CHAPTER VII - TN 24: THE COMPARABILITY OF NATIONAL SURVEY DATA ON PARTICIPATION IN HUNTING AND FISHING WITH OTHER DATA ON THE SAME OUTDOOR RECREATION ACTIVITIES

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ABSTRACT

Research scientists can have little faith in results obtained and conclusions drawn from a study if the reliability and validity of the data are not known or cannot be established.

This paper takes a step toward measuring the reliability and validity of data from certain national surveys on participation of Canadians in outdoor recreation activities. The procedure followed is to (1) test reliability by determining if the measurements are consistent, and (2) test validity by comparing the results of national surveys with the findings of independent studies.

In the comparisons reviewed, a variation of 10 percent between the data of the national surveys and that of the control sources is sometimes used as the critical threshold value. When the data permit, significance tests are applied to discover if the differences noticed between percentages from national surveys and the percentages of the "control" sources are chance differences.

In the first part of the paper, the statistical data used are presented and some explanations about the national surveys used are given. The significance tests used are explained in a second part. Data on hunting and fishing are compared in the two remaining sections.

OBJECTIVE

Criticisms concerning the reliability and validity of data have been raised about some national surveys on participation of Canadians in outdoor recreation activities because no reliability and validity analyses had been presented. The objective of this paper is to take a step towards measuring the reliability and validity of some CORDS National Survey results.

INTRODUCTION

Concern for reliability comes from the desire by data uses for measurement that is reproducible. Simply, degree of reliability refers to the prospects for obtaining consistent and similar measurements when a data collection procedure is replicated. Kerlinger (1965) approaches the concepts of reliability and accuracy with three questions.

1. If we measure the same set of objects again and again with the same or comparable measuring instrument, will we get the same or similar results?
2. Are the measures obtained from a measuring instrument the "true" measures of the property measured?
3. How much error of measurement is there in a measuring instrument?

In a similar vein Kendall and Buckland (1957) propose a functional definition of reliability which takes into consideration the concepts of stability and random error. Reliability is conceived as "that part which is due to permanent systematic effects, and therefore persists from sample to sample, as distinct from error-effects which vary from one sample to another."

The merits of having reliability figures as part of assessing accuracy, getting near the correct value, are obvious. If measurement is not reliable, how can it be accurate? However, even if statistical results are proven to be reliable, this alone cannot convince the reader that the results obtained are valid/accurate in that the reliable value is appropriately near to the correct/true value. Reliability does not take into consideration the congruence of the object measured with that of the measuring instrument. In practical terms, techniques for assessing reliability determine the statistical variability of the measuring instruments but neglect to show whether or not the measuring instrument truly measures what was intended to be measured in the first place.

It is therefore quite possible to have reliable statistical results that are not accurate in the sense of being valid.

Kendall and Buckland (1957, p. 309) propose a definition of validity which takes into consideration a sample being representative and is otherwise known as content validation (Kerlinger 1965). Validation is "a procedure which provides, by reference to independent sources, evidence that an inquiry is free from bias or otherwise conforms to its declared purpose. In statistics it is usually applied to a sample investigation with the object of showing that the sample is reasonably representative of the population..." In this context a good test for validity is to compare survey results with the finding of independent non-survey studies that yield measurement that is believed not to be biased. If the results are similar, one can assume that the survey is probably valid.

The procedure that is followed in this paper is (a) to test the reliability of the national surveys by determining if the measurements are consistent from survey to survey, and (b) to test the validity of the national surveys by comparing their results with the findings of independent studies.

Although it is not particularly desirable, in the comparisons presented in this paper a variation of 10 percent between the data of the national surveys and that of the control sources is sometimes used as the critical threshold value for questioning the reliability and the validity of the results of the national surveys. However, when data permit, significance tests are applied to discover if the differences noticed between percentages of the national surveys and the percentages of the "control" sources are consistent with chance differences to be expected.

THE STATISTICAL DATA COMPARED

The CORDS National Survey results to be tested for reliability and validity are described and data documentation provided elsewhere (CORDS Volume III). Briefly, in these surveys, questions were asked to determine the participation and frequency of participation of respondents in outdoor recreation activities. In 1967, 22 activities were covered; in 1969, 26 activities were covered and in 1972, there were 28 activities (for more detail see TN 22). Participation in hunting was obtained in 1967, 1969 and 1972; however information on specific types of hunting (small game, large game, waterfowl) was obtained only in the 1972 survey. Information on fishing was obtained in 1967 and 1972 while participation in specific types of fishing (salt water, fresh water) was procured only in 1972.

The other data sources used for the comparisons in this research paper are shown in Table 1. The National Survey results (Sources 1-4) are compared with statistical data from other sources (5-10). Tests used are described in the Appendix to this TN. The variations in the methods of data collection, years of data collection and age groups for which the data were collected are noted in describing the respective studies.

COMPARISON OF HUNTING DATA

The 1967, 1969 and 1972 "8M" (CORDS national surveys, see Vol. 3) surveys may be compared to provide some check on survey reliability. From Table 2, it can be seen that as far as hunting in general is concerned, the percentage of Canadians who hunted was fairly constant from 1967 to 1972. The maximum variation is 3%, i.e. when 1967 and 1972 percentages are compared. This difference is small enough that it probably reflects trends over time so that the data on hunting seem reliable even if the 3% maximum difference is highly significant ($\alpha > .002$). When the data from the three national surveys are compared on a regional basis (see Table 2), the maximum differences between two surveys are all still less than 10%. Only two differences (of 8) are significant.

TABLE 1: DATA SOURCES AND THEIR CHARACTERISTICS (Part 1 above – Part 2 below)

| Source | Type of Data |
|---|---|
| 1) 1967 CORDS National Participation Survey | National Survey by Personal interviews |
| 2) 1969 CORDS National Participation Survey | National Survey by Personal interviews |
| 3) 1972 CORDS National Participation Survey | National Survey by Personal interviews |
| 4) D.A. Benson, "Fishing and Hunting in Canada 1961: A report on an Economic Survey." | Labour Force Survey Sample of 30,000 |
| 5) "Statistics on Sales of Sport Fishing Licenses in Canada 1966-1971". | Figures on license sales and fees on the basis of information provided by the agency responsible in each Jurisdiction. |
| 6) "Report on Sales of the Canada Migratory Game Bird Hunting Permit, Migratory Game Bird Harvest and Hunter Activity, 1971". | Canadian migratory game bird hunting permits sold post offices across Canada and a Harvest Survey. |
| 7) "Travel, Tourism and Outdoor Recreation: A Statistical Digest 1572" | Information drawn from variety of sources. |
| 8) P.G. Whiting, "A Comparison of Two Estimates of Angler Numbers in Canada." | Compares 1972 National Survey data on Fishing, Recreation Fisheries Branch estimates of angler numbers in Canada and U.S.A. 1970 Survey of Hunters and Fishermen data. |
| 9) "National Survey of Fishing and Hunting 1970". | 8,700 sportsmen were interviewed, age 12 years and older who participated on any of three different days or more, or spent $7.50 or more to go fishing or hunting during 1970. |

| Source | Year of Data | Age Groups to |
|---|---|---|
| 1) | Fall of 1967 | 18+ |
| 2) | Fall of 1969 | 18+ |
| 3) | Fall of 1972 | 10 and 18+ |
| 4) | February 1962 | 14+ |
| 5) | April 1 to the next March 31 for 66, 67, 68, 69,70,71 | 16+ to 19+ depending on agencies licensing practices. |
| 6) | Sales of permits from August 1971 through January 1972. 10,603 useable mailed questionnaires for Harvest Survey. | Unspecified |
| 7) | Between 1965 and 1971 | Unspecified |
| 8) | 1967, 1970, 1972 figures are compared. | 10+, 12+, 16+ and 18+ |
| 9) | 1970 | 12+ |

A comparison of the 1961 Canadian Wildlife Survey and the 1972 national survey results presents major problems from the point of view of evaluation of what differences mean. The results shown in Table 3 may reflect an increase in participation in hunting in Canada between 1961 and 1972. It will also be noticed that the age groups of the two surveys compared do not coincide exactly. However all the increases are less than 10% and so the 1972 national survey results seem plausible even if three differences out of four which were tested are highly significant ($\acute{a} < .001$). Considering that the wild life survey was a "focused survey" with much "tighter" sampling controls carried out and with many basic differences from the 1972 national survey, it is encouraging to see that differences are as small as they were found to be.

TABLE 2: PERCENTAGE OF CANADIANS 18 YEARS AND OVER WHO DID NOT PARTICIPATE IN HUNTING IN 1967, 1969, AND 1972, BY REGION, ACCORDING TO NATIONAL SURVEY DATA

| | 1967 | | 1969 | | 1972 | | Maximum |
| | % | # | % | # | % | # | Difference X |
|---|---|---|---|---|---|---|---|
| Canada | 14 | 5986 | 13 | 2967 | 11 | 3002 | 3% |
| Atlantic Provinces | 21 | 625 | 15 | 288 | 21 | 295 | 6 |
| Quebec | 11 | 1742 | 12 | 882 | 10 | 870 | 2 |
| Ontario | 12 | 1972 | 10 | 1003 | 8 | 1018 | 4 |
| Manitoba | 8 | 320 | 11 | 147 | 12 | 148 | 4 |
| Saskatchewan | 12 | 291 | 19 | 124 | 16 | 132 | 7 |
| Alberta | 14 | 433 | 14 | 217 | 8 | 251 | 6 |
| British Columbia | 15 | 603 | 16 | 306 | 15 | 288 | 1 |

| | Standard Error of maximum difference $\gamma D\%$ | Confidence Coefficient Z(c) $=x/\gamma D\%$ | Significance Level $\acute{\alpha}$ |
|---|---|---|---|
| Canada | 1.00% (67-69) | 3.00 | > .002 |
| Atlantic Provinces | 3.18 (72-69) | 1.89 | > .05 |
| Quebec | 1.48 (69-72) | 1.35 | > .17 |
| Ontario | 1.23 (67-72) | 3.25 | > .001 |
| Manitoba | 2.85 (67-72) | 1.40 | > .16 |
| Saskatchewan | 3.72 (67-69) | 1.88 | > .06 |
| Alberta | 2.90 (69-72) | 2.07 | > .03 |
| British Columbia | 2.93 (69-72) | 0.34 | > .73 |

TABLE 3: COMPARISON OF 1961 CANADIAN WILDLIFE SERVICE SURVEY AND 1972 NATIONAL SURVEY OF CANADIAN HUNTERS - SIGNIFICANCE TESTS

| | a -- C.W.S. 1961 Survey Age 14+ (N=30,000) | b --National 1972 Survey Age 15+ (N=3,255) | Difference x = b-a |
|---|---|---|---|
| Hunting (all types) | 6.5% | 11.1% | 4.6% |
| Small Game Hunting | - 3.4 | 8.0 | 4.6 |
| Large Game Hunting | 3.8 | 5.0 | 1.2 |
| Waterfowl Hunting | 2.8 | 3.4 | 0.6 |

| | Standard Error of the Difference $\gamma D\%$ | Confidence Coefficient Z(c) = x/$\gamma D\%$ | Significance Level $\acute{\alpha}$ |
|---|---|---|---|
| Hunting (all types) | .45% | 10.22 | < .000 |
| Small Game Hunting | .32 | 14.38 | < .001 |
| Large Game Hunting | .32 | 3.75 | < .001 |
| Waterfowl Hunting | .32 | 1.88 | .06 |

Comparison of 1970-71 hunting license sales data and the 1972 National Survey data, Canada and Provinces, potentially allows the testing of survey validity. Thus it is fortunate that the two types of data on hunting in general (Table 4), the 1972 National Survey and the 1970-71 hunting license sales yield similar results except for three western provinces. In the western provinces there could be problems such as (1) unreliability of the national survey sample as far as provinces are concerned; (2) special circumstances surrounding license regulations; or (3) the

failure of many people to actually hunt after purchasing a hunting license. Actually 5 out of 8 differences tested are significant, reflecting some basic discrepancy between the two data sources.

TABLE 4: COMPARISON OF PERCENTAGES OF CANADIAN HUNTERS (ALL TYPES) ACCORDING TO 1970 - 1971 LICENSE SALES AND 1972 NATIONAL SURVEY, CANADA AND REGIONS (SIGNIFICANCE TESTS)

| | 1970-71 Hunting Licenses Sales, 16+* (u)% | 1972 National Survey Hunters, (X)% | 16+ # | Difference X% - u% |
|---|---|---|---|---|
| Canada | 15.8 | 10.8 | 3155 | -5.0% |
| Atlantic Provinces | 18.5 | 15.4 | 312 | -3.1 |
| Quebec | 9.3 | 10.3 | 917 | 1.0 |
| Ontario | 11.5 | 9.3 | 1069 | -2.2 |
| Manitoba | 13.6 | 11.1 | 153 | -2.5 |
| Saskatchewan | 26.2 | 13.7 | 139 | -12.5 |
| Alberta | 34.5 | 9.6 | 260 | -24.9 |
| British Columbia | 28.8 | 12.8 | 305 | -16.0 |

| | $\gamma D\% = 100 (pq/n)^{1/2}$ | Confidence Coefficient $Z_c = (X-u\%)/\gamma D\%$ | Significance Level $\acute{\alpha}$ |
|---|---|---|---|
| Canada | 0.55% | -9.09 | $< .001$ |
| Atlantic Provinces | 2.05 | -1.51 | $> .13$ |
| Quebec | 1.00 | 1.00 | $> .31$ |
| Ontario | 0.89 | -2.47 | $> .01$ |
| Manitoba | 2.53 | -0.99 | $> .32$ |
| Saskatchewan | 2.92 | 4.28 | $< .001$ |
| Alberta | 1.82 | 13.68 | $< .001$ |
| British Columbia | 1.92 | 8.33 | $< .001$ |

* License sates % were calculated from absolute number of License Sales given in Statistics Canada, TRAVEL, TOURISM, AND OUTDOOR RECREATION: A STATISTICAL DIGEST, 1972, CAT. 66-202, Table 8.7 p. 94. Population 16 years and over is given in 1971 Census of Canada, Statistics Canada, CAT. 92-715/716.

A comparable similarity between 1972 National Survey results and license data is seen in Tables 5-7. Yet here again similarity is associated with statistically significant differences. In Table 5 are shown the differences of percentages of participants in Small Game Hunting. It will be noticed that all differences are less than 10% and still three of these differences out of 8 are highly significant. In Table 6, on Large Game Hunting, only one difference is greater than 10% but 4 differences out of 8 are significant. In Table 7, we notice that as far as Waterfowl Hunting is concerned the 1972 National Survey results are not very different from Permit Sales estimates. None of the differences are close to 10%; however 3 differences are statistically significant.

Comparison of U.S.A. 1970 National Survey data on Hunting and 1972 National Survey is of some value. Canadian and U.S. statistics are often quite similar. As can be seen from Table 8, there is similarity as far as percentage of hunters are concerned, even when the sexes are considered separately; all differences are much lower than 5% which is indeed surprising. Significance tests could not be applied to figures by sex, as data on the number of males and females in the U.S. sample were not available. However, as might be suspected, superficial

similarity is contrasted by statistical difference. Three out of 4 tests show that the differences are highly significant.

## SYNOPSIS ON HUNTING COMPARISONS

Out of 60 comparisons on participation in hunting, only 7% (4/60) of the differences computed are greater than 10%. However 47% of the ά's computed (23/49) are significant statistically. There are few large differences between national survey results and results from other sources, even though almost half of the differences are statistically different. In more detail, the national survey data on Canadian hunters are consistent for the three years: 1967, 1969, and 1972. They are not very different from the data collected in a comparable survey in 1961. The 1972 results are also quite similar to to estimates of hunters made from Licenses Sales data, and that is true for all types of hunting: small game, big game, and waterfowl hunting. The percentages of Canadian hunters given by the 1972 survey are also very similar to 1970 U.S.A. data. In sum, it seems that the hunting data are reasonably reliable and valid.

## TABLE 5: COMPARISON OF PERCENTAGES OF CANADIAN SMALL GAME HUNTERS ACCORDING TO 1970 -1971 LICENSE SALES AND TO 1972 NATIONAL SURVEY, CANADA AND PROVINCES (SIGNIFICANCE TEST)

| | 1970-71 Small Game Hunting Licenses Sates, 16+* (u)% | 1972 National Survey Small Game Hunters, (X)% | 16+ # | Difference X% - u% |
|---|---|---|---|---|
| Canada | 7.1 | 7.7 | 3155 | 0.6% |
| Atlantic Provinces | 7.3 | 12.5 | 312 | 5.2 |
| Quebec | 5.1 | 7.2 | 917 | 2.1 |
| Ontario | 7.1 | 7.4 | 1069 | 0.3 |
| Manitoba | 6.7 | 6.5 | 153 | -0.2 |
| Saskatchewan | 9.9 | 9.4 | 139 | -0.5 |
| Alberta | 7.8 | 5.8 | 260 | -2.0 |
| British Columbia | 10.7 | 6.6 | 305 | -4.1 |

| | $\gamma D\% = 100\,(pq/n)^{**1/2}$ | Confidence Coefficient $Zc = (X\% - u\%)/\gamma D\%$ | Significance Level ά |
|---|---|---|---|
| Canada | 0.45% | 1.33 | > .18 |
| Atlantic Provinces | 1.87 | 2.78 | > .005 |
| Quebec | G.83 | 2.53 | > .01 |
| Ontario | 0.78 | 0.38 | > .70 |
| Manitoba | 2.00 | -0.10 | > .92 |
| Saskatchewan | 2.47 | -0.20 | > .84 |
| Alberta | 1.45 | -1.38 | > .16 |
| British Columbia | 1.41 | -2.91 | > .003 |

* See remarks below Table 4.

TABLE 6: COMPARISON OF PERCENTAGES OF CANADIAN LARGE GAME HUNTERS ACCORDING TO 1970 - 1971 LICENSE SALES AND 1972 NATIONAL SURVEY, CANADA AND REGIONS. (SIGNIFICANCE TEST)

| | 1970-71 Large Game Hunting Licenses Sales, 16+* (u)% | 1972 National Survey Large Game Hunters, (X)% | 16+ # | Difference X% - u% |
|---|---|---|---|---|
| Canada | 7.1 | 5.1 | 3155 | -2.0% |
| Atlantic Provinces | 10.6 | 9.0 | 312 | -1.6 |
| Quebec | 3.9 | 4.1 | 917 | 0.2 |
| Ontario | 3.1 | 3.7 | 1069 | 0.6 |
| Manitoba | 6.9 | 6.5 | 153 | -0.4 |
| Saskatchewan | 16.3 | 7.9 | 139 | -8.4 |
| Alberta | 14.3 | 3.8 | 260 | -10.5 |
| British Columbia | 18.1 | 8.2 | 305 | -9.9 |

| | $D\% = 100\,(pq/n)^{**1/2}$ | Confidence Coefficient $(Zc = X\% - u\%)/\gamma D\%$ | Significance Level ά |
|---|---|---|---|
| Canada | 0.45% | -4.44 | < .001 |
| Atlantic Provinces | 1.61 | -0.99 | > .32 |
| Quebec | 0.63 | 0.32 | > .74 |
| Ontario | 0.55 | 1.09 | > .27 |
| Manitoba | 2.00 | -0.20 | > .84 |
| Saskatchewan | 2.28 | -3.68 | < .001 |
| Alberta | 1.18 | -8.90 | < .001 |
| British Columbia | 1.58 | -6.27 | < .001 |

* See remarks below Table 4.

COMPARISON OF FISHING DATA

Regarding the 1967. 1969 and 1972 national surveys, it is unfortunate that only the 1972 survey gives data on detailed types of fishing. However, as far as fishing in general is concerned, the percentages of Canadians who fished is not very different in 1967 and 1972. as can be seen in Table 9. The variation between the results of the two surveys being 4%, it could be concluded that the data on percentages of Canadian sport fishers in general is fairly reliable even though this 4% difference is significant at a .001 level.

However, there are greater variations between the data of the 1967 and 1972 surveys, when one compares results by provinces, as seen in Table 10. Still, the national data, even when disaggregated to provincial levels, is fairly consistent. There is only one province (Manitoba) for which the percentages for the two surveys differ by more than 10%; this may be due to a change in licensing regulations or enforcement practices. However, some differences (even if not large) are significant (Canada: a < .001; Quebec: a < .001; Manitoba: a < .001).

TABLE 7: COMPARISON OF PERCENTAGES OF CANADIAN WATERFOWL HUNTERS ACCORDING TO 1970 - 1971 LICENSE SALES AND 1972 NATIONAL SURVEY, CANADA AND REGIONS (SIGNIFICANCE TEST)

| | 1971 Migratory Game Bird Hunting Permit Sales, 16+* (u)% | 1972 National Survey Waterfowl Hunters, (X)% | 16+ # | Difference X% - u% |
|---|---|---|---|---|
| Canada | 2.6 | 3.5 | 3155 | 0.9% |
| Atlantic Provinces | 3.6 | 3.5 | 312 | -0.1 |
| Quebec | 1.2 | 2.5 | 917 | 1.3 |
| Ontario | 2.3 | 3.6 | 1069 | 1.3 |
| Manitoba | 5.4 | 5.2 | 153 | -0.2 |
| Saskatchewan | 6.6 | 7.2 | 139 | 0.6 |
| Alberta | 5.5 | 5.0 | 260 | -0.5 |
| British Columbia | 2.0 | 2.6 | 305 | 0.6 |

| | $\gamma D\% = 100\,(pq/n)^{**1/2}$ | Confidence Coefficient $Z_c = (X\% - u\%)/\gamma^D\%$ | Significance Level $\acute{\alpha}$ |
|---|---|---|---|
| Canada | .32% | 2.81 | .005 |
| Atlantic Provinces | 1.05 | -0.10 | > .92 |
| Quebec | 0.55 | 2.36 | > .01 |
| Ontario | 0.55 | 2.36 | > .01 |
| Manitoba | 1.79 | -0.11 | > .91 |
| Saskatchewan | 2.19 | 0.27 | > .86 |
| Alberta | 1.34 | -0.37 | > .71 |
| British Columbia | 0.89 | 0.67 | > .50 |

* Permit Sales % were calculated from absolute number of Permit Sales given in Canadian Wildlife Service, Progress Notes, No. 28, July 1972. Population 16 years and over is given in 1971 Census of Canada, Statistics Canada CAT. No. 92-715 and 92-716. These figures are given in Appendix.

Generally the results in Table 11 indicate poor fit between 1961 Canadian Wildlife Service Survey data and 1972 National Survey data. It is not impossible that the percentage of Canadian fishers has increased from ll% in 1961 to 28% in 1972, but this explanation is not likely. It should be noticed that the differences are all highly significant (a < .001) in Table 11. What is important is that one may reasonably hypothesize that the differences are partly due to differences in definitions of "fishing". In fact, for the 1961 C.W.S. survey, a person was considered a fisherman if one hour or more was spent sport fishing during 1961; for the 1972 national survey a respondent was considered as having fished in 1972 if he said that he had fished at least once in the past year. The 1961 C.W.S. survey definition of fisherman seems much more restrictive than the national survey definition. There is good reason to believe that wives who accompanied husbands on fishing trips would often say to national survey interviewers that they fished (they had been fishing) in the past year. Regardless, one or the other (or both surveys) are not valid in all likelihood.

Comparison of 1970-71 Estimate of Anglers from Sport Fishing Licenses in Canada and of percentage of fishers according to 1972 National Surveys results in the figures given in Table 12. Then it can be seen that the two estimates of the numbers of Canadian fishermen differ considerably, not only when provinces are considered but even when Canada as a whole is considered. The 1970-71 estimates of anglers from licenses sales are much closer to the 1961 C.W.S. survey figures (see Table 11) than to the 1972 national survey percentages.

TABLE 8: PERCENTAGES OF HUNTERS IN CANADA (1972 NATIONAL SURVEY) AND IN U.S.A. (1970 NATIONAL SURVEY OF FISHING AND HUNTING) ACCORDING TO SEX (SIGNIFICANCE TEST)

| | U.S.A. 1970, 12+ (N=8,700) (a) | Canada 1972, 12+ (N=3681) (b) | Difference x = b - a |
|---|---|---|---|
| HUNTING | | | |
| Total | 9.2% | 12.0% | 2.8% |
| Mates | 18.3 | 21.3 | 3.0 |
| Females | 1.1 | 3.2 | 2.1 |
| SMALL GAME | | | |
| Total | 7.5 | 9.0 | 1.5 |
| Males | 15.0 | 16.2 | 1.2 |
| Females | 0.7 | 2.3 | 1.6 |
| LARGE GAME | | | |
| Total | 5.0 | 4.7 | -0.3 |
| Mates | 9.9 | 8.4 | 1.5 |
| Females | 0.6 | 1.3 | 0.7 |
| WATERFOWL | | | |
| Total | 1.9 | 3.7 | 1.8 |
| Males | 3.8 | 7.1 | 3.3 |
| Females | 0.1 | 0.4 | 0.3 |

| | Standard error of the difference $\gamma D\%$ | Confidence coefficient Zc $= (x/\gamma D\%)$ | Significance Level $\acute{\alpha}$ |
|---|---|---|---|
| HUNTING | .59% | 4.75 | $< .001$ |
| SMALL GAME | .55 | 2.73 | $> .006$ |
| LARGE GAME | .45 | -0.67 | $> .50$ |
| WATERFOWL | .32 | 5.63 | $< .001$ |

It is highly tempting to conclude from the Table 12 comparisons that the figures confirm the hypothesis that the number of people fishing is much greater, probably twice as great as the number of Canadians who purchase fishing licenses. (Purchasing licenses should not be taken literally because "license purchases" for Ontario are estimates after 1970 since no fishing license is required by residents.)

Of course another and better explanation for the large variation is that the differing definitions of fishermen in the two surveys mean the survey results should not agree!

As with hunting, comparison of US 1970 National Survey Data on Fishing and 1972 National Survey data is of some relevance in evaluating Canadian surveys. As can be seen from Table 13, for salt water fishing, Canadian and American percentages are almost identical for both sexes. But when fishing in general and freshwater fishing in particular are considered, the Canadian percentages are much higher than the American percentages. It may be tempting to conclude that, in fact, the percentages of Canadians who fish, particularly in freshwater, are greater than the percentages of Americans; but these facts may well indicate nothing more than the differences in the questions asked.

TABLE 9: PERCENTAGE OF CANADIANS 18 YEARS AND OVER WHO DID PARTICIPATE IN FISHING IN 1967, 1969, 1972 (CORDS NATIONAL SURVEYS)

| | Fishing | Salt-Water Fishing | Fresh-Water Fishing |
|---|---|---|---|
| 1967 (N=5986) | 27% | - | - |
| 1969 (N=2967) | - | - | - |
| 1972 (N=3002) | 31% | 6% | 29% |
| Maximum Difference (x) | 4% | | |
| Standard Error of the Maximum Difference ($\gamma D\%$) | 1.0% | | |
| Confidence Coefficient ($Zc=x/\gamma D\%$) | 4.00 | | |
| Level of Significance | $< .001$ | | |

TABLE 10: PERCENTAGE OF CANADIANS 18 + WHO DID PARTICIPATE IN FISHING IN 1967 AND 1972 BY REGION (CORDS NATIONAL SURVEYS)

| | 1967 | | 1972 | | |
|---|---|---|---|---|---|
| | % | # | % | # | Difference x |
| Canada | 27 | 5986 | 31 | 3002 | 4% |
| Atlantic Provinces | 33 | 625 | 31 | 295 | 2 |
| Quebec | 21 | 1742 | 29 | 870 | 8 |
| Ontario | 29 | 1972 | 30 | 1018 | 1 |
| Manitoba | 17 | .320 | 38 | 148 | 21 |
| Saskatchewan | 26 | 291 | 31 | 132 | 5 |
| Alberta | 24 | 433 | 29 | 251 | 5 |
| British Columbia | 31 | 603 | 39 | 288 | 2 |

| | Standard error of Difference $\gamma D\%$ | Confidence coefficient $Zc = x/ \gamma D\%$ | Significance Level $\acute{\alpha}$ |
|---|---|---|---|
| Canada | 1.0% | 4.00 | $< .001$ |
| Atlantic Provinces | 3.30 | 0.61 | $> .54$ |
| Quebec | 1.76 | 4.55 | $< .001$ |
| Ontario | 1.76 | 0.57 | $> .57$ |
| Manitoba | 4.24 | 4.95 | $< .001$ |
| Saskatchewan | 4.71 | 1.06 | $> .29$ |
| Alberta | 3.48 | 1.44 | $> .14$ |
| British Columbia | 3.28 | .61 | $> .54$ |

SYNOPSIS OF FISHING COMPARISONS

Most comparisons that were presented in this section leave the reader with the impression that the national surveys overestimate the percentage of Canadians who go fishing. The 1972 survey gives a percentage of Canadian fishers about three times greater than the percentages given by a similar survey conducted in 1961 by the Canadian Wildlife Service. The 1972 percentages of Canadians who fish are about twice as high as percentages given by a 1970-71 estimate of Anglers from Licenses Sales. The 1972 percentages of Canadian fishers are much higher than 1970 American figures. This may be explained by speculative causes such as (1) participation in fishing has greatly increased in the last ten years, (2) people who go fishing

without a license are as numerous as those who get a license and that in fact (3) freshwater fishing is more popular in Canada than in the U.S.A. However since the results of the 1967 and 1972 surveys are very similar, it appears that the "overestimate" is obtained consistently by national surveys. So it can be concluded that the survey results on fishing by Canadians are reliable (consistent), but their validity should be questioned.

TABLE 11: COMPARISON OF PERCENT RESULTS OF 1961 CANADIAN WILDLIFE SURVEY AND 1972 NATIONAL SURVEY ON CANADIAN FISHERS

|  | Fishing | Fresh-Water Fishing | Salt-Water Fishing |
|---|---|---|---|
| C.W.S 1961 Survey Age 14+ (N=30,000) (a) | 10.8 % | 10.4% | 1.2 |
| National 1972 Survey Age 15+ (N=3255) (b) ' | 28.3% | 27.1% | 5.2% |
| Difference x=b-a | 17.5% | 16.7% | 4.0% |
| Standard Error of Difference $\gamma D\%$ | .63% | .63% | .32% |
| Confidence Coefficient Zc=x/$\gamma D\%$ | 27.78% | 26.51% | 12.50% |
| Significance Level ά | < .001 | < .001 | < .001 |

TABLE 12: COMPARISON OF PERCENTAGES OF CANADIAN FISHERS (ALL TYPES) ACCORDING TO 1970 - 1971 ESTIMATE OF ANGLERS FROM SPORT FISHING LICENSES AND 1972 NATIONAL SURVEY, CANADA AND REGIONS

|  | 1970-71 Estimate of Anglers from Licenses Sales, 16+* (u)% | 1972 National Survey Fishers, (X)% | 16+ # | Difference X% - u% |
|---|---|---|---|---|
| Canada | 14.2 | 27.5 | 3155 | 13.3% |
| Atlantic Provinces | 17.1 | 25.0 | 312 | 7.9 |
| Quebec | 13.2 | 25.6 | 917 | 12.4 |
| Ontario | 13.0 | 29.1 | 1069 | 16.1 |
| Manitoba | 13.8 | 30.7 | 153 | 16.9 |
| Saskatchewan | 17.3 | 25.9 | 139 | 8.6 |
| Alberta | 12.1 | 24.6 | 260 | 12.5 |
| British Columbia | 14.7 | 32.5 | 305 | 17.8 |

|  | $\gamma g D\%=100 (pq/n)^{**1/2}$ | Zc = (X - u%)/$\gamma D\%$ | Significance Level ά |
|---|---|---|---|
| Canada | 0.78% | 17.05 | < .001 |
| Atlantic Provinces | 2.45 | 3.22 | < .001 |
| Quebec | 1.45 | 8.55 | < .001 |
| Ontario | 1.38 | 11.67 | < .001 |
| Manitoba | 3.73 | 4.53 | < .001 |
| Saskatchewan | 3.72 | 2.31 | > .02 |
| Alberta | 2.67 | 4.68 | < .001 |
| British Columbia | 2.68 | 6.64 | < .001 |

* License sates % were calculated from absolute number of License Sales given Statistics Canada on Sates of Sport Fishing Licenses in Canada 1966 - 1971, Environment Canada, September, 1973. Population 16 and over is given in 1971 Census of Canada, Statistics Canada, CA( No. 92-716. These figures are given in Appendix.

TABLE 13: PERCENTAGES OF FISHERS IN CANADA (1972 NATIONAL SURVEY) AND IN U.S.A. (1970 NATIONAL SURVEY OF FISHING AND HUNTING) ACCORDING TO SEX

| | U.S.A. 1970 Age 14+ (N 8700) (a) | Canada 1972 Age 12+ (N 3681) (b) | Difference b-a |
|---|---|---|---|
| FISHING | | | |
| Total | 21.4% | 31.5% | 10.1% |
| Males | 32.7 | 44.5 | 11.8 |
| Females | 11.1 | 19.4 | 8.3 |
| SALT-WATER FISHING | | | |
| Total | 6.1 | 5.5 | -0.6 |
| Males | 9.9 | 8.4 | -1.5 |
| Females | 2.6 | 2.7 | 0.1 |
| FRESH-WATER FISHING | | | |
| Total | 18.9 | 30.3 | 11.4 |
| Males | 29.1 | 42.8 | 13.7 |
| Females | 9.7 | 18.6 | 8.9 |

| | Std Error of difference $\gamma D\%$ | Confidence Coefficient $Zc=x/\gamma D\%$ | Significance Level |
|---|---|---|---|
| FISHING | .84% | 12.02 | < .001 |
| SALT-WATER FISHING | .45% | 1.33 | > .18 |
| FRESH-WATER FISHING | .84% | 13.57 | < .001 |

GENERAL CONCLUSION

The national surveys data seem quite reliable, i.e. consistent from one survey to another when hunting and fishing data are compared. However, the hunting data seem more valid than the fishing data when compared to other data sources. As far as hunting data are concerned, only 7% (4/60) of the comparisons show differences greater than 10%; for fishing data, 45% (13/29) of the comparisons show differences greater than 10%. While 47% (23/49) of the significance levels are less than .05 for hunting, in the case of fishing it is 74% (17/23) of the significance levels that are less than .05; i.e. 74% of the differences noticed from the comparison of fishing data are highly significant. While the hunting data seem reliable and valid, the fishing data raise many questions which the data limitations do not permit one to answer.

TABLE 15: ABSOLUTE NUMBERS FROM WHICH PERCENTAGES OF HUNTERS WERE ESTIMATED FROM LICENSES SALES

| Regions | 1971 Population Age 16+* | Hunting Licenses Sales 1970-71** |
|---|---|---|
| Canada | 14,742,225 | 2,322,800 |
| Atlantic Region | 1,336,335 | 247,700 |
| Quebec | 4,112,625 | 382,800 |
| Ontario | 5,344,935 | 617,000 |
| Manitoba | 681,560 | 93,000 |
| Saskatchewan | 625,380 | 163,800 |
| Alberta | 1,078,655 | 372,200 |
| British Columbia | 1,531,715 | 440,400 |

| Regions | Licenses Small Game Hunting Sales 1970-71** | Big Game Hunting Licenses Sales 1970-71** | Waterfowl Hunting Permit Sales 1971*** |
|---|---|---|---|
| Canada | 1,044,300 | 1,048,800 | 395,622 |
| Atlantic Region | 98,100 | 141,000 | 49,414 |
| Quebec | 211,700 | 160,300 | 49,001 |
| Ontario | 378,500 | 165,900 | 125,010 |
| Manitoba | 45,800 | 47,200 | 37,668 |
| Saskatchewan | 61,700 | 102,100 | 42,525 |
| Alberta | 84,100 | 154,500 | 61,007 |
| British Columbia | 163,300 | 277,100 | 30,897 |

* Source: 1971 Census of Canada, Statistics Canada, CAT. No. 92-715 & 92-716
** Source: Statistics Canada, Travel Tourism and Outdoor Recreation: A Statistical Digest, 1972, CAT. No. 66-202, Table 8.7, p. 94.
*** Source: Canadian Wildlife Service, Progress Notes, No. 28, July 1972.

TABLE 16: ABSOLUTE NUMBERS FROM WHICH PERCENTAGES OF PERSONS WHO FISH WERE ESTIMATED FROM LICENSES SALES

| Regions | Estimated Anglers Age 16+ 1970-71 (Resident) |
|---|---|
| Canada | 2,095,000 |
| Atlantic Provinces | 228,C00 |
| Quebec | 543,000 |
| Ontario | 696,000 |
| Manitoba | 94,000 |
| Saskatchewan | 108,000 |
| Alberta | 131,000 |
| British Columbia | 225,000 |

Source: Statistics on Sales of Sport Fishing Licenses in Canada 1966-1971, Recreation Fisheries Branch Department of the Environment, Ottawa, Ontario, September 1973.

APPENDIX THE SIGNIFICANCE TESTS

To determine the level of significance two different approaches were used depending on whether the comparison was done between two samples or between a sample and license sales data.

Comparison Between Two Samples

The level of significance ά is given by the Normal Curve Area Table once a confidence coefficient $Zc = x/\gamma D\%$ is obtained, where x is the difference observed between two results, i.e. between the 1967 percentage of participants and the 1972 percentage of participants. Incidentally, n1 and n2 are large so one is not concerned with the Student's T distribution.

The standard error of the difference $\gamma D\%$ is obtained by the use of the following formula for proportions:

$\gamma(D)\% = 100 (p(1-p)((1/n1)+(1/n2)))**1/2$

(Note: variance in a proportion determined by sampling of size n is $p(1-p)/n$)

WHERE p is the total percentage of participants in the two surveys compared,

n1 = number in first sample, and

n2 = number in second sample.

Comparison Between A Sample and License Sales Data,

In this case, the significance level is also given by the Normal Curve Area Table once a confidence coefficient Zc has been obtained by the use of the following formula:

$Zc = (X\% — u\%)/\gamma(D)\%$

WHERE X% is the percentage of participants in the national survey.

u% is the percentage of license holders, and

$\gamma D\%$ is the standard error of the difference between the national survey results and the proportion of license holders.

The standard error of the difference $\gamma D\%$ was calculated by the use of the following formula:

$\gamma(D)\% = 100 (p(1-p)/n)**1/2$

WHERE p is the percentage of participants in the survey sample, and

n = number in survey sample.

If the level of significance of .05 was chosen a difference was considered as significant, not due to chance, if the probability of the difference is less than .05; i.e. there are less than 5 chances in 100 that the difference is a chance difference due to sampling. For example in Table 1, the maximum difference of 3% which is noticed between the 1967 and 1972 national surveys is significant at > .002, i.e. there is little more than 2 chances in 1000 that the 3% difference noticed is due to sampling.