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An Evaluation of Estimates of Sport Fish Harvest from the Alaska Statewide Mail Survey

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Michael J. Mills

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Michael J. Mills
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Allen L. Howe

Alaska Department of Fish and Game
Division of Sport Fish
Anchorage, Alaska

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

Estimates of sport fish harvest from Alaska's statewide mail survey were examined to assess their accuracy and precision. This examination demonstrated that the mail survey provided estimates that did not differ appreciably from comparable estimates from on-site creel surveys. Guidelines for using the estimates are provided.

INTRODUCTION

Since 1977, the Sport Fish Division of the Alaska Department of Fish and Game has conducted annual surveys to estimate participation and harvest by anglers who sport fished in Alaska. These surveys involved repeated mailings of questionnaires to random samples selected from computerized files of names and addresses of individuals who had purchased licenses to sport fish in Alaska. Further details and results for these surveys may be found in Mills (1979, 1980, 1981a, 1981b, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991).

From time to time questions have arisen regarding the utility of the harvest estimates produced by these statewide mail surveys. This report, an edited and expanded version of an oral presentation to the Alaska Board of Fisheries on March 7, 1992, in Juneau, Alaska, addresses some of those questions.

ACCURACY AND PRECISION--CONCEPTS

Two characteristics are commonly used to assess the quality of estimates--accuracy and precision. Accuracy refers to the closeness of an estimate to the true value. Precision refers to the closeness of repeated estimates of the same quantity to each other. Accuracy is dependent on methods of measurement and estimation. Precision is dependent on inherent variability and sample size.

Estimates can be categorized (Figure 1) as:

- accurate but imprecise,
- inaccurate but precise,
- inaccurate and imprecise, or
- accurate and precise.

Accurate but imprecise estimates could result from use of unbiased methods and small sample sizes. Inaccurate but precise estimates could result from use of biased methods with large sample sizes. Inaccurate and imprecise estimates could result from use of biased methods with small sample sizes. Accurate and precise estimates should result from use of unbiased methods and adequate sample sizes.

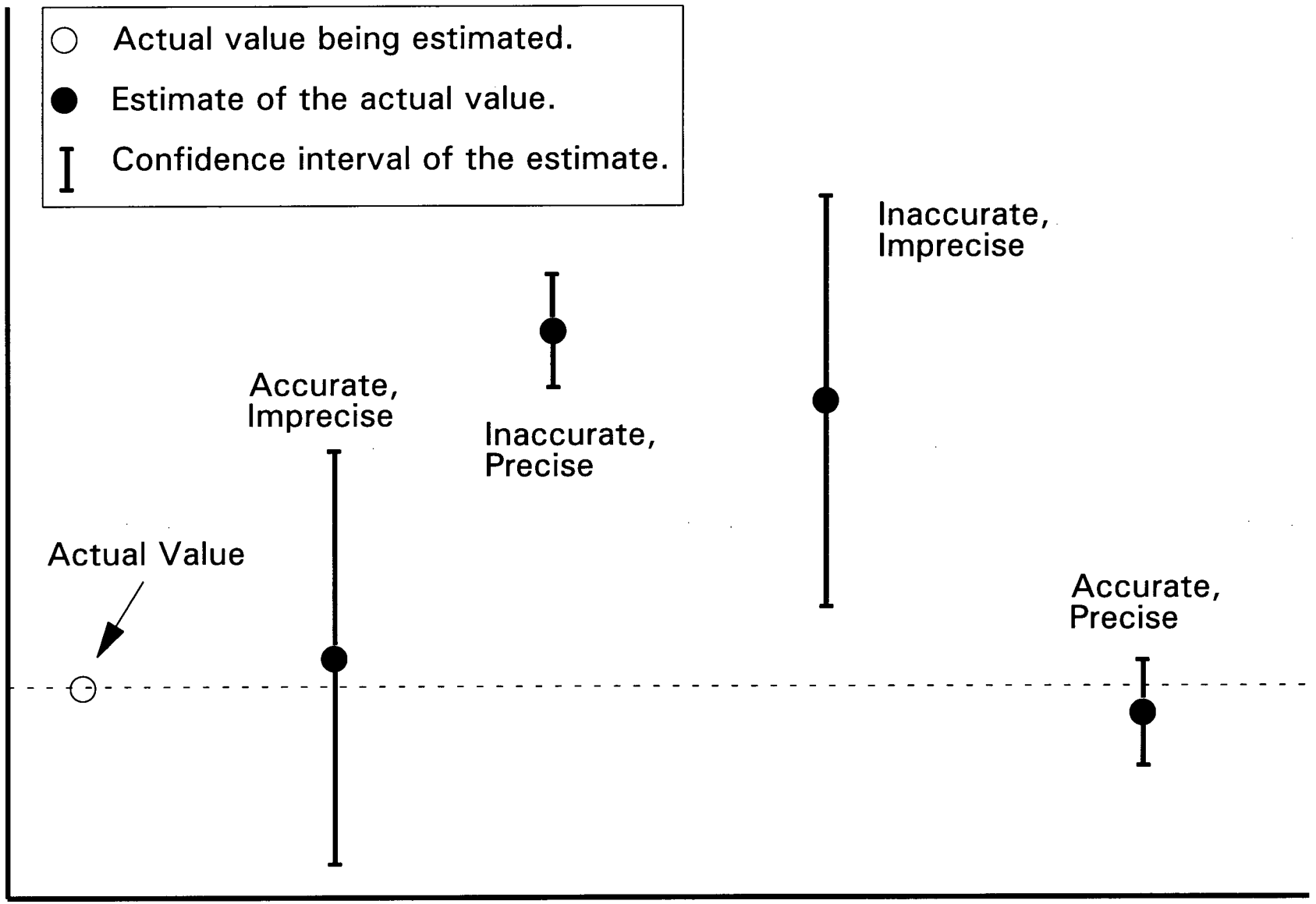

Figure 1. Hypothetical illustrations of accuracy and precision of statistical estimates.

ACCURACY AND PRECISION OF ESTIMATES STATEWIDE, 1990

Although actual values of harvests being estimated from the statewide mail survey are unknown, on-site creel surveys which produce estimates for the same fisheries can be used for comparison. Figure 2 and Table 1 contain comparable on-site creel survey and statewide survey estimates and 95% confidence intervals for several fisheries selected to represent a range of harvests (from around 1,500 to over 30,000). From a statistical perspective, the hypothesis that these estimates are the same is generally not rejected if their confidence intervals overlap. Note that all confidence intervals do overlap.

ACCURACY OF ESTIMATES STATEWIDE, 1977-1990

Figure 3 and Table 2 present ratios of the means of statewide survey and comparable on-site creel survey estimates of harvest for all years since the statewide survey began. A ratio of 2.0 would indicate the statewide survey estimates of harvest averaged twice those of the creel survey. A ratio of 0.5 would indicate that the statewide survey estimates of harvest averaged one half those of the creel survey. A ratio of 1.0 would indicate that comparable estimates from the two surveys on average were the same.

Note that the ratios are sometimes higher than one (as much as 17%) and sometimes lower than one (as much as 11%). The ratios are not, however, always higher or lower than one; and over the fourteen year history of the statewide survey, they average about one.

ACCURACY OF ESTIMATES FOR SOUTHEAST ALASKA CHINOOK SALMON, 1985-1990

In 1985, the Pacific Salmon Treaty between the United States and Canada established a quota for the harvest of chinook salmon in Southeast Alaska. The statewide mail survey has been used to estimate sport harvests that were to be applied toward this quota. Thus, the accuracy of these estimates has been of special interest.

There have been no creel surveys covering all of Southeast Alaska. Furthermore, the on-site creel surveys covering parts of Southeast Alaska have produced estimates that have not been strictly comparable with those of the statewide survey. While the on-site creel surveys have covered most sites where anglers enter and exit fisheries, they have not covered all; and while the creel surveys have covered most of the fishing season and fishing day, they have not covered the entire season and fishing day. The statewide survey produces estimates for fisheries in their entirety. Thus the statewide survey estimates have been expected to be somewhat higher than the creel survey estimates.

Figure 4 and Table 3 present ratios of the means of the statewide survey and on-site estimates for chinook salmon fisheries where creel surveys were conducted for the years 1985-1990. Note that the statewide survey estimates have generally been about 10% higher than creel survey estimates in Southeast Alaska. Due to the more limited coverage of the creel surveys, Southeast Sport Fish Division staff have considered this difference reasonable.

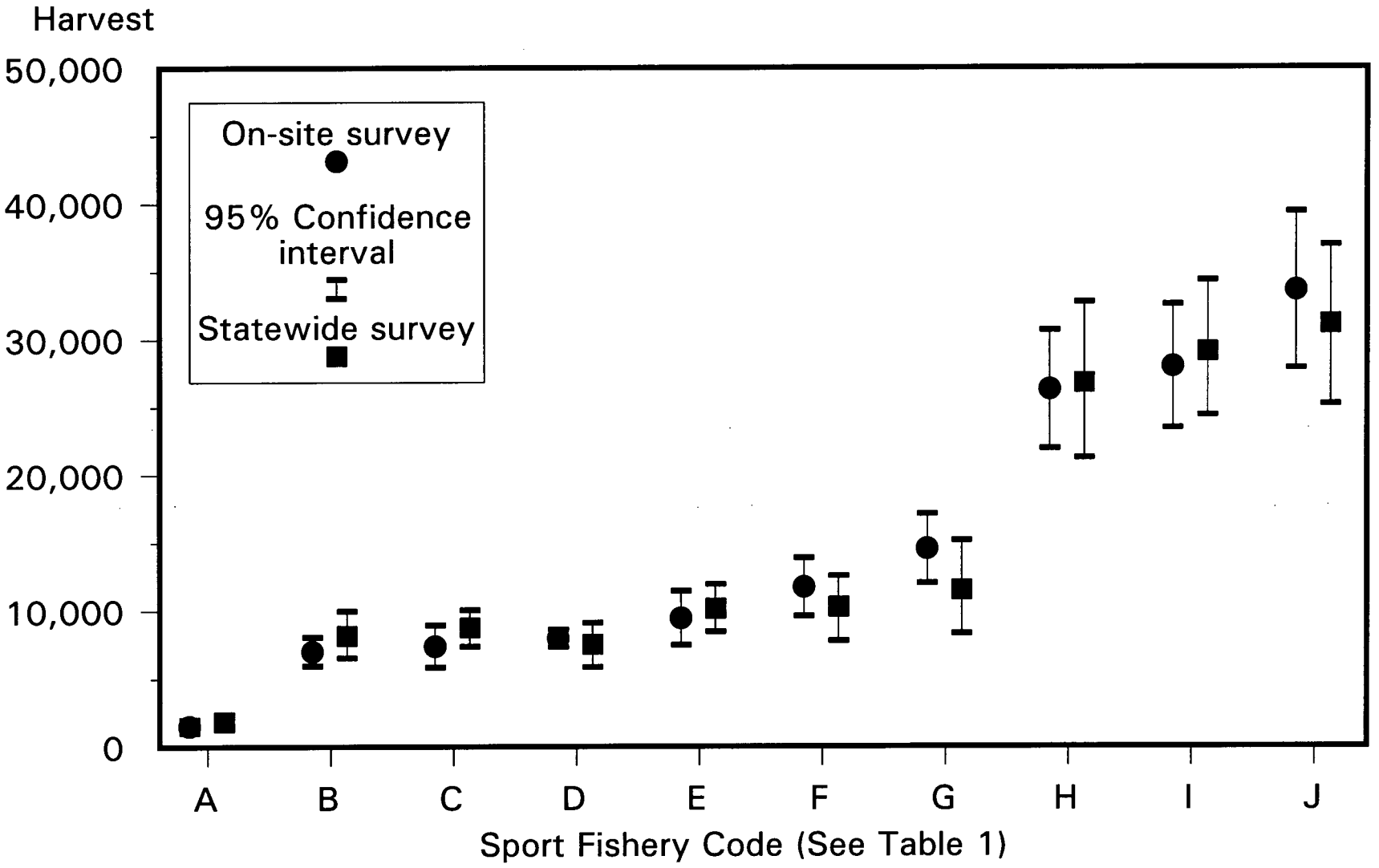

Figure 2. Comparisons of several 1990 on-site creel survey and statewide mail survey estimates of sport fish harvest.

Table 1. Comparison of several 1990 statewide mail survey and on-site creel survey estimates of sport fish harvest.

Code	Sport Fishery	Species	On-site Survey			Statewide Survey[a]		
			Harvest	Lower 95% CI[b]	Upper 95% CI[b]	Harvest	Lower 95% CI[b]	Upper 95% CI[b]
A	Little Susitna River[c]	chinook salmon	1,546	1,064	2,028	1,813	1,464	2,162
B	Juneau marine (boat)[d]	chinook salmon	7,031	5,969	8,093	8,137	6,515	9,953
C	Ketchikan marine (boat)[d]	Pacific halibut	7,419	5,865	8,973	8,743	7,346	10,028
D	Little Susitna River[e]	coho salmon	8,001	7,368	8,634	7,497	5,828	9,095
E	Ketchikan marine (boat)[d]	chinook salmon	9,481	7,492	11,470	10,123	8,428	11,906
F	Juneau marine (boat)[d]	Pacific halibut	11,774	9,632	13,916	10,262	7,768	12,540
G	Kenai River - Cook Inlet to Soldotna Bridge, guided anglers[f]	coho salmon	14,602	12,046	17,158	11,502	8,296	15,159
H	Juneau marine (boat)[d]	coho salmon	26,343	21,978	30,708	26,760	21,241	32,724
I	Kenai River - Cook Inlet to Soldotna Bridge, non-guided anglers[f]	coho salmon	28,036	23,485	32,587	29,065	24,376	34,330
J	Ketchikan marine (boat)[d]	coho salmon	33,661	27,887	39,435	31,104	25,189	36,919

[a] Statewide survey estimates from: Mills, M. J. (1991).
[b] CI = Confidence Interval.
[c] On-site survey estimates from: Sweet, D., A. E. Bingham, and K. Webster (1991).
[d] On-site survey estimates from: Suchanek, P. and A. E. Bingham (1991).
[e] On-site survey estimates from: Bartlett, L. and A. E. Bingham (1991).
[f] On-site survey estimates from: Hammarstrom, S. (1991).

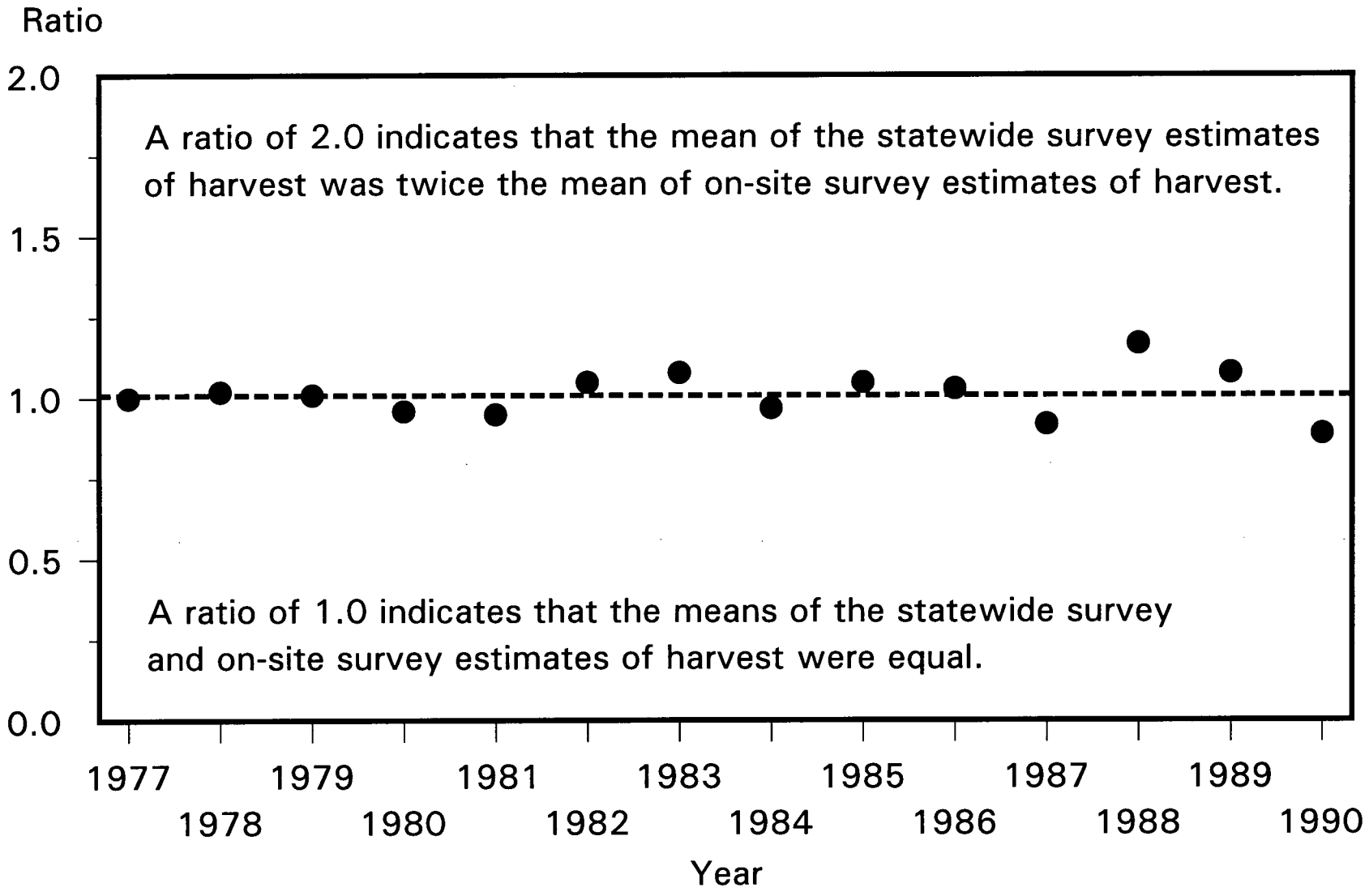

Figure 3. Ratios of means of statewide mail survey and on-site creel survey estimates of sport fish harvest, 1977-1990.

Table 2. Ratios of means of statewide mail survey and on-site creel survey estimates of sport fish harvest, 1977-1990.

Year	Number of Comparisons	Ratio of Means[a]
1977	38	1.00
1978	38	1.02
1979	49	1.01
1980	41	0.96
1981	41	0.95
1982	40	1.05
1983	36	1.08
1984	39	0.97
1985	46	1.05
1986	49	1.03
1987	76	0.92
1988	79	1.17
1989	46	1.08
1990	33	0.89
1977-1990 mean		1.01

[a] Mean of statewide survey estimates of harvest divided by mean of on-site creel survey estimates of harvest.

Table 3. Ratios of means of statewide mail survey and on-site creel survey estimates of sport fish harvest of chinook salmon statewide and for Southeast Alaska, 1985-1990.

	Statewide		Southeast	
Year	Number of Comparisons	Ratio of Means[a]	Number of Comparisons[b]	Ratio of Means[a]
1985	20	0.96	3	1.11
1986	25	1.03	4	1.09
1987	30	0.96	8	0.96
1988	25	1.05	9	1.11
1989	21	1.02	6	1.11
1990	12	1.04	4	1.13
1985-1990 mean		1.01		1.09

[a] Mean of statewide survey estimates of harvest divided by mean of on-site survey estimates of harvest.

[b] Except for the Situk River, comparisons are for saltwater boat fisheries. Included are separate estimates for fish greater than or equal to (≥) or less than (<) the total fish lengths, in inches, shown below in parentheses.

Comparisons included:
1985 Juneau (≥ 28) and Situk River (≥ 16 and < 16).
1986 Ketchikan and Juneau (≥ 28), and Situk River (≥ 16 and < 16).
1987 Ketchikan, Juneau, Sitka, and Haines (≥ 28 and < 28).
1988 Ketchikan, Juneau, Sitka, and Haines (≥ 28 and < 28), and Situk River (combined lengths).
1989 Ketchikan, Juneau, and Haines (≥ 28 and < 28).
1990 Ketchikan and Juneau (≥ 28 and < 28).

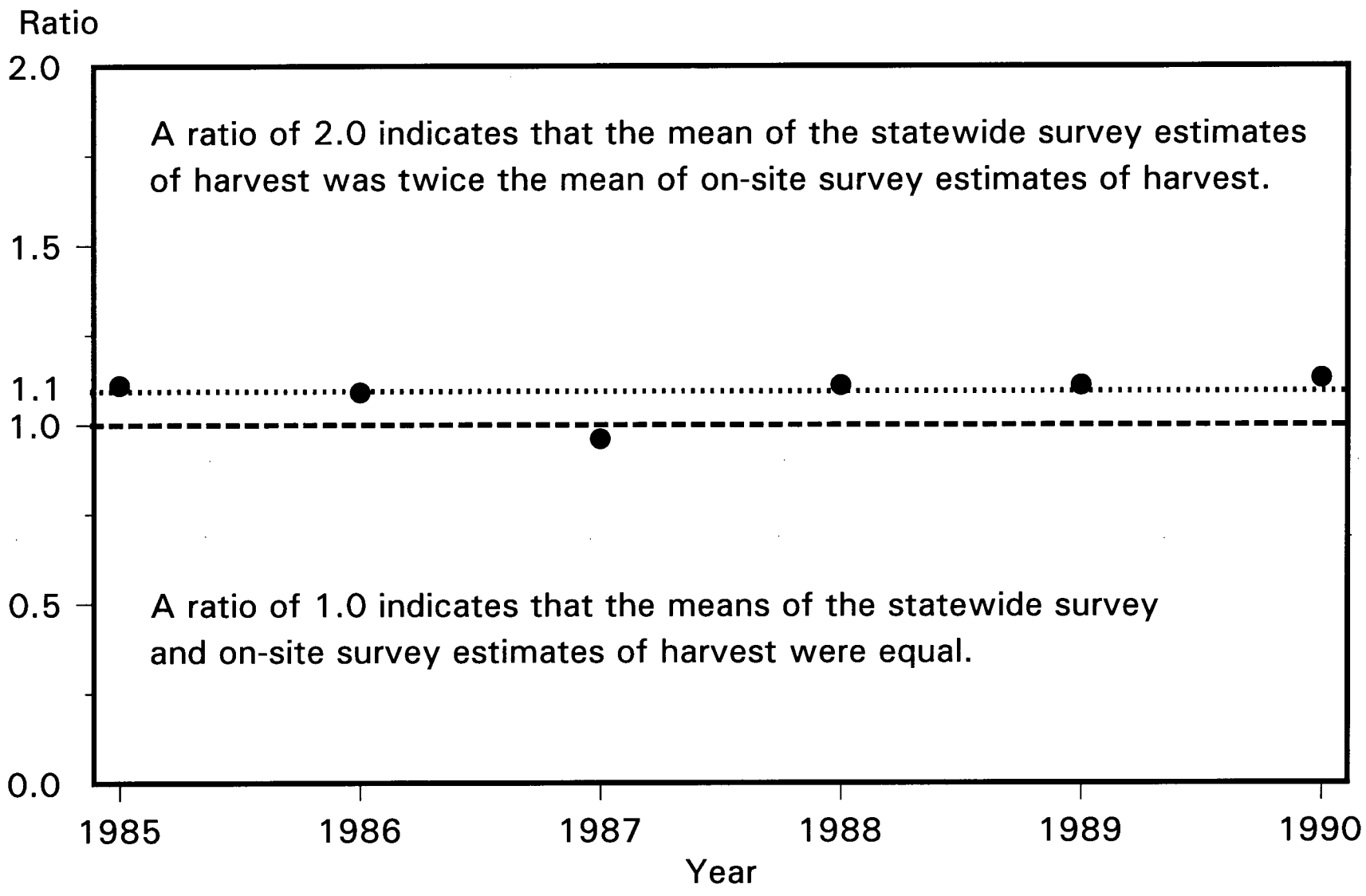

Figure 4. Ratios of means of statewide mail survey and on-site creel survey estimates of sport fish harvest of chinook salmon for sport fisheries in Southeast Alaska, 1985-1990.

PRECISION OF ESTIMATES

The precision of the statewide mail survey estimates of sport fish harvests for particular fisheries is related to the number of respondents who report participating in those fisheries. Figure 5 and Table 4 present precision for 1990 chinook salmon harvests for several response levels. Precision is measured by the coefficient of variation of the estimate (the standard error of an estimate divided by the estimate itself) expressed as a percentage. The smaller the coefficient, the higher the precision.

Note that when the number of respondents is greater than 200, the estimates are relatively precise and precision increases gradually with increasing response. Precision drops off moderately from 200 responses down to about 30 responses. Below 30 responses precision drops rapidly. Below 12 responses estimates are imprecise.

Past observations of this type have lead to the following guidelines for evaluating the utility of statewide survey estimates:

- Other than to document that sport fishing occurred, estimates based on fewer than 12 respondents should not be used.
- Estimates based on 12 or more, but less than 30 responses can be useful for indicating relative orders of magnitude and for assessing long-term trends.
- Estimates based on 30 or more responses are generally usable.

A table of the number of respondents for each site for which estimates are produced is included in the appendix of each annual statewide survey report. Estimates for sites with less than 12 responses are normally not published in the report.

CONCLUSIONS

The accuracy and precision of estimates of sport fish harvest from Alaska's statewide survey have been examined to evaluate their utility. This examination indicated that the statewide survey provides estimates that do not differ appreciably from comparable estimates from on-site creel surveys. As long as the general guidelines provided concerning the relationship between number of respondents and precision of estimates are followed, estimates from the statewide survey should be useful to fisheries managers and decision makers.

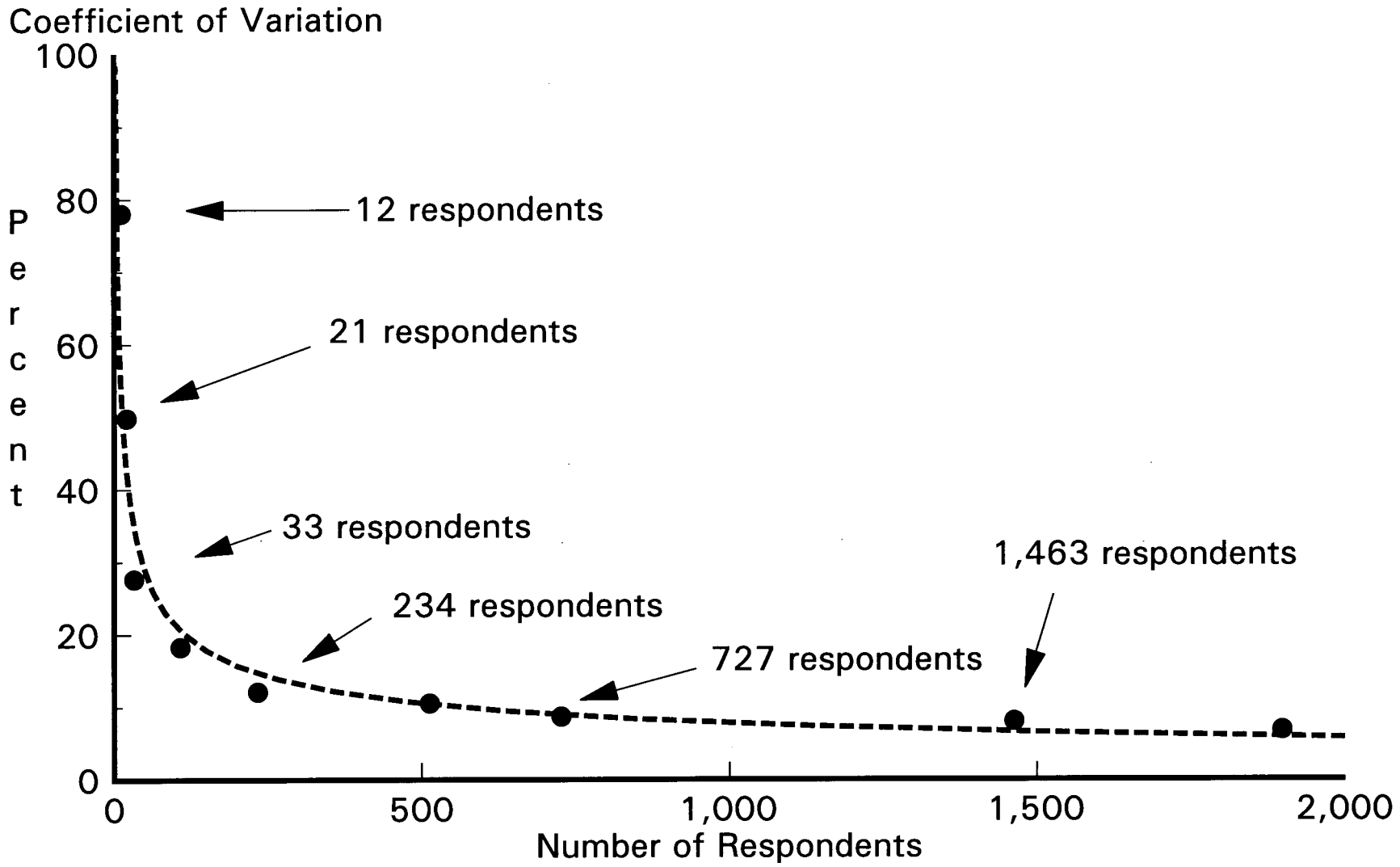

Figure 5. Number of respondents and coefficients of variation for several chinook salmon sport fisheries, estimated from the 1990 statewide mail survey.

Table 4. Number of respondents, sport fish harvests, standard errors, and coefficients of variation for several chinook salmon sport fisheries, estimated from the 1990 statewide sport fish mail survey.

Sport Fishery	Number of Respondents	Harvest	Standard Error	Coefficient of Variation (%)[c]
West Side Cook Inlet - West Side Susitna Drainage	1,898	19,568	1,326	7
Lower[a] Kenai River (nonguided)	1,463	2,111	169	8
Ketchikan marine (boat)	727	10,123	878	9
Juneau marine (boat)	513	9,324	983	11
Lake Creek	234	3,423	415	12
Gulkana River float fishing[b]	108	525	96	18
Kanektok River	33	503	139	28
Lewis River	21	285	142	50
Hoonah marine (boat)	12	41	32	78

[a] Cook Inlet to Soldotna Bridge.
[b] Sourdough to Richardson Highway.
[c] (Standard Error ÷ Harvest) X 100

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