

A RECALL EXPERIMENT: IMPACT OF TIME ON RECALL OF RECREATIONAL FISHING TRIPS

Barbara Gems, Dharendra Ghosh and Robert Hitlin, Electronic Data Systems, Statistical Consultant and American University

In 1976, National Marine Fisheries Service (NMFS) awarded a contract to Human Sciences Research, Inc. (HSR) of McLean, Virginia to develop and test a methodology for the collection of marine recreational fishing data. Previous survey attempts had been found to have limitations in terms of nonresponse, recall error, or inaccurate reporting. In a series of studies,¹ HSR tested a variety of survey approaches and addressed issues specific to each approach.

The optimal method was found to be a "complemented survey" utilizing both a household telephone survey and an in-person interview. This design allowed for each component survey method to collect the different types of data in the most appropriate way while overcoming the limitations that would exist if either method was used alone.

The telephone survey provides a cost-efficient approach to contacting a large sample of people over a wide geographical area. Creel census methods alone are inadequate for determining the total number of fishermen in the population and the total number of fishing trips they take. The on-site interview and creel census allows non-telephone owning fishermen to be sampled and provides accurate species identification, weights and lengths. This data could not be obtained in previous surveys by telephone.

One area of concern in designing the telephone survey was to determine the recall period, or the length of time over which fishermen could reliably recall dates and details about their fishing trips. A previous survey in 1971, under contract to NMFS, has recommended a two-month recall period.² After listening to anglers report catch and effort data for various time periods, it appeared to researchers that respondents could accurately report the dates of their fishing trips for a period of one or two months.

Further support for the 60-day recall period came from prior work done by HSR as part of the methodological research.³ One of the critical issues which was analyzed was the ability of the sportfisherman to recall catch and effort information over time. One of the outcomes of this study was that fishermen could not accurately estimate the length and weight of their catch, nor could they identify the fish they caught at the species level. As a result of this research, it was decided that the best way to obtain accurate catch data was through a creel census.

The study design also included follow-up contacts by telephone with a sample of individuals initially intercepted and surveyed while fishing. These people were followed up after periods of 15, 30 or 60 days and asked to give the dates for all fishing trips as far back as they could remember. It was discovered that fishermen could report fishing trip dates for which they could not actually recall details of the trip. Some fishermen were able to remember fishing trip dates as far back as 180 days, but as the recall period got longer, fewer trips were reported and less detailed information was available. Overall, almost 70 percent of the total trips were reported within a 0-60 day reference period. When recall by fishing avidity was studied, the span of calendar days over which trips were recalled varied very little between highly avid and less avid fishermen. The average length of time over which fishermen of *all* avidity levels could voluntarily recall dates of fishing trips was 59.7 days. These findings led to the conclusions that fishermen can reliably recall trips over a period of not more than two months, and that the length of recall is relatively stable over avidity levels.

Therefore, when NMFS awarded the contract to HSR to conduct the 1978-79 National Survey of Marine Recreational Fishermen, the two-month recall period was chosen as the most economically feasible option for the telephone portion of the survey.

As part of the national survey, HSR scientists conducted a separate study to further investigate the optimum recall period for which fishermen can accurately report their fishing activity. This report is an analysis of the findings of that study.

Purposes of the Recall Experiment

For most people, a recreational fishing trip may be thought of as a discrete event. Fishing activity in a given time period is likely to occur at irregular intervals with no typical pattern. When a person is asked to report the number of fishing trips taken in a specified time period, he may be unable to reconstruct this activity event by event and his report is subject to inaccuracies.

Since accurate reporting of fishing frequency is necessary for correct estimates of catch and participation statistics, defining the optimum recall period has been an important concern to HSR. The number of fishermen and the number of fishing trips as reported from the telephone survey are used as multipliers to the average catch data reported in the intercept survey. This allows computation of the *total* catch and effort.*

The purpose of the recall experiment was to examine the reporting errors associated with the two-month recall period and determine the most efficient recall period. This efficiency is measured by the total mean square error associated with a recall period for a fixed cost. In general, the longer the recall period for which accurate information can be obtained, the more efficient the survey design is, since more information is collected in each interview.

However, a long recall period also introduces systematic inaccuracies such as omission and telescoping error. Therefore, even though the sampling error associated with a long recall is low, the introduction of bias increases the total error measured by the mean square error (sum of the sampling error and the square of the bias). Random reporting error is included in the sampling error estimated from the sample and the bias stands for systematic reporting error.

As the recall period decreases, the magnitude of the bias decreases, but the sampling error of the estimate for the year increases. The objective is to determine the optimum recall period such that the total mean square error is minimum.

The recall experiment was designed to compare reports of fishing activity from people contacted at two-month intervals (the reference period currently used in the household telephone survey), with reports from people contacted every two weeks for a two-month period using bounded recall procedures. The two-week interval is short enough to prevent omission error, and the bounded recall technique will largely

*The general form of the catch estimates as follows:

Telephone Data	Intercept Data	Results
Number of fishing trips for each state by mode and area	Average catch per trip by species by mode and area	Number of each species caught by mode and area for each state

*For a complete description of the methodology involved, see Dharendra N. Ghosh, "Sampling Design for the National Marine Recreational Fishery Survey: Proceedings American Statistical Association Section of Survey Research Methods, 1981"

overcome the telescoping effect. Therefore, the information received from this group was considered to reflect the true activity. An additional objective of the recall experiment was to obtain two reports (one month apart) of fishing for the same month to investigate the impact of time on recall ability. This data was collected once, shortly after the activity, and again after a 30-day interval. If there was no recall error, both reports should have been the same. The recall experiment was also designed to allow for analysis of comparisons of recall by mode.

Research Design

Table 1 presents the research design. The recall experiment was, in effect, two experiments with several objectives as follows:

Experiment 1:

- Objectives: (1) Compare two-week bounded recall intervals with a longer two-month interval. (2) Compare differences in recall by mode.
- Method: Compare Group 1 with Group 2.

Experiment 2:

- Objective: Determine stability of recall over time by comparing two reports of the same activity given a month apart by the same people.
- Method: Within Groups 4A and 4B compare the first report of October activity with the second report.

During the months of September and October, Group 1 fishermen were contacted every two weeks by interviews from Tele Survey, Inc., and the bounded recall technique was employed. At the second call, fishermen were reminded of their previous trips and the interviewer attempted to obtain a very accurate and current report of fishing activity. Group 2 fishermen were contacted once in early November using the standard telephone interview for a two-month recall period. Appendix A contains interviewer instructions and recording forms for the various groups.

Experiment 2

For this part of the study, another group, Group 3, was added consisting of fishermen identified by the household survey in Wave VI. The groups for Experiment 2 were formed by recontacting fishermen in Groups 2 and 3 during the first week in December and asking for October-November fishing activity. Each group had previously reported October activity; Group 2 to Tele Survey interviewers in November, Group 3 to Burke Interviewers in November. This provided two reports of fishing activity for a single month, given 30 days apart. If there was no recall error, the reports should be the same. By comparing the differences between the first and second report, it was possible to estimate the magnitude of recall errors as well as the direction of error (over- or under-recall).

Table 1. Research Design for the Recall Experiment

Group	n	Fishermen Identified in Household Telephone Survey	Callbacks	Asking for Activity During	Purpose or Technique
1	411	Wave V (July-August) (Called between 8/23/79. 9/7/79)	4 times—every two weeks for two months in September, October and early November	September-October	Control Group— Bounded Recall
2	219	Wave V	Once in early November	September-October	Experiment Group to compare with Group 1—longer interval
3	655	Wave VI (Sept-Oct) (called between 10/23/79. 11/7/79)		September-October	To be called back about October activity.
4A (Formerly Group 2)	210	Wave V	Once in early November (as Group 2) December 1-7	September-October October-November	Compare 2 reports October
4B (Formerly Group 3)	444	Wave VI Called in early November	December 1-7	October-November Originally called by Burke 10/23-11/7 for September and October activity	Compare 2 reports October

Procedures

Experiment 1

Using call records from the household telephone survey for Wave V (July-August 1979), fishermen were randomly assigned to Groups 1 and 2. They were matched by county of residence and fishing activity. In order to prevent "outliers" from skewing the data, persons with greater than 25 fishing trips were excluded. The experiment was confined to fishermen located in Regions 5, 6, or 7 because of the expectation that fishing activity in Region 4 would drop more sharply than in these other regions during the latter stages of the experiment (October and November).

Groups 4A and 4B then, consisted of those fishermen originally in Groups 2 and 3 who provided two reports of October fishing activity.

Analysis and Results

Experiment 1

Table 2 presents the means and standard deviations for recalled number of trips by mode for Groups 1 and 2.

Table 2. Comparison of Reports Given at Two-Week Intervals and Two-Month Intervals: Mean Number of Fishing Trips Reported by Mode

		M/M	B/B	P/C	P/R	TOTAL
Group 1 (n = 411) (2-week intervals)	Mean	0.32	0.26	0.08	0.73	1.40
	s.d.	1.47	1.14	0.49	1.88	2.69
Group 2 (n = 219) (2-month intervals)	Mean	0.16	0.16	0.02	0.58	0.93
	s.d.	1.57	1.01	0.18	1.99	2.66

MODES: M/M = Man/Made Structure
 B/B = Beach or Bank
 P/C = Party or Charter Boat
 P/R = Private or Rental Boats

Fishermen in Group 1, called at two-week intervals, recalled significantly more fishing trips ($z = 2.10, p < .05$) than those persons contacted only once at the end of the two-month period. Differences in recall for the various modes were not significant with the exception of the P/C mode ($z = 2.05, p < 0.5$). However, the numbers of fishermen reporting fishing trips in this mode (18 in Group 1, and 4 in Group 2) were small. It should be noted, however, that even though the differences were not statistically significant in three modes, the differences were consistently in the same direction.

A further examination of the recall behavior of Groups 1 and 2 was made by examining the percentage of fishermen reporting no activity in the reference period. For both groups, this accounted for more than half of the fishermen. In Group 1, 58.2 percent (239 fishermen) reported no fishing trips while in Group 2, 71.7 percent (160 fishermen) reported no fishing for the same period. This difference was highly significant ($z = 3.85, p < .0001$). Since Groups 1 and 2 were matched for location and avidity, we can assume that the differences are due to recall. In other words, comparisons between a two-week and two-month recall interval show more reports of "no trips" for the two-month group. Therefore, using the two-month recall interval may lead to underestimates of true fishing activity.

In a final comparison, Groups 1 and 2 were divided according to fishing avidity. An avid fishermen was considered to be a person who took four or more trips during the previous two-month period (Wave V). In both groups, avid fishermen accounted for approximately 22 percent of the group.

Table 3 shows the means and standard deviations for fishing frequency as well as the proportion of each subgroup reporting no activity.

Table 3. Recall of Fishing by Avid and Non-Avid Fishermen

	AVID (4 or more trips)		NON-AVID (3 or less trips)	
Group 1 2-week recall interval	n	= 91	n	= 320
	Mean	= 2.12	Mean	= 1.19
	s.d.	= 3.12	s.d.	= 2.52
	No trips	= 47.3%	No trips	= 61.2%
Group 2 2-month recall interval	n	= 49	n	= 170
	Mean	= .94	Mean	= .92
	s.d.	= 1.61	s.d.	= 2.90
	No trips	= 63.3%	No trips	= 75.9%

Within Group 1 (2-week intervals), avid fishermen (as defined by Wave V activity) report significantly more trips in Wave VI ($z = 2.6, p < .01$) and a significantly lower percentage ($z = 2.35, p < .02$) of no trips than non-avid fishermen. In Group 2 (2-month recall), there are no differences in mean

number of trips reported by avid and non-avid fishermen, nor is there a statistically significant difference between the proportion of each group that reports no activity. It appears that the two-month recall period washes out the avidity effect. With the longer recall period, as the number of trips increases, especially for avid fishermen, the ability of the fishermen to recall trips decreases. Avid fishermen "lose" 55.7 percent of their trip $\frac{2.12 - .94}{2.12}$ as compared with 22.7 percent for the non-avid fishermen.

Experiment 2

The main objective for this portion of the recall experiment was to compare two reports of fishing for the same month given by the same people. To do this, a pairwise comparison was made between the first and second reports. Table 4 shows the results of this analysis.

Table 4. Mean Number of Trips Reported for October—Reports Given a Month Apart by the Same People

	Immediately Preceding 30 Days	Same 30 Days After One-Month Interval	Mean Difference
Group 4A	0.54 n = 219	0.32 n = 210	0.21
Group 4B	1.78 n = 655	1.28 n = 444	0.50

For both groups the differences were significant ($t = 2.59, p < .01$; $t = 3.95, p < .00$, respectively). When the data is examined more closely, an interesting pattern emerges as illustrated in Table 5.

Table 5. Frequency of October Fishing Trips—Two Reports Given a Month Apart by the Same People

	Immediately Preceding 30 Days			Same 30 Days After One-Month Interval		
	Trips	Frequency	Cum %	Trips	Frequency	Cum %
Group 4A	0	168	80.0	0	181	86.2
	1	18	88.6	1	15	93.3
	2	13	94.8	2	9	97.6
	3	2	95.7	3	1	98.1
		201			206	
Group 4B	0	106	23.9	0	279	62.8
	1	170	62.2	1	50	74.1
	2	82	80.6	2	43	83.8
	3	39	89.4	3	24	89.2
		397			396	

As Table 5 illustrates, for both groups, there is a rather stable corps of fishermen who took three or less trips. Within these groups, many fishermen seem to be forgetting approximately one trip when they re-report their fishing activity. The number reporting no trips increased in all situations while the number reporting one, two or three trips declines at the second callback. To further examine the magnitude and direction of the recall error, a frequency table of differences between the two reports was calculated and the results are presented in Table 6.

Table 6. Differences Between the First and Second Report of October Activity Given a Month Apart by the Same People

Differences Between the Two Reports	Percentage of Group 4A (n=46)	Percentage of Group 4B (n=351)
-3 Trips	4.3	5.0
-2	17.4	17.0
-1	21.7	36.0
0 (no difference)	34.8	14.0
+1	8.7	10.0
+2	4.3	5.0
+3	—	2.0
	91.2%	89.0%

To do this analysis, fishermen who reported *no* October activity on *both* reports were eliminated. Out of the 210 in Group 4A, only 46 (21.9%) remained who fished at least once in October, and out of Group 4B, 351 (79%) fished at least once in October. It must be kept in mind that Group 4A and 4B represent different populations of fishermen. Group 4B have been identified as two-month fishermen in the telephone survey for Wave VI. In order to be in that group, these fishermen had to fish in September and October. Group 4A fishermen were identified as two-month fishermen in Wave V, July and August. A test for homogeneity of variance shows that the two underlying populations are statistically different [$F = 2.59, p < .001$]. However, both groups, approximately half the fishermen are reporting between one and three trips less the second time.

Table 7 shows the differences in October reports by mode. This was done to investigate the possibility that trips in certain modes are more "memorable" than other modes. It is apparent from the table that private/rental boat mode trips are subject to the greatest amount of "forgetting" between the two activity reports.

Table 7. Differences Between Two Reports for October Fishing Activity by Mode

	Percentage of Group 4A (n = 46)				Percentage of Group 4B (n = 35)			
	M/M	B/B	P/C	P/R	M/M	B/B	P/C	P/R
-2	—	2.2	—	—	6.0	3.1	0.9	9.4
-1	8.7	—	4.3	13.0	10.5	7.4	5.1	18.8
(No difference) 0	87.0	91.3	95.7	58.7	75.2	81.2	92.0	51.9
+1	4.3	2.2	6.5	6.5	1.4	1.7	1.1	7.1
+2	—	—	—	—	2.0	0.6	0.3	2.6

Conclusions

The two-month recall interval may be too long for fishermen to accurately recall their activity. Significantly more fishermen report no activity utilizing a two-month recall interval than a two-week interval, and it is the avid fishermen who forgets trips. With a one-month interval, fishermen tend to underreport by one trip the second time they are asked, especially if they have taken a few trips. Overall, then, it would appear that the current methodology for the household telephone survey will result in an underestimate of the true fishing activity.

Some qualifications must be considered in interpreting these results, since fishing is a seasonal activity and this experiment was run during the fall months on fishermen identified in the summer. The patterns found may be atypical of other types of fishermen. However, the tendency toward underre-

porting in our samples is so marked and consistent that it seems unlikely that the results reported here are unique to this study.

We must also point out danger in conclusions from experiments such as this one, where the same recall period was covered in two contacts. It has been observed that people report more events for the more recent month than for the month preceding, if data for the most recent month is requested first. If data for the past month is requested first, however, respondents report more events in the past month than they do in the more recent month.⁴ Since our method of data collection (for any recall period whatsoever) consists in asking the respondent to think backward in time listing each of the fishing trips they can remember, starting with the most recent one, the conclusions that we arrive at, (namely that respondents forget a large fraction of their trips for the second month in a two-month recall period) may be due to this method of data collection and not due to the length of the time period. This must be further examined before any decision is taken.

As a result of the preceding analyses, several alternatives should be examined as a refinement of the present technique in order to increase the reliability of the data.

1. Consideration should be given to use of a one-month recall period. While this would be more expensive, this option represents a balance between optimum recall data and available funds. An even shorter recall period, such as two weeks, would provide the most accurate data, but would be even more costly.
2. Use of a shorter recall period coupled with calling households two times (or more) would cut down on the expenses associated with the random digit dialing procedures utilized to identify fishing households during each wave of calling. In addition, methods should be studied to intensify the prompting and bounded recall procedures used by the telephone interviewers to discover if recall can be enhanced with better interview techniques.
3. Investigate how recall behavior varies over different data collection methods, such as asking for fishing activity from the past forward.

The two-month recall interval for the telephone survey was selected based on sound methodological judgment. However, this experiment has served to identify a weakness in the method. At the time when the methodology of the NMFS National Statistical Survey was developed, there was nothing in the literature to indicate such a weakness. This leads us to believe that further investigation of issues related to recall are necessary to bring the literature up to date and to optimize the methodology utilized in surveys of this type.

¹Robert L. Hiatt and Dharendra N. Ghosh, *A Recommended Approach to the Collection of Marine Recreational Finfishing and Shellfishing Data on the Pacific Coast*, McLean, Va.: HSR, August 1977.

²Audits and Surveys, Inc., *A Pilot Household Study Designed to Yield Estimates of the Saltwater Sport Fish Catch by Persons Residing in the State of California*, New York: Author, July-September.

³Dharendra N. Ghosh, "Optional Recall for Discrete Events," in the American Statistical Association's "Proceedings of the Section on Survey Research Methods," 1978.

⁴Theodore D. Woolsey, *Results of the Sick-Leave Memory Test of October 1952*, Division of Public Health Methods, Public Health Service, February 1953.