no feasible way to accurately determine actual kill in southeast Alaska.

Comparison of the harvest report to the interview indicates that a portion of the hunters sampled in the interview did not possess harvest tickets (9 percent). Of those that did possess tickets, 20 percent did not return them. The 2 groups combined accounted for 28 percent of the deer harvest as reported on the interview. These figures alone could indicate that the hunter interview is providing more reliable data than that derived from the reports; however, this is based on the assumptions that all hunters were reporting their harvest correctly and that the interviews were random. There is reason to believe that both assumptions may be incorrect. A number of studies have indicated tendencies for some hunters to falsely report the number and sex of their kill [Eberhardt and Murray, 1960; Menzel, 1968]. In Alaska, Johnson (*in* McKnight, 1974] has reported that harvests well in excess of the bag limit are sometimes common in communities where "subsistence use" is high. If this is correct, then it is quite conceivable that harvest estimates derived from either method are incorrect. If bag limits are sometimes exceeded then hunt information as to sex, location, and date of kill would vary depending on which animals the hunter decided to report. Also, if interviewed hunters were reporting accurately, but the sample was not representative, considerably discrepancies could occur.

It was noted that the hunter interview contained more variation in many of the harvest statistics than did the harvest report. Reasons for the variability are not known, although factors such as differences in interviewer and interviewee personality, small sample size, exclusion of most female and juvenile hunters, procedures for conducting interviews, and interview locations could add a considerable amount of unmeasurable variation and thus provide a nonrepresentative sample. Some of the obvious advantages and disadvantages of each method are listed below.

Hunter interview - advantages:

1. Cost is considerably lower than harvest reports.

2. Data are available within short period after conclusion of season.

3. Some public relations value is obtained.

Hunter interview - disadvantages:

1. Contains a considerable number of unmeasurable variables.

2. Sample size is proportional to manpower and funds available and thus many communities are not sampled.

3. Both out-of-state and nonlocal hunters are not sampled.

4. Samples often exclude juvenile and female hunters.

Harvest report - advantages:

1. A great volume of data on individual hunters and hunt areas is available.

2. Some of the variables associated with method are measurable.

3. All communities and hunter classes are sampled.

4. Data are analyzed and logged in uniform systematic manner for documentation purposes.

Harvest report - disadvantages:

1. Cost is considerably higher than interview.

2. Computer printouts are not available until 3 to 4 months after conclusion of season.

3. An unknown percentage of hunters may not participate in program.

4. Does not measure harvest in excess of legal bag limit.

For management purposes the most significant finding of this study is that both methods provide the same annual trend for total harvest. Deer management by the Department has consisted of occasionally altering seasons and bag limits, most of which have been due to public demand rather than biological reasons [Merriam, *in* McKnight, 1971]. He believes that sport hunting is not now a regulating factor on deer populations and, therefore, no severe adjustments in season lengths or bag limits are necessary. If this situation were to continue, the need for accurate harvest data would be unnecessary. Therefore, either of the 2 methods would be satisfactory for most management purposes under those circumstances. However, if hunting pressure increases as it has elsewhere and if land management agencies continue to request hunt information by specific areas then hunter interviews will be inadequate.

Arney [1975] reviewed the methods utilized for estimating harvests in 13 western states and summarized problems associated with each method. He found that 5 of 13 states used the interview methods but "practically all" were one-shot special studies. Whereas 8 of 13 utilized the report method because it had higher public acceptance and a low cost per response. Reports, however, were plagued with low return rates, non-return bias and reporting bias. Although these latter problems can be solved with special studies, the correction factors change with time and return rates [Arney, 1975]. Consequently, to provide accurate harvest statistics, effort should be periodically addressed to measuring the biases associated with the reports or a new system, such as random mail questionnaires, should be investigated for its suitability under Alaskan conditions.

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SITKA BLACK-TAILED DEER:

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