

# RECALL BIAS IN THE NATIONAL SURVEY OF FISHING, HUNTING, AND WILDLIFE ASSOCIATED RECREATION

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## I. Introduction

The National Survey of Fishing, Hunting and Wildlife Associated Recreation (FHWAR) collects data on the fishing and hunting in the United States. The survey is sponsored by the Fish and Wildlife Service (FWS). The data is collected by the Bureau of the Census. Until 1985 the data was collected in a single interview with a one year reference period. WESTAT conducted for FWS a study of the effects of recall using several recall periods in two states in 1987. FWS then decided to switch the recall period from twelve months to four months. In the 1991 survey, we conducted a national recall bias study to measure the effects of the changes in procedures on the national estimates. This paper reports on our findings.

Our study showed that annual recall resulted in an overstatement of the number of days hunting and fishing and in the money spent on these activities. It showed a much small overstatement of the number of hunters and an understatement of the number of anglers.

## II. The 1991 Recall Bias Study

The purpose of the study was to recall measure recall bias and assist in evaluating recall options for the next survey. It would also help in estimating trends in participation and expenditures. There were three distinct surveys in our recall bias study: the 1985 FHWAR, the 1991 FHWAR, and the 1991 annual recall survey. Each design was different.

In January, 1986 we fielded a general population survey asking about hunting and fishing during 1985. This was used as a screening sample to select respondents for the detailed survey. The screening sample was conducted for the most part by phone. A few weeks later we conducted personal interviews of a subsample of the sportsmen.

The 1991 survey was more complex. In January, 1991 we fielded a general population survey. We collected the data for the most part by phone. The respondents were asked about their

activities during the past five years, their activities to date in 1991, and their plans for the remainder of 1991. Those who had participated in the last five years or intended to participate in 1991 were subsampled. Those selected in this subsample were interviewed, usually by phone, three times during the year (May 1991, September 1991 and January 1992). We knew that by restricting the subsample to those who were active in the last five years or those who intended to participate in 1991 we would miss some sportsmen. We felt this group would be small. Also, the cost would be substantial to include those people who, for the most part, would not participate had we used broader criterion. No attempt was made to measure any impact of the switch from personal to phone interviews for the detailed questions.

The sample for the annual recall study was selected at the same time as the 1991 FHWAR using the same screening and sampling methods. The FHWAR frame for the annual recall study was restricted to those who participated in 1990 or 1991 or who intended to participate in 1991. This limits the conclusions that can be drawn as about 8 percent of the main survey target population is ineligible for the annual recall study.

The analysis for the recall bias study involved only the last two surveys. Because of the design differences between 1985 and 1991 we did not obtain all of the information we would like. For example, in 1986 the detail interview followed the screener by a few weeks and both interviews covered the same year. In the 1991 annual recall survey the detail interview occurred a year after the screener. The screener and the detailed interview covered different years. So the 1991 survey provides information on the differences in recall periods when the samples are selected in the same way.

Each person in the screening sample was assigned to one of the following groups:

Active - a person who participated in hunting or fishing in 1990 or in 1991 or who intended to participate in 1991. This group represented 42.1 percent of the universe.

Inactive - a person who did not participate in hunting or fishing in 1990 or 1991, participated in

1986 to 1989, and did not intend to participate in 1991. This group represented 3.9 percent of the universe.

Nonparticipant - a person who did not participate in hunting or fishing in 1986 to 1991, and who did not intend to participate in 1991. It was difficult to be in this group as any hint of possible future participation would move the respondent to the active group. This group represented 54.0 percent of the universe.

A subsample of the active and inactive groups were selected for the main survey. Only those in the active group were eligible for the annual recall sample. To make the annual and trimester estimates comparable for the analysis, we excluded the inactive from the trimester estimates. Therefore, the data described in the following section applies only to the active group. It does not match published estimates based on the full sample.

### III. Results of the Annual Recall Bias Study

#### A. Setting the Stage

The analysis of the data from the recall bias study showed recall effects that were for the most part consistent with what was expected. The exception to this was that the number of anglers appears to be understated when annual recall is used. For most other significant characteristics the use of trimester interviewing resulted in lower estimates. However, the magnitude of the effects are larger for anglers than for hunters. The standard errors on the estimates of hunters are relatively large - the difference vary from 1.0 to 1.6 standard errors. Thus, while not statistically significant the estimates themselves are consistent with what we see for the anglers for average days and expenditures.

Table 1 summarizes the effects of annual recall for a few major statistics. The differences are likely linked to the nature of the two sports. Fishing tends to be more of a year round sport, with more activity in the spring and summer. Hunting, tends to be concentrated in the latter part of the year. This means that in an annual recall survey conducted in January the recall period is longer for fishing related data than it is for hunting data.

Table 2 shows participation for each of the three trimesters. About 20 percent of the anglers are not active after the first trimester and 72 percent of the anglers are not active after the second trimester. Thus, in an annual survey the minimum recall period for 20 percent of the anglers

is over eight months and that the minimum recall period for 72 percent of the sample is over four months.

Hunters are different. Only 8 percent are not active after the first trimester and only 12 percent are not active after the second trimester. Half of the hunters are active only in the last trimester. Thus, in an annual recall survey hunters have a significantly shorter recall period.

It is not surprising that the recall bias effects are larger for anglers than for hunters. 52 percent of the hunters are active only in the last trimester. Compare this to 5 percent for anglers. For this group the recall period is effectively the same for both the annual and trimester recall situations. Recall bias effects should be small for this group.

Note that 57 percent of the sample did not participate in fishing and that 82 percent of the sample did not participate in hunting. These numbers are high since persons were included based on participation or anticipated participation in either sport. We also included in sample anyone who thought he or she might participate in either sport in 1991. We would much rather include too many persons in our sample and find out later that they did not participate. The alternative of being too restrictive in whom to include would mean that we would miss participants and create a downward bias in the estimates of participation rates.

Recall bias can take two forms. Overestimates occur when people telescope forward events from earlier time periods. The screening interview, which serves as a bounding interview in our study, would tend to reduce this effect. Alternately if people forget events then we see lower estimates. We expect the effects to be smaller with the use of trimester recall. Our results show that there appears to be an overstatement of the true level of activity with the use of annual recall relative to trimester recall. The exception to this was the participation rates for anglers.

#### B. How Recall Bias Effects Participation Rates

Recall bias effects for participation are quite different for anglers and hunters. The overall effect on the participation rate of hunters caused by the switch to trimester recall was a small 2.4 percent decline. This decline is not statistically significant being slightly less than one standard error. This is not very surprising in light of the concentration of hunting in the latter part of the year.

One feature that stands out in the analysis is that the effects for hunters is clearly sex dependent. The use of trimester recall did not show any effect

on the male participation rate. In contrast the use of trimester recall reduced the number of female participants by 25 percent. Approximately 92 percent of the hunters are male so this does not have a large effect on the total estimate.

There are indications that recall bias is effected by what we call attachment to the sport. Table 3 illustrates this point for hunters. We classified the respondents by the reason they were screened into sample for the survey. This was based on activity at the time of the screener interview. At that time we determined degree of activity in both sports during 1990 and asked about activity to date in 1991. The groups are mutually exclusive. Activity in 1991 is given precedence over activity in 1990 in this table. Thus, if a respondent was an avid hunter in 1990, but also fished in 1991 he/she is included in this table as fished in 1991.

It appears the more one is attached to the sport the lower is the recall bias in terms of participation. This is not a surprise. Very active participants should not be making errors in participation.

In theory the recall bias for those who were selected because they indicated that they had already hunted in 1991 should be zero. Our estimate was 3.9 percent. This is caused by discrepancies in answers given in the follow-up interviews. That is some of those who indicated activity in 1991 in the screener told us that they did not hunt in the follow-up detail interview(s). This effect was apparently different for the trimester recall and the annual recall.

The effect of recall on estimates of the number of anglers was quite different. The group showed an increase of approximately 10 percent in the number of anglers when trimester recall is used.

Given the sex dependency of the recall bias effects for hunters it is natural to examine the same feature for anglers. The effect is still there but it is quite different. The use of trimester recall increased the number of male anglers by about 8 percent and increased the number of female anglers by about 18 percent. So for females the effect is smaller, but in the opposite direction. While females made up only 8 percent of the hunters they are about 27 percent of the anglers. So they have a correspondingly greater effect on the overall recall bias. This seems to indicate that with the use of annual recall people tend to forget about fishing activities and that women are more likely to forget than men. This may again be linked to the degree of attachment to the sport.

It also indicates that recall bias is linked to attachment to the sport. However, the effect is different for anglers than it was for hunters. The impression one gets from Table 3 is that the less one is attached to fishing the greater the recall bias effects. This is the same effect as we saw with the hunters.

This data stands in contrast with what we saw for the hunters. There we saw a decrease in the number of hunters with the use of trimester recall with anglers. There is an increase in the number with the use of trimester recall.

This data supports the assumption that the different periods of activity during the year affect recall bias. With hunting there is little time to forget about hunting activity as most hunting occurs in the latter part of the year. Most fishing is completed by early fall. Thus, it is much more likely that in an annual recall situation with January interviewing people will forget about some fishing activities.

#### C. How Recall Bias Effects Estimates of Involvement and Expenditures

We expected to see lower estimates for many of the characteristics with the use of trimester recall. Indeed that is what we found. Tables 4 and 5 show the data on this effect.

The average days of activity declined. The average number of trips taken declined. The average cost for trips also declined. There was no measurable effect on the expenditures for equipment. Where differences were noted they were in general larger for anglers than for hunters.

These results must be considered in light of the findings on participation rates. For hunters the participation rates with trimester and annual recall were not very different (2.4%). Thus, we can conclude that with annual recall we were likely getting overstatements of the amount of activity and the money spent on these activities.

The participation rates for anglers were significantly higher for trimester recall. We indicated in the previous section that the additional people we picked up had a more marginal attachment to the sport. It was very reasonable then that on the whole these additional people were less active and spent less money on the sport. This would itself tend to result in lower estimates of average days of activity and average expenditures. Thus, the lower numbers we show in the tables show the combined effect of the change in participation rates, the kinds of people we added as participants, and any changes in actual expenditures.

Thus, we feel that it would not be valid to claim that the real effects on expenditures and amounts of activity are different for hunters and anglers. For averages there is a difference, but that difference may not hold up for individuals.

There are reasons to believe that the effects would be different for hunters and anglers. The data we showed in Section III.A above on the period of year each sport is active is also a factor in considering the differences. Again the effect would logically be greater for anglers since under annual recall they have longer recall period than do the hunters. We examined data on average days and expenditures based on which trimesters people were active. However, we found it difficult to draw and conclusions from this data.

In summary we have concluded that participation rates are affected by recall period differently for hunters than for anglers. This difference is related to the periods of the year during which each sport is most active. Data such as degree of activity and amounts of money spend are also affected. There is an interaction between this data and the data on participation that makes it very difficult to examine how the data are different for hunters and anglers.

#### IV. Comparison to the WESTAT Study

The 1987 WESTAT study formed the basis for the decision to move to a trimester survey. It is desirable to compare the results of that study with what we found. There are a number of differences between the studies that weaken the comparison.

First, the WESTAT study was restricted to East Central Wisconsin and East Texas. The study it considered a number of different recall periods, did not use trimester survey. They extrapolated the results to estimate what the effects would be. Both the WESTAT study and our study used a screening sample to obtain a sample of people who were active in the proceeding year. In this feature they were similar to our universe. However, our study also included people who expected to be active in the current year. Because of this our universe was about 26 percent larger than the WESTAT universe. WESTAT's interviews involved a two step procedure. They first conducted a telephone screening interview. If there was activity, this interview was followed by a personal visit for a more detailed interview. We have no measure of the impact this two step process has on the comparability of the results. Also, our follow-up interviews were conducted by telephone. We did

not try to measure any effects from the switch from personal interviews to telephone interviews. The detailed interview in our annual recall survey was conducted by telephone.

Because of these features we examined only a few key statistics. There is considerable sampling variance on these estimate from the WESTAT study. Table 6 shows these estimates. In terms of days of activity and expenditures the recall biases are in the same direction.

The recall bias for participation rates for fishing are different. The other difference could be all due to sampling error. The reasons for the difference is not apparent due to the differences in the two studies. It may be that the seasonal patterns of participation in the two sports are different in the two states selected for the WESTAT study. It could be that the additional screening interview used in the WESTAT study had an effect. We cannot measure that.

Most surprising in some ways is the size of the recall bias in the WESTAT study for the number of hunters in a trimester recall situation. This is surprising when we consider that over half the hunters were active in only the last trimester. No recall bias would be expected to be measured for that group. If that is true it would mean that fully a quarter of the people who report hunting in the first two trimesters in an annual survey do so in error. This would be a sizeable recall bias.

In summary the two studies found recall bias for days of activity and expenditures in the same direction. There were differences in the recall bias patterns for participation rates. These differences are not readily explained. And finally, there are a number of design issues that make it difficult to compare the results from the two studies. We are not comfortable making firm comparisons between the two studies with such significant differences in designs, target populations, and procedures. We take comfort in the simple fact that for the most part we see biases in the same direction. It should be remembered that the two studies had different purposes. The WESTAT study was designed to choose an alternative reference period. Our study was designed to measure the effect of the shift to the trimester reference period.

#### V. Conclusions

The area of recall bias is a complex one. There are many factors which affect the size and kinds of recall bias that confront the survey designer. The general wisdom is that more frequent

interviewing is preferred. But, this comes at a cost for the additional interviews. The key is to select an appropriate tradeoff between cost and recall bias in selecting the recall period.

We have seen in our analysis that indeed recall bias acts differently for the two types of sportsmen in which we are interested for the FHWAR survey. For both groups we see that a shorter reference period results in lower estimates of both the average amount of activity and the average expenditure. However, when we consider participation rates we find that the different seasonal nature of the two sports results in different recall bias conclusions.

We saw little recall bias for hunters. We find this a satisfying result given that most hunting occurs in the last trimester. For anglers the results were different. We also showed that the increase was linked to attachment to the sport. Those who were less attached to fishing showed the larger increases. This is an internal consistency in the data that we find very satisfying.

We conclude that the use of trimester recall has substantially improved the quality of the data gathered in the survey.

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Table 6: Percent Change Due to Trimester Recall

		<u>WESTAT</u>	<u>1991 AR</u>
Hunting	Participants	-12.6%	-2.4%
	Average Days	-15.1%	-6.6%
	Average Expenditures	-8.7%	-7.2%
Fishing	Participants	-8.4%	9.6%
	Average Days	-30.8%	-22.5%
	Average Expenditures	-32.3%	-19.6%

Table 1: Increases and Decreases Due to Trimester Recall

	<u>Anglers</u>	<u>Hunters</u>
Participation	9.6%	-2.4%
Average Days	-22.5%	-6.6%
Average Expenditures	-19.6%	-7.2%

Table 3: Recall Bias as Related to Type of Activity

<u>Screener Criterion</u>		<u>Screener Criterion</u>	
Avid Hunter in 1990	-4.3%	Hunted in 1991	3.9%
Avid Hunter and Fisher in 1990	-3.4%	Hunted and Fished in 1991	-6.2%
Avid Fisher in 1990	-14.4%	Fished in 1991	-10.8%
Avid Fisher in 1990	4.0%	Fished in 1991	1.1%
Avid Hunter and Fisher in 1990	6.2%	Hunted and Fished in 1991	5.8%
Avid Hunter in 1990	11.6%	Hunted in 1991	7.0%

**Table 2. Anglers and Hunters by Trimesters of Participation  
(includes only those interviewed all 3 Trimesters)**

	<u>Anglers</u>			<u>Hunters</u>		
	<u>Number</u>	<u>Percent of Total</u>	<u>Percent of Anglers</u>	<u>Number</u>	<u>Percent of Total</u>	<u>Percent of Hunters</u>
Trimester 1 only	6412627	8.5%	19.7%	995180	1.3%	7.5%
Trimester 2 only	9293233	12.3%	28.6%	560262	0.7%	4.2%
Trimester 3 only	1452962	1.9%	4.5%	6835325	9.1%	51.7%
Trimesters 1 & 2	7672457	10.2%	23.6%	106758	0.1%	0.8%
Trimesters 1 & 3	1134374	1.5%	3.5%	2326964	3.1%	17.6%
Trimesters 2 & 3	1908399	2.5%	5.9%	1254309	1.7%	9.5%
Trimesters 1, 2 & 3	4639036	6.2%	14.3%	1133499	1.5%	8.6%
Nonparticipants	42825426	56.8%	0.0%	62126217	82.5%	0.0%
Total	75338514	100.0%	100.0%	75338514	100.0%	100.0%

**Table 4. Annual and Trimester Recall Estimates of Participation**

	<u>Average Days of Participation</u>				<u>Average Trips Taken</u>			
	<u>Annual Recall Estimate</u>	<u>Trimester Recall Estimate</u>	<u>Diff</u>	<u>t-stat</u>	<u>Annual Recall Estimate</u>	<u>Trimester Recall Estimate</u>	<u>Diff</u>	<u>t-stat</u>
All hunters	18.1	16.9	1.1	1.42	16.9	15.4	1.5**	2.04
big game	11.6	12.1	-0.4	-0.74	9.4	9.8	-0.4	-0.75
small game	10.6	10.1	0.4	0.69	9.9	9.5	0.4	0.65
migratory birds	7.4	7.4	-0.1	-0.13	6.6	6.5	0.1	0.12
other animal	17.3	13.8	3.5	1.56	15.8	12.9	2.9*	1.39
All fishermen	19.1	14.8	4.4	5.95	16.9	13.1	3.8**	5.89
great lakes	14.2	10.2	4.1	1.73	9.7	8.2	1.5	0.97
other freshwater	22.0	14.6	7.4	7.76	16.2	12.5	3.6**	5.27
saltwater	12.4	8.5	3.9	3.86	9.5	7.3	2.2**	2.96

where \* means significantly different at the .10 level and \*\* means significant at the .05 level.

**Table 5. Annual and Trimester Recall Estimates of Expenditures**

	<u>Average Trip-Related Expenditures</u>				<u>Average Equipment Expenditures</u>			
	<u>Annual Recall Estimate</u>	<u>Trimester Recall Estimate</u>	<u>Diff</u>	<u>t-stat</u>	<u>Annual Recall Estimate</u>	<u>Trimester Recall Estimate</u>	<u>Diff</u>	<u>t-stat</u>
All hunters	265	246	19	1.07	239	236	3	0.16
big game	199	205	-6	-0.38	139	149	-10	-0.68
small game	110	101	9	0.83	77	78	-1	-0.08
migratory birds	144	115	29	1.30	74	95	-21	-1.05
other animal	91	84	7	0.28	59	74	-15	-0.38
All fishermen	428	344	84	2.46	111	109	2	0.21
great lakes	349	352	-3	-0.05	36	77	-41	-2.99
other freshwater	322	269	53	2.00	88	78	10	1.24
saltwater	490	358	132	2.45	76	88	-12	-0.92

where \* means significantly different at the .10 level and \*\* means significant at the .05 level.