NEW YORK STATEWIDE ANGLER SURVEY 2007

REPORT 4: SURVEY METHOD COMPARISON AND ANALYSIS OF TRENDS IN FISHING EFFORT

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by

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EDITOR'S NOTE

(Revisions / Corrections)

The June, 2009 Report 4 was modified in July, 2009. Changes were made to Tables 8 and 9 to clarify the estimated angler days and at-location expenditures for the Delaware River (main stem). Some of the yearly totals listed earlier in these tables included estimated angler days and expenditures for the West Branch Delaware River and East Branch Delaware River *(note that these are listed separately in Report 1 for year 2007)*. In addition, the number of estimated angler days for black bass (From 3-phase) in Table 3 of this report was adjusted (it was previously incorrectly entered).

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INTRODUCTION

To efficiently manage New York's freshwater fisheries, comprehensive information is needed periodically on the fishing patterns, preferences, and attitudes of anglers as well as the economic impacts of New York's fisheries. Such information is most effectively obtained from a statewide mail survey. New York has conducted four such surveys, in 1973 (Brown 1975), in 1976-77 (Kretser and Klatt 1981), in 1988 (Connelly et al. 1990), and in 1996 (Connelly et al. 1997). This is the last in a series of four reports that document the results of a fifth statewide angler survey. The survey was conducted in three phases over the course of 2007-08 and focused on resident and nonresident fishing experiences in New York during the calendar year 2007. A comparative 12-month recall survey also was conducted at the end of 2007. The Human Dimensions Research Unit (HDRU) at Cornell University conducted the study for the Department of Environmental Conservation, Bureau of Fisheries.

The study had multiple objectives. Those addressed in this report include:

1. Examine the degree of recall bias by comparing the results of the three-phase survey with the 12-month recall survey.
2. Examine the costs and benefits of the three-phase methodology.
3. Examine trends in angler effort and expenditures in New York State.

Dissimilar to previous statewide angler surveys, which were conducted using a single annual mailing, the 2007 survey was implemented at three different times during the calendar year. By using a three-wave approach, it was hoped that the amount of recall bias associated with angler trip recollection could be reduced. Past research (Connelly et al. 2000) has shown that both nonresponse bias and recall bias affect estimates of fishing effort. By reducing the recall period from one year to 3-5 months, it was hoped that recall bias would be reduced, and by conducting nonrespondent telephone follow-ups, it was hoped that that bias could be estimated. In addition, a smaller 12-month recall survey similar to previous annual statewide angler surveys was conducted to measure the degree of recall bias, provide for trend comparisons, and offer feedback on the improved estimates versus the increased cost of a three-wave approach.

METHODS

Questionnaire Design

The Bureau of Fisheries Angler Survey Team met numerous times to go over questions from past surveys and develop new ones to address issues of current interest and management needs. Core questions on fishing effort and expenditures were retained from past surveys to allow for trends comparisons. The 12-month recall survey contained only the core questions. Appendix A shows the exact content and wording of the 12-

month recall questionnaire. The three-phase questionnaires were identical in question wording for the sections on fishing effort and expenditures compared with the 12-month recall questionnaire, except for the dates of fishing effort.

Sample Selection

For each phase, a random sample of 17,000 was drawn from all license holders eligible to fish during the phase. For the 12-month recall survey, a random sample of 6,000 was drawn from all license holders eligible to fish in 2007 (the 12-month period). Lifetime licenses holders aged 16 or older at the time the survey was implemented were included in the random drawing. Other license types that permitted fishing included annual resident fishing and sportsman, annual nonresident fishing and sportsman, and short-term (1-day, 7-day) resident and nonresident fishing licenses.

Mail Survey Implementation

The mail survey for each phase was implemented as soon as possible after the phase period ended. The first phase covered the period from Jan. 1 to May 31, 2007. The surveys were sent out on May 31, 2007 with up to three follow-up mailings sent to nonrespondents over the course of the following month. Phase 2 covered the period from June 1 to Sept., 30, 2007, and the first mailing of the survey was sent out on Oct. 18, 2007. Phase 3 covered the period from Oct. 1 to Dec. 31, 2007, and the first mailing of the survey was sent out on Jan. 7, 2008. For the 12-month recall survey, the questionnaire was sent out Jan. 11, 2008 and covered the period from Jan. 1, 2007 to Dec. 31, 2007.

Nonrespondent Telephone Follow-up

A telephone follow-up to 200 nonrespondents was implemented after each phase and after the 12-month recall survey, for a total of 800 nonrespondent interviews. Questions were asked on fishing effort. Past research has found that nonrespondents fished less than respondents (Connelly et al. 1990, 1997). Nonrespondent data allows us to adjust overall fishing estimates to account for any nonresponse bias.

Analysis and Data Weighting

Returned mail questionnaires were scanned and entered into SPSS (a statistical analysis package for the social sciences). Locations fished, as written in by anglers, were matched to the Bureau of Fisheries database of water bodies and assigned unique identifiers (FIN codes [Fisheries Index Numbers]). An explanation of the matching process can be found in Appendix B of Report 1 (Connelly and Brown 2009a). Yearly

effort totals were calculated by adding data from the three phases. Confidence intervals were calculated at the 95% and 80% levels.

Response rates and undeliverable rates differed based on where people lived (Appendix Table B-1). Response rates were lower and undeliverable rates were higher in the New York City and Long Island areas than in central and western New York. This is typical of mail surveys in New York State (Connelly et al. 2002, Enck and Brown 2008). Without weighting the data to account for these differences, estimates of fishing effort would likely be underestimated in locations in and near New York City, and slightly overestimated elsewhere. Therefore, respondents from regions with lower response rates (and higher undeliverable rates) were given more weight, and those in regions with higher response rates were given less weight, corresponding to delivery and response rates.

Nonrespondents who were contacted by telephone were considered to be representative of all nonrespondents. Checks of license type at least partially confirmed this assumption. Comparisons of respondents and nonrespondents indicated that only days fished during Phase 2 and in the 12-month recall survey differed significantly. Thus, nonresponse adjustments were made only for effort estimates in phase 2 and in the 12-month recall survey.

Estimates of effort by species were derived from the question asking for an estimate of the number of days spent primarily fishing for each species at each water body fished. The question was worded in such a way that the number of days fished for each species should add to the total days fished. A number of anglers misunderstood the question and likely reported catch instead of days or perhaps indicated they were fishing primarily for several species on the same day. Only respondents whose sum of days by species equaled total days were used in the estimate of mean days fished by species. However, the mean days by species was expanded to the total estimate of days for a particular species using all respondents who indicated that they fished for that species.

RESULTS

Mail Survey Response and Adjustments for Nonresponse Bias

Of the 17,000 questionnaires mailed out during each phase, between 700 and 1,100 were undeliverable and between 6,000 and 8,000 completed questionnaires were returned (Table 1). For the 12-month recall survey, 391 questionnaires were undeliverable and 2,238 completed questionnaires were returned. This resulted in adjusted response rates for all surveys between 38% and 49%.

Analysis of the nonrespondent telephone follow-up surveys showed that nonrespondents were just as likely to have fished during the survey period and fished approximately the same number of days as respondents. The exceptions were for days fished in phase 2, in which respondents fished more than nonrespondents (17.3 vs. 12.8

Table 1. 2007 statewide angler survey response rates.				
	Phase 1 (Jan.-May)	Phase 2 (June-Sept.)	Phase 3 (Oct.-Dec.)	Annual (Jan.-Dec.)
Initial sample size	17,000	17,000	17,000	6,000
Undeliverable	800	1,103	751	391
Undeliverable rate	4.7%	6.5%	4.4%	6.5%
Responses	6,823	6,018	7,934	2,238
Response rate adjusted for undeliverables	42.1%	37.9%	48.8%	39.9%

days), and in the 12-month recall survey, where respondents fished more than nonrespondents (26.0 vs. 19.9 days). As noted previously in the methods section, data were weighted for these biases. Comparisons between respondents and nonrespondents for all questions asked on the nonrespondent survey and covered in this report can be found in Appendix Table B-2.

Degree of Recall Bias

Past research suggests that recall bias would result in higher estimates for the 12-month recall survey than for the three-phase survey. Estimates of fishing effort derived from the three-phase survey did not differ significantly very often from the 12-month recall survey, and when differences occurred, no consistent pattern could be found. For the overall statewide estimate of fishing effort, the estimate from the three-phase survey was slightly larger than from the 12-month recall survey (the opposite of what was expected) but the difference was not significant at the 95% or 80% confidence levels (Table 2). (Sometimes in applied research a wider confidence interval [80%] is considered acceptable because management decisions often do not require the certainty associated with the 95% level.) For most of the water bodies, with a sufficient sample size in the smaller 12-month recall survey ($n > 40$) for comparisons, the differences were not significant between the two survey methods. The difference was significant for several water bodies at the 80% confidence level, but only for Lake Erie at the 95% level.

In comparing estimates from the two methods for days spent fishing by species, there were several cases in which the three-phase estimates were significantly higher than the 12-month recall estimates (Table 3). This occurred primarily with coldwater gamefish (trout and salmon), but also with walleye.

In an effort to explain why the differences between some estimates were positive and some negative (although most did not differ statistically), other variables were examined that might influence the degree of recall bias. Table 4 compares the difference between the two survey estimates (Column 1) with possible explanatory variables (Columns 2-5), but does not reveal any strong relationships. For example, if a water body attracts mostly anglers who travel a long distance to get to the fishing site or who spend more money while at the site, then the fishing experience might be more

Table 2. Differences in estimates of angler effort by water body between two survey methodologies.					
Water Body	Angler Days				
	From 3-Phase	From 12-Month	% Diff.*	Significant at 95%	Significant at 80%
Statewide	18,763,714	17,312,485	8.4	NS**	NS
Lake Erie	657,821	336,164	95.7	Sign.***	Sign.
Chautauqua Lake	413,961	256,311	61.5	NS	Sign.
St. Lawrence River	651,455	461,152	41.3	NS	Sign.
Niagara River	369,449	273,575	35.0	NS	NS
Lake Ontario (and Bays)	1,553,223	1,280,005	21.3	NS	Sign.
Oneida Lake	786,401	707,191	11.2	NS	NS
Mohawk River	219,735	202,806	8.3	NS	NS
Black Lake	219,659	209,589	4.8	NS	NS
Salmon River	332,827	337,223	-1.3	NS	NS
Hudson River	470,731	483,232	-2.6	NS	NS
Seneca Lake	340,290	362,084	-6.0	NS	NS
Lake George	289,011	308,837	-6.4	NS	NS
Cayuga Lake	295,920	384,401	-23.0	NS	NS
Lake Champlain	277,759	458,072	-39.4	NS	Sign.

* Three-phase estimate minus12-month recall estimate.
**NS = Not Significant
***Sign.=Significant

memorable for those anglers and recall bias might be less (as appears to be the case for the Salmon River). But anglers who fished the Niagara River or Cayuga Lake, for example, traveled shorter distances and spent less money, but the difference in estimates between the two survey methodologies was 35% for one and -23% for the other. No consistent pattern, as measured by correlation, could be found. Another possible explanation for the differences might be if the recall bias in the 12-month recall survey were less for water bodies in which more of the fishing took place during the latter part of the year compared with water bodies where more fishing took place earlier in the year, but this was not borne out in a consistent pattern. For the Salmon River, 48% of fishing effort took place in the fall phase and the difference between the two survey estimates is almost zero, supporting the above statement. Conversely, at Black Lake, very little fishing effort occurred in the fall phase, yet the estimates from the two survey methods were almost identical.

Trends in Fishing Effort and Expenditures

On the assumption that data from the three-phase survey is the most accurate data representing fishing effort in 2007, and that little significant evidence of recall bias could be found, data from the three-phase survey was used for trend comparisons.

Table 3. Differences in estimates of angler effort by species fished for between two survey methodologies.

Species Groups	Angler Days				
	From 3-Phase	From 12-Month	% Diff.*	Significant at 95%	Significant at 80%
Warmwater gamefish	7,145,740	6,449,932	10.8	NS**	Sign.
Coldwater gamefish	5,747,765	4,745,007	21.1	Sign.***	Sign.
Panfish	3,328,521	2,967,986	12.1	NS	NS
Marine/anadromous	444,458	370,546	19.9	NS	NS
Carp	167,971	240,338	(30.1)	NS	NS
Nonspecific or unclassified	1,326,627	1,446,883	(8.3)	NS	NS
Species					
Walleye	2,212,317	1,548,030	42.9	Sign.	Sign.
Pickerel	325,727	232,913	39.8	NS	NS
Coho/chinook salmon	700,250	529,365	32.3	NS	Sign.
Striped bass (freshwater only)	401,720	306,600	31.0	NS	NS
Trout (brook, brown, rainbow)	3,784,604	2,964,218	27.7	Sign.	Sign.
Yellow perch	1,816,026	1,426,190	27.3	NS	Sign.
Other	177,110	146,419	21.0	NS	NS
Crappie (calico bass)	698,243	583,784	19.6	NS	NS
Lake trout	954,511	887,817	7.5	NS	NS
Steelhead trout	788,035	737,892	6.8	NS	NS
Bluegill/sunfish	944,978	910,258	3.8	NS	NS
Black bass (small or largemouth)	4,613,610	4,466,226	3.3	NS	NS
Muskie	127,029	138,898	(8.5)	NS	NS
Landlocked Atlantic salmon	262,773	290,495	-9.5	NS	NS
Shad	54,687	60,660	-9.8	NS	NS
No specific species	1,132,624	1,278,330	-11.4	NS	NS
Northern pike	847,385	1,004,225	-15.6	NS	NS
Tiger muskie	82,094	99,029	-17.1	NS	NS
Bullheads/catfish	578,396	793,248	-27.1	NS	NS
Carp	167,971	240,338	-30.1	NS	NS

* Three-phase estimate minus12-month recall estimate.
**NS = Not Significant
***Sign.=Significant

Table 4. Indicator variables that might explain differences in estimates of fishing effort between two survey methodologies.					
Water body	% difference in fishing effort between methodologies*	From three-phase survey			
		Average miles traveled	Most popular fish	Average at-location expenditure	% fishing effort occurring in Oct.-Dec.
Statewide	8.4				18.1
Lake Erie	95.7	59	Walleye	$20.42	19.1
Chautauqua Lake	61.5	66	Walleye	$24.30	11.3
St. Lawrence River	41.3	136	Bass	$35.59	14.6
Niagara River	35.0	53	Bass	$10.11	23.3
Lake Ontario (and Bays)	21.3	118	Coho/Chinook Salmon	$39.45	17.1
Oneida Lake	11.2	53	Walleye	$15.46	21.1
Mohawk River	8.3	24	Bass	$ 8.10	22.4
Black Lake	4.8	215	Bass	$56.27	10.8
Salmon River	-1.3	190	Coho/Chinook Salmon	$56.40	48.1
Hudson River	-2.6	32	Striped bass	$12.79	16.5
Seneca Lake	-6.0	50	Lake trout	$16.37	24.0
Lake George	-6.4	112	Bass	$48.81	11.5
Cayuga Lake	-23.0	53	Bass	$19.24	18.3
Lake Champlain	-39.4	116	Bass	$20.54	16.8
Correlation with % Difference		-0.1468		-0.0843	-0.1305
* Three-phase estimate minus12-month recall estimate.					

The statewide angler survey estimated that 18.7 million days were spent fishing New York's freshwaters in 2007, which is quite similar to the 1996 estimate of 18.6 million days. These estimates are both lower than the peak of 20.8 million days estimated in the 1988 survey. All of these estimates are higher than the 16 million days estimated in the 1970s.

Comparisons are possible between the 1996 and 2007 surveys for Great Lakes and inland waters (Table 5), by DEC region fished (Table 6), by most species (Table 7). Differences were generally not significant between years for the Great Lakes, inland waters, and most DEC regions. The exception is Region 2 (New York City) where there appears to be a decrease in fishing effort, even taking into account the large confidence intervals around each estimate. This could in part be an artifact of the careful attention paid to respondents who indicated that they fished in "New York" when coding the 2007

Table 5. Estimated number of angler days for Great Lakes and inland waters, 1996 and 2007.				
	Angler Days			
	1996		2007	
	Number	Confidence Limits, ±	Number	Confidence Limits, ±
Inland Waters	15,565,140	562,010	15,248,702	485,034
Great Lakes	4,061,790	237,480	3,563,072	216,275

Table 6. Estimated number of angler days fished by DEC region, 1996 and 2007.				
	Angler Days			
	1996		2007	
Region Fished	Number	Confidence Limits, ±	Number	Confidence Limits, ±
1	383,960	72,991	360,103	64,018
2	102,440	68,280	29,319	19,520
3	2,033,540	163,400	2,252,597	185,104
4	1,404,410	142,750	1,410,128	127,697
5	2,496,870	176,040	2,530,014	192,222
6	2,810,760	202,550	2,674,411	191,275
7	3,147,300	244,780	3,275,457	214,999
8	3,179,500	268,710	2,916,539	221,890
9	3,028,480	225,390	3,163,369	245,088

survey. In some cases, anglers wrote "New York" as the county location fished. The computer program assigned them to "New York County," but examination of these questionnaires revealed that some were likely referring to "New York State" and so were not counted in the Region 2 results. We do not believe this type of check was done for the 1996 survey, and this, therefore could account for some of the differences in effort between the two years.

Effort associated with most of the major species has increased between 1996 and 2007 (Table 7). (Note: Several species of trout had to be grouped together in order to make comparisons across years.) Walleye and yellow perch effort appear to have increased the most. Bass effort has remained unchanged, but continues to be the most frequently sought species in the state.

Trends in angler effort by major water bodies can be traced back as far as the first statewide angler survey in 1973 (Table 8). While effort on some water bodies has remained relatively constant between 1996 and 2007 (e.g., Lake Erie, Salmon River), none of the major water bodies appears to have had level effort over the entire period (1973 to 2007). For example, Lake Ontario (and bays) increased rapidly into the 1980's and has gradually declined between 1996 and 2007.

Table 7. Estimated number of angler days fished by species sought, 1996 and 2007.				
Species Sought	Angler Days			
	1996		2007	
	Number	Confidence Limits, ±	Number	Confidence Limits, ±
Black Bass (small or largemouth)	4,627,280	215,840	4,613,610	265,493
Trout (brook, brown, rainbow, steelhead)*	4,044,620	309,340	4,572,639	316,038
Walleye	1,667,020	121,890	2,212,317	199,508
Yellow Perch	1,162,410	112,850	1,816,026	176,354
Lake Trout	762,050	92,070	954,511	100,865
Bluegill/Sunfish	647,600	71,970	944,978	117,242
Northern Pike	784,680	72,320	847,385	85,879
Coho/Chinook Salmon	604,190	64,560	700,250	74,832
Crappie (calico bass)	540,750	68,140	698,243	170,134
Bullheads, Catfish	511,540	65,560	578,396	83,513
Landlocked Atlantic Salmon	291,230	46,890	262,773	41,514
*Several categories had to be combined from the original data to create a comparable trout category.				

At-location expenditures, with 1996 estimates adjusted to 2007 constant dollars, have generally decreased, dramatically in some cases, between 1996 and 2007 (Table 9). For example, estimates of expenditures along the St. Lawrence River decreased from $45 million (in constant dollars) in 1996 to $23 million in 2007. Smaller decreases were seen among the top water such as Lake Ontario, the Salmon River, and Chautauqua Lake. A few waters have seen an increase in spending due primarily to an increase in fishing effort (e.g., Hudson River), or an increase in both the amount spent per day and fishing effort (e.g., Black Lake).

DISCUSSION

Evidence of Recall Bias

Past research, including work done with the previous statewide angler survey, has generally shown that longer recall periods result in overestimates of fishing effort (Hiett and Worrall 1977, Tarrant et al. 1993, Westat Inc. 1989). For example in the last statewide angler survey, mean days fished was 17.6 days for anglers responding to the 12-month recall survey compared to 15.4 days for anglers responding to quarterly phone interviews (Connelly et al. 2000). However in the current survey, comparisons of overall fishing effort were not significantly different, even at the 80% confidence level.

Table 8. Estimated number of angler days for major New York waters 1973, 1976-77, 1988, 1996, and 2007.					
	Angler Days				
Waterway	1973	1976-77	1988	1996	2007
Lake Ontario (and Bays)	664,000	1,027,000	2,568,610	1,730,350	1,553,223
St. Lawrence River	596,000	702,800	716,440	921,790	651,455
Lake Erie	697,000	663,000	945,500	609,340	657,821
Salmon River	126,000	178,100	329,090	344,230	332,827
Oneida Lake	693,000	703,400	782,400	573,060	786,401
Chautauqua Lake	283,000	417,700	438,980	460,090	413,961
Lake George	152,000	192,800	298,600	337,020	289,011
Niagara River	534,000	515,700	525,490	477,690	369,449
Hudson River	144,000	116,600	232,110	276,520	470,731
Delaware River (main stem)	*	**	163,219	146,160	128,344
Seneca Lake	274,000	399,800	350,130	455,500	340,290
Cayuga Lake	214,000	274,200	365,210	291,900	295,920
Lake Champlain	309,000	335,000	482,170	273,310	277,759
Mohawk River/Barge Canal	*	274,800	284,840	258,430	219,735
Keuka Lake	87,000	144,800	178,140	260,670	178,340
Black Lake	148,000	111,500	188,940	173,860	219,659
Beaver Kill	*	137,700	126,050	81,520	114,285
Genesee River	62,000	94,810	151,580	147,790	143,952
Saratoga Lake	138,000	141,600	145,410	120,120	148,840
Susquehanna River	149,700	142,200	146,510	176,440	174,897
Oswego River	*	79,440	159,580	146,460	159,089
Cattaraugus Creek	*	**	102,180	102,590	147,905
*Comparable data not available from the 1973 study. **Comparable data not available from the 1976-77 study.					
(Sources: Brown 1975, Kretser and Klatt 1981, Connelly et al. 1990, 1997.)					

Furthermore, the direction of the difference, even though not significant, was not in the expected direction, based on past research.

Differences that were significant between the two survey methodologies did not follow any patterns that could be discerned. In some cases, like Lake Champlain, the three-phase estimate of effort was lower than the 12-month recall estimate. In others, such as fishing effort associated with coldwater gamefish, the three phase estimate was higher than the 12-month recall estimate. The most troubling difference was in estimates for Lake Erie (658,000 in the three-phase versus 336,000 in the 12-month recall). The two samples were examined for anomalies (e.g., did one sample live closer to the lake than the other), but did not find any evidence of those types of differences.

While it is believed that the level of recall bias has been reduced by shortening the recall period, other researchers have suggested that telescoping bias may play a role in

Table 9. Estimated at-location expenditures, total and average per day, for major New York waters in 1996 and 2007.				
Waterway	At-Location Expenditures			
	1996 (adjusted to 2007 constant dollars)		2007	
	Total	Avg./Day	Total	Avg./day
Lake Ontario (and Bays)	$69,321,250	$40.06	$54,253,280	$34.93
St. Lawrence River	45,125,530	48.96	23,187,420	35.59
Lake Erie	12,365,020	20.29	13,435,690	20.42
Salmon River	20,074,050	58.32	18,771,740	56.40
Oneida Lake	10,064,050	17.56	12,154,610	15.46
Chautauqua Lake	16,422,240	35.69	10,059,120	24.30
Lake George	20,000,690	59.35	14,107,010	48.81
Upper Niagara River	1,609,540	6.49	1,056,830	6.11
Lower Niagara River	2,598,560	12.14	2,801,005	14.38
Hudson River	3,307,380	11.96	6,021,200	12.79
Delaware River (main stem)	3,270,184	22.37	3,687,358	28.73
Seneca Lake	11,927,610	26.19	5,569,010	16.37
Cayuga Lake	7,189,310	24.63	5,692,930	19.24
Lake Champlain	6,441,180	23.56	5,704,090	20.54
Mohawk River	1,969,180	7.62	1,778,760	8.10
Keuka Lake	6,544,940	25.11	3,154,050	17.69
Black Lake	7,125,370	40.99	12,359,810	56.27
Beaver Kill	3,815,970	46.81	4,334,869	37.93
Genesee River	995,280	6.73	994,260	6.91
Saratoga Lake	2,243,420	18.68	1,879,360	12.63
Susquehanna River	1,095,260	6.20	1,174,550	6.72
Oswego River	3,741,790	25.54	2,293,825	14.42
Cattaraugus Creek	1,132,970	11.05	1,142,100	7.72

angler estimates as well (Sudman and Bradburn 1974). Telescoping bias refers to the reporting of angler days in a time period other than the one in which they occurred. Because anglers were asked about a relatively short time period in the three-phase survey, they might have been more likely to report a trip during that period that actually took place outside the period. This could result in a slightly larger estimate of fishing effort using the three-phase approach. This is less likely to occur with the 12-month recall survey, and the larger concern of recall decay is thought to outweigh it.

No evidence of significant recall bias from this study could be found that we think warrants some adjustment of the three-phase data in order to compare it with previous statewide angler surveys. Therefore, in the trend analysis data from the three-phase survey was compared with past statewide angler surveys. Without having done this comparative study, it would not have been known if the differences between 1996 and 2007 were due to methodological differences in how the studies were conducted or true changes in fishing effort.

Costs Versus Benefits of Reducing the Recall Period for the Statewide Angler Survey

There are a variety of benefits and costs associated with reducing the recall period on such an important survey as the statewide angler survey. These benefits and costs do not all have to do with reducing recall bias. However, that is presumed to be the primary benefit. Previous literature has suggested that any reduction in recall period will result in more accurate estimates (Pollock et al. 1994). Therefore:

<u>Benefits of Three-phase Survey</u>

1. More accurate estimates of fishing effort and expenditures (recognizing that no estimates are perfect and these estimates may be impacted by telescoping bias for example, as discussed earlier).
2. The phased data provides for seasonal usage estimates. For example, readers of Report 1 (Connelly and Brown 2009a) can look at data for a specific water body and see what time of year usage was greatest and what species were sought during that period.

<u>Costs</u>

1. Expense. The cost of conducting the three-phase survey was estimated at 2.4 times as much as if a 12-month recall survey of comparable size (n=17,000) had been conducted. (Three phases are not three times as much because they share some planning and analysis time.)
2. It is not possible to estimate the number of anglers fishing a water body or for a particular species over the course of a year. Estimates of the number of anglers fishing during a phase can be calculated. However, one cannot sum the number of anglers across phases for a year long estimate because many anglers fish in more than one time period.
3. Report 2 (Connelly and Brown 2009b) examines anglers' preferred species to fish for. It is not possible with this methodology to see if anglers actually fished for their preferred species at some time during the year. They may have been surveyed during a time period when fishing for their preferred species was not likely to have occurred.
4. Confidence limits for a yearly estimate cannot be calculated if there is a very small sample size in one phase, even though angler effort in the other phases is sufficient.

In summary, it was somewhat surprising that no evidence of significant recall bias was found. This was the primary justification for switching from an annual to a three-phased survey approach. (Without this study, though, it would not be known that this was the case.) Seasonal usage estimates were a benefit that was not fully recognized when the decision was made to change survey methodologies and is a benefit to be considered for using the three-phase approach in the future. Some difficulties can surface with the three-phase approach, including providing opportunity for telescoping bias (as described above) as well as preventing calculation of some estimates as a result of having a small sample size in one of the three phases, which might not happen with an annual survey. The primary disadvantage of the three-phased approach remains its higher

implementation cost. Fisheries managers will need to consider both the benefits and costs associated with the phased survey approach when they plan for the next statewide angler survey.

LITERATURE CITED

Brown, T. L. 1975. The 1973 New York statewide angler study. Cornell University/NYSDEC. 117pp.

Connelly, N. A., and T. L. Brown. 2009a. New York statewide angler survey 2007, Report 1: Angler effort and expenditures. NYS Department of Environmental Conservation, Bureau of Fisheries. 104pp.

Connelly, N. A., and T. L. Brown. 2009b. New York statewide angler survey 2007, Report 2: Angler characteristics, preferences, satisfaction, and opinion on management topics. NYS Department of Environmental Conservation, Bureau of Fisheries. 79pp.

Connelly, N. A., T. L. Brown, and B. A. Knuth. 1990. New York statewide angler survey 1988. NYS Department of Environmental Conservation, Bureau of Fisheries. 158 pp.

Connelly, N. A., T. L. Brown, and B. A. Knuth. 1997. New York statewide angler survey 1996, Report 1: Angler effort and expenditures. NYS Department of Environmental Conservation, Bureau of Fisheries. 107pp.

Connelly, N. A., T. L. Brown, and B. A. Knuth. 2000. Assessing the relative importance of recall bias and nonresponse bias and adjusting for those biases in statewide angler surveys. Human Dimensions of Wildlife 5(4):19-29.

Connelly, N. A., B. A. Knuth, and D. L. Kay. 2002. Public support for ecosystem restoration in the Hudson River Valley, USA. Environmental Management 29(4):467-476.

Enck, J. W., and T. L. Brown. 2008. 2007 Statewide deer hunter survey: Opinions about hot-button issues and trends in characteristics of hunters. HDRU Publ. No. 08-5. Dept. of Nat. Resour., N.Y.S. Coll. Agric. and Life Sci., Cornell Univ., Ithaca, N.Y. 81pp.

Hiett, R. L., and J. W. Worrall. 1977. Marine recreational fishermen's ability to estimate catch and to recall catch and effort over time. Research Report HSR-RR-77/13-cd. Human Sciences Research, McLean, VA.

Kretser, W. A., and L. E. Klatt. 1981. 1976-77 New York angler survey final report. NYSDEC, Survey and Inventory Unit. 214p.

Pollock, K. H., C. M. Jones, and T. L. Brown. 1994. Angler survey methods and their applications in fisheries management. American Fisheries Society Special Publication 25, American Fisheries Society, Bethesda, MD.

Sudman, S., and N. M. Bradburn. 1974. Response effects in surveys. Aldine, Chicago, IL.

Tarrant, M. A., M. J. Manfredo, P. B. Bayley, and R. Hess. 1993. Effects of recall bias and nonresponse bias on self-report estimates of angling participation. North American Journal of Fisheries Management 13:217-222.

Westat, Inc. 1989. Investigation of possible recall/reference period bias in National Surveys of Fishing, Hunting, and Wildlife-Associated Recreation. Westat, Rockville, MD.

APPENDIX A:

Questionnaire

New York State

Freshwater Angler Survey

Cornell University
Human Dimensions Research Unit

New York State Department of
Environmental Conservation
Bureau of Fisheries

2007 NEW YORK STATE FRESHWATER ANGLER SURVEY

Research conducted by

CORNELL UNIVERSITY

Department of Natural Resources

in cooperation with the

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

BUREAU OF FISHERIES

Dear Angler,

Thank you in advance for taking the time to fill out our Statewide Angler Survey. We have asked Cornell University to conduct this survey so we can learn more about your fishing experiences in New York State and your preferences for different types of fishing opportunities. The New York State Department of Environmental Conservation (DEC) will use the information you and others provide to carry out its mission in a manner that is responsive to your needs and desires as anglers.

Your name was selected to receive this survey because license sale records indicate that you have a license that allows fishing in New York State during the study period. If you did not fish in New York State in 2007, we ask that you complete the first question and send the questionnaire back to Cornell University to avoid receiving reminder mailings.

Please complete this questionnaire at your earliest convenience, place it in the enclosed, postage-paid envelope, and drop it in any mailbox. Your participation in this survey is voluntary, but we sincerely hope that you will take a few minutes to complete the questionnaire. The information you provide will remain strictly confidential and will never be associated with your name.

Once again, thanks for your participation. See you on the water.

Good fishing,

Douglas L. Stang
Chief, DEC Bureau of Fisheries

SPORT FISH RESTORATION

Instructions: Please Read Before Starting

Please use blue or black ink when completing this survey and make sure that you fill in each circle completely.

Shade Circles Like This → ●

Not Like This → ⊗ ✓

1. **In which of the past 5 years have you fished in New York State?** ***(Select all that apply.)***

○	2007
○	2006
○	2005
○	2004
○	2003
○	I have **NOT** fished in New York State in any of the above years (2003 - 2007).

STOP!!!

If you did not fish in New York State in 2007, please stop here and return this questionnaire to us. Place it in the enclosed, self-addressed envelope; postage has been provided.

If you have fished in New York State in 2007, please continue with Question 2.

2. **Please answer the questions below about <u>all</u> of your freshwater fishing trips IN NEW YORK STAT**
<u>please list each location only once</u>. Include only the fishing you personally did or the dollars you personally

Where did you fish in NY ?			How many **days** did you fish at each location ? (please distinguish between open water and ice fishing)						
Name of Water Please be as specific as possible so lakes are not confused with streams (e.g., if fishing Oneida Lake enter "Oneida Lake", not just "Oneida," so it is not confused with the Oneida River).	County (or nearest town/village)	Approximate mileage from home (one way)	Open Water	Ice Fishing	Black Bass (smallmouth, largemouth)	Yellow Perch	Walleye	Northern Pike	Pickerel
Example: Indian Lake	Hamilton	90	4	2		2			

TE between JANUARY 1 and DECEMBER 31, 2007. Since we are interested in totals for each location, lly spent. A partial day of fishing is considered one full day.

On how many of those **days** were you fishing **primarily** for the following types of fish? (Your total for each location should = the # of days fished at that location. Please write in days fished, not how many fish you caught.)															How much did you spend for all days fished on each water? The amount should reflect all of your fishing related expenses (gas and oil, food, lodging, boat rental, tackle, bait, etc.).		Satisfaction
Crappie (calico bass)	Bluegill / Sunfish (bluegill, pumpkinseed, redbreast)	Muskie	Tiger Muskie	Lake Trout	Trout (brook, brown, rainbow)	Steelhead Trout	Coho / Chinook Salmon	Landlocked Atlantic Salmon	Bullheads, Catfish	Carp	Shad	Striped Bass (freshwater only)	No Specific Species	Other	Total spent at fishing location	Total spent while traveling to and from fishing location	On a scale of 1 to 5, how satisfied were you with your fishing experience at this body of water? 1= very dissatisfied 3=neutral 5=very satisfied
				3				1							$70	$40	4

3. **Please rank your five favorite species to fish for in New York State, with #1 as your favorite.** ***(Choose only five species to rank. Rank from 1 to 5.)***

Rank	Species
___	Black Bass (smallmouth bass, largemouth bass)
___	Bullhead / Catfish
___	Carp
___	Crappie / Calico Bass
___	Coho / Chinook Salmon
___	Landlocked Atlantic Salmon
___	Lake Trout
___	Muskie
___	Northern Pike
___	Pickerel
___	Shad
___	Steelhead
___	Striped Bass (freshwater only)
___	Sunfish (bluegill, pumpkinseed, redbreast)
___	Tiger Muskellunge
___	Trout (brook, brown, rainbow)
___	Walleye
___	Yellow Perch
___	No Specific Type

4. **Normally, the DEC Bureau of Fisheries or Cornell University never associates your name with the information you provide. However, it would be extremely valuable to state fisheries managers to be able to contact a sample of anglers for updated information about specific waterways or fishing preferences. If such information is needed in the future, may Cornell University or the DEC Bureau of Fisheries contact you for further information?**

   ○ Yes ○ No

Please use the space below for any comments you wish to make.

Thank you for your time and effort!

To return this questionnaire, simply place it in the enclosed, self-addressed envelope; postage has been provided. If you have lost the postage-paid envelope, please mail the questionnaire back to Tom Brown, Cornell University, 122B Fernow Hall, Ithaca, NY 14853.

APPENDIX B:

Additional Tables

Table B-1. Initial sample, number of respondents, and response rate (not adjusted for undeliverable questionnaires), by survey phase and region of residence.

Region of Resid-ence	*Phase 1*			*Phase 2*			*Phase 3*			*12-Month Recall*		
	Initial n	# Respondents	Response Rate	Initial n	# Respondents	Response Rate	Initial n	# Respondents	Response Rate	Initial n	# Respondents	Response Rate
1	790	269	34.1	605	164	27.1	638	252	39.5	219	73	33.3
2	605	143	23.6	508	118	23.2	496	162	32.7	211	58	27.5
3	2,493	934	37.5	1,668	495	29.7	1,730	736	42.5	650	224	34.5
4	1,501	592	39.4	1,369	472	34.5	1,553	744	47.9	479	183	38.2
5	989	380	38.4	1,362	494	36.3	1,424	642	45.1	500	172	34.4
6	1,587	630	39.7	1,425	486	34.1	1,601	755	47.2	596	217	36.4
7	2,774	1,208	43.5	2,244	835	37.2	2,505	1,280	51.1	856	342	40.0
8	2,182	921	42.2	2,648	985	37.2	2,824	1,357	48.1	954	375	39.3
9	2,916	1,213	41.6	2,338	887	37.9	2,742	1,330	48.5	802	300	37.4
Out-of-state	1,163	533	45.8	2,833	1,030	36.4	1,487	676	45.5	733	289	39.4

Table B-2. Tests for nonresponse bias.								
	Phase 1		*Phase 2*		*Phase 3*		*12-Month Recall*	
	Respon-dents	Non-respondents	Respon-dents	Non-respondents	Respon-dents	Non-respondents	Respon-dents	Non-respondents
Questions	**Percent**							
Fish in NYS Jan. 1 2007 through current phase								
No	48.1	49.0	24.6	33.0	28.7	42.8	26.7	28.1
Yes	51.9	51.0	75.4	67.0	71.3	57.2	73.3	71.9
	NS*		(X^2=7.3, df=1, p=.01)		(X^2=18.9, df=1, p<.001)		NS	
Fish in NYS in 2006								
No	31.9	34.2	30.7	38.2	29.9	41.3	31.6	36.2
Yes	68.1	65.8	69.3	61.8	70.1	58.7	68.4	63.8
	NS		(X^2=5.0, df=1, p=.03)		(X^2=12.1, df=1, p=.001)		NS	
Fish in NYS in 2005								
No	32.1	34.5	33.4	42.6	31.1	37.0	34.4	34.4
Yes	67.9	65.5	66.6	57.4	68.9	63.0	65.6	65.6
	NS		(X^2=7.2, df=1, p=.01)		NS		NS	
Provided # days fished in Phase								
No	54.5	49.0	34.3	35.0	62.7	58.7	30.9	29.5
Yes	45.5	51.0	65.7	65.0	37.3	41.3	69.1	70.5
	NS		NS		NS		NS	
Gender								
Male	89.0	92.0	85.8	85.0	91.2	92.0	86.6	87.0
Female	11.0	8.0	14.2	15.0	8.8	8.0	13.4	13.0
	NS		NS		NS		NS	
	Mean							
# Days fished NYS during time period (for those who fished)	13.3	12.7	17.3	12.8	12.9	12.6	26.0	19.9
	NS		(t=2.8, df=138, p=.01)		NS		(t=2.3, df=170, p=.02)	
# Days fished Lake Ontario during time period (for those who fished Lake Ontario)	7.7	4.3	8.3	7.3	7.8	9.3	9.1	12.9
	NS		NS		NS		NS	
# Days ice fishing in NYS during Phase 1 (for those who went ice fishing)	8.7	7.3						
	NS							
*NS = Not significant.								