Marine Recreational Information Program Report
FY-2018

Testing a web-push design for Estimating Recreational Fishing Effort

Project: Testing a Web-push Design for Estimating Recreational Fishing Effort

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1. Is it Influential Scientific Information?

N

2. Has it had sufficient Peer Review?

N

3. MRIP Certified

4. Report Title

Testing a web-push design for Estimating Recreational Fishing Effort

5. Background

NOAA Fisheries implemented the Marine Recreational Information Program (MRIP) Fishing Effort Survey (FES) in 2015 to estimate recreational shore and private boat fishing effort for residents of coastal states in the Atlantic and Gulf of Mexico regions. The FES is a cross-sectional, self-administered mail survey that asks residents of sampled households to report the number of recreational, saltwater fishing trips taken by each household member during a two-month reference wave. The sample frame is derived from the USPS Computerized Delivery Sequence File (CDS) and includes all residential addresses within each coastal state. Each year, the survey is administered for six independent waves beginning with wave 1 (January/February) and ending with wave 6 (November/December).

In a 2016 review of MRIP, the National Academies of Sciences Engineering and Medicine (NAS) recommended that the program evaluate electronic data collection options for the FES (NAS 2017). As a result, MRIP is considering web-based data collection designs. There are several potential benefits to web-based survey designs, including reduced data collection costs, improved data accuracy, reduced response burden and/or tailored questions resulting from automated skip patterns, and more timely access to survey data and estimates. However, there are also notable challenges. For example, web surveys provide poor household coverage and generally achieve lower response rates than mail surveys. In addition, switching data collection modes can have unanticipated impacts on survey measures (Couper, 2011).

Much of the recent research on web-based surveys has focused on mixed-mode designs that combine web reporting with another data collection mode, usually paper. Web and paper reporting are uniquely compatible because both are self-administered, and survey requests, usually consisting of a postcard or invitation letter, can be delivered to sample members through the mail. Mixed-mode designs can either be concurrent, where respondents are offered a choice of reporting modes (e.g. paper or web), or sequential, where respondents are first encouraged to respond via one mode before being provided the option of a second mode (De Leeuw, 2018). A principal goal of both concurrent and sequential mixed-mode designs is to maximize the number of web responders and subsequently reduce mailing costs.

Data collection protocols for concurrent designs – also known as choice designs - usually include a paper questionnaire, but also provide an invitation for sample members to complete an online questionnaire. Choice designs may offer promised incentives to encourage web response. The Residential Energy Consumption Survey (RECS), administered by the U.S. Energy Information Administration, tested a variety of choice designs during the 2015 survey

administration (Biemer et al. 2018).

In contrast, sequential designs, such as “web-push” designs, encourage sample members to complete an online questionnaire before providing a paper version. The National Household Education Survey (NHES), which is administered by the U.S. Census Bureau on behalf of the National Center for Education Statistics, recently transitioned from a random-digit-dial telephone survey design (1991-2011), to a self-administered, mail-based design (2012-2016) and finally to a web-push design. The NHES web-push design was tested in 2016 and 2017 and implemented for the full-scale data collection in 2019.

Research has demonstrated that both concurrent and sequential mixed-mode designs generally achieve lower response rates than mail-only designs (Smyth et al. 2010, Messer and Dillman 2011, Lesser et al. 2016). A notable exception is research on the American Community Survey (ACS) in which some mixed mode treatments attained higher response rates than mail-only controls (Matthews et al. 2012). Results from studies comparing response rates between concurrent and sequential designs are mixed. Most studies observed higher response rates for concurrent designs (Smyth et al. 2010, Lesser et al. 2016). However, others measured higher response rates for sequential designs (Matthews et al. 2012), while still others measured similar response rates for concurrent and sequential designs (Biemer 2016, Bucks et al. 2019). One consistent result in comparisons between sequential and concurrent designs is that sequential designs with web as the initial reporting mode achieve significantly more web responses than concurrent designs (De Leeuw, 2018). Consequently, web-push designs provide the greatest opportunity for cost savings and improving data quality.

The objective of this study was to evaluate the feasibility of a web-push design for the MRIP Fishing Effort Survey. Study results were compared to those from the standard, mail-based FES. Specifically, we evaluated the following items:

1. Overall response rates,
2. The proportion of sample reporting via the web instrument (web-push design only),
3. Timeliness of data collection,
4. Demographic composition overall, as well as for web and paper respondents,
5. Data quality, including editing and imputation rates,
6. Key survey measures, including estimates of shore and private boat fishing activity.

6. Executive Summary

NA

7. Methods

Fishing Effort Survey Design

The MRIP Fishing Effort Survey (FES) is a bi-monthly (wave), cross-sectional mail survey designed to estimate the total number of private boat and shore-based recreational, saltwater fishing trips taken by residents of coastal states during two-month reference waves. Each year, the FES is administered for 6 waves in Hawaii, North Carolina and the states along the Gulf of Mexico and for 5 waves (wave 2 – wave 6) in the states along the Atlantic coast. For each wave, the FES utilizes address-based samples (ABS) covering Hawaii and 16 coastal states along the Atlantic coast and Gulf of Mexico (Maine through Alabama). The sample frame is derived from the USPS Computerized Delivery Sequence File (CDS) and includes all full-time (non-seasonal), residential addresses, with the exception of PO boxes that are not flagged as the only way to get mail. Sampling is stratified both geographically and by angler license status. Within each state, sampling is stratified into coastal and non-coastal regions defined by geographic proximity to the coast. Generally, counties with borders that are within 25 miles of the coast are in the "coastal" stratum and all other counties are in the "non-coastal" stratum. Rhode Island, Connecticut, Delaware and Florida are not geographically stratified due to relatively consistent rates of fishing among counties.

Within geographic strata, addresses are matched to the National Saltwater Angler Registry (NSAR), which consists of state lists of licensed saltwater anglers. This creates two additional strata; license matched (households with one or more licensed anglers) and license unmatched (households that cannot be matched to NSAR). Within each stratum, addresses are selected in a single stage using simple random sampling.

The questionnaire (Appendix A) asks residents of sampled households to report the total number of shore and private boat recreational fishing trips taken by each household member (up to 5) during the reference wave. The data collection period for each wave begins one week prior to the end of the wave with an initial survey mailing. The timing of the initial mailing is such that materials are received prior to the end of the reference wave. The initial mailing is delivered by regular first class mail and includes a cover letter stating the purpose of the survey, a survey questionnaire, a post-paid return envelope and a $2 prepaid cash incentive. One week following the initial mailing, a thank you/reminder postcard is sent via regular fist class mail to all sample units. Three weeks after the initial survey mailing, a follow-up mailing is delivered to all sample units that have not responded to the survey. The follow-up mailing is delivered via first class mail and includes a nonresponse conversion letter, a second questionnaire and a post-paid return envelope. Data are collected for approximately 13 weeks following the initial survey mailing for each reference wave. However, preliminary estimates are generated from surveys returned within four weeks of the initial survey mailing.

FES Web-Push Design

The FES web-push design was tested in Massachusetts, New York, North Carolina and Florida during wave 5 (September/October), 2018 through wave 1 (January/February), 2019. The sampling design for the web-push treatment was identical to the FES. Independent samples were selected for each state and reference wave. Table 1 provides the initial sample sizes for the base FES and the web-push treatment for each state and reference wave.

Table 1. Sample size allocations to FES and web-push treatment.

State/Wave	FES	Web-Push
Massachusetts Total	8,854	8,854

Wave 5, 2018	2,658	2,658
Wave 6, 2018	6,196	6,196
Wave 1, 2019	NA	NA
New York Total	8,483	8,483
Wave 5, 2018	2,841	2,841
Wave 6, 2018	5,642	5,642
Wave 1, 2019	NA	NA
North Carolina Total	11,924	11,924
Wave 5, 2018	2,292	2,292
Wave 6, 2018	3,331	3,331
Wave 1, 2019	6,301	6,301
Florida Total	4,160	4,160
Wave 5, 2018	1,585	1,585
Wave 6, 2018	1,423	1,423
Wave 1, 2019	1,152	1,152
Overall Total	33,421	33,421

We used multiple logistic regression to predict characteristics of households that responded via the web instrument (versus the paper instrument), as well as households that responded to initial (preliminary) survey request. We evaluated differences between FES and web-push samples for response rates, demographic characteristics and survey measures using paired t-tests, where FES and web-push estimates for each state and wave formed a pair. *Analysis* The web questionnaire was designed to be as consistent as possible to the FES paper questionnaire. The instrument was programmed in Voxco and optimized for mobile devices. Screen shots of the instrument are included in Appendix B. Data collection for each wave began 5-6 days prior to the end of the wave with an initial mailing that included a $2.00 prepaid cash incentive and cover letter. The cover letter described the survey and included the survey URL and a unique access code. A bi-fold reminder postcard that included the URL and access code was sent to all nonrespondents approximately 10 days after the initial mailing. A third mailing was sent to all nonrespondents approximately two weeks after the initial mailing. This mailing included a refusal conversion letter with instructions for completing the survey online, as well as the FES paper instrument and a BRE. A final bi-fold postcard urging nonrespondents to complete the mail questionnaire but also providing the URL and access code was mailed 10 days after the paper questionnaire

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8. Results

Response Rates

Figure 1 shows weighted response rates (AAPOR RR2) for the FES and web-push design by state and reference wave. Overall, FES response rates (31.9) were 8.75 points higher than web-push response rates (23.3), which is a significant difference ($p<0.0001$). Among states and waves, differences between FES and web-push response rates ranged from 7.2 points to 11 points.

Figure 1. Weighted response rates (AAPOR2) by state and reference wave. Addresses returned by the post office as undeliverable have been removed from the denominator of the

response rate calculation.

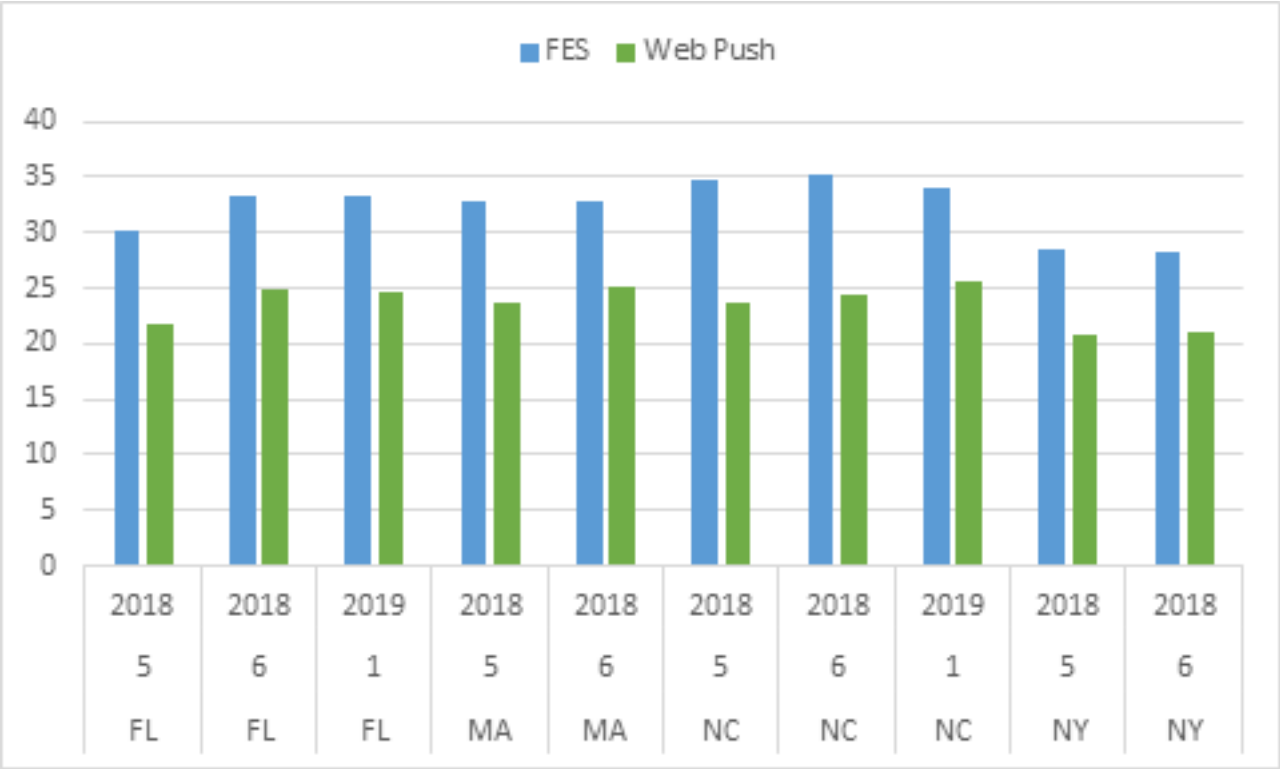


Figure 2 shows cumulative response rates for the FES and web-push. As expected, response for the web-push outpaced the FES through the first several days of data collection. However, FES response increased rapidly beginning 7-10 days after the initial survey mailing, and response rates quickly outpaced those for the web-push design. Overall, the median response time for the FES (14 days) was actually a day less than the web-push (15 days).

Figure 2. Cumulate response rate curves for FES and web-push samples.

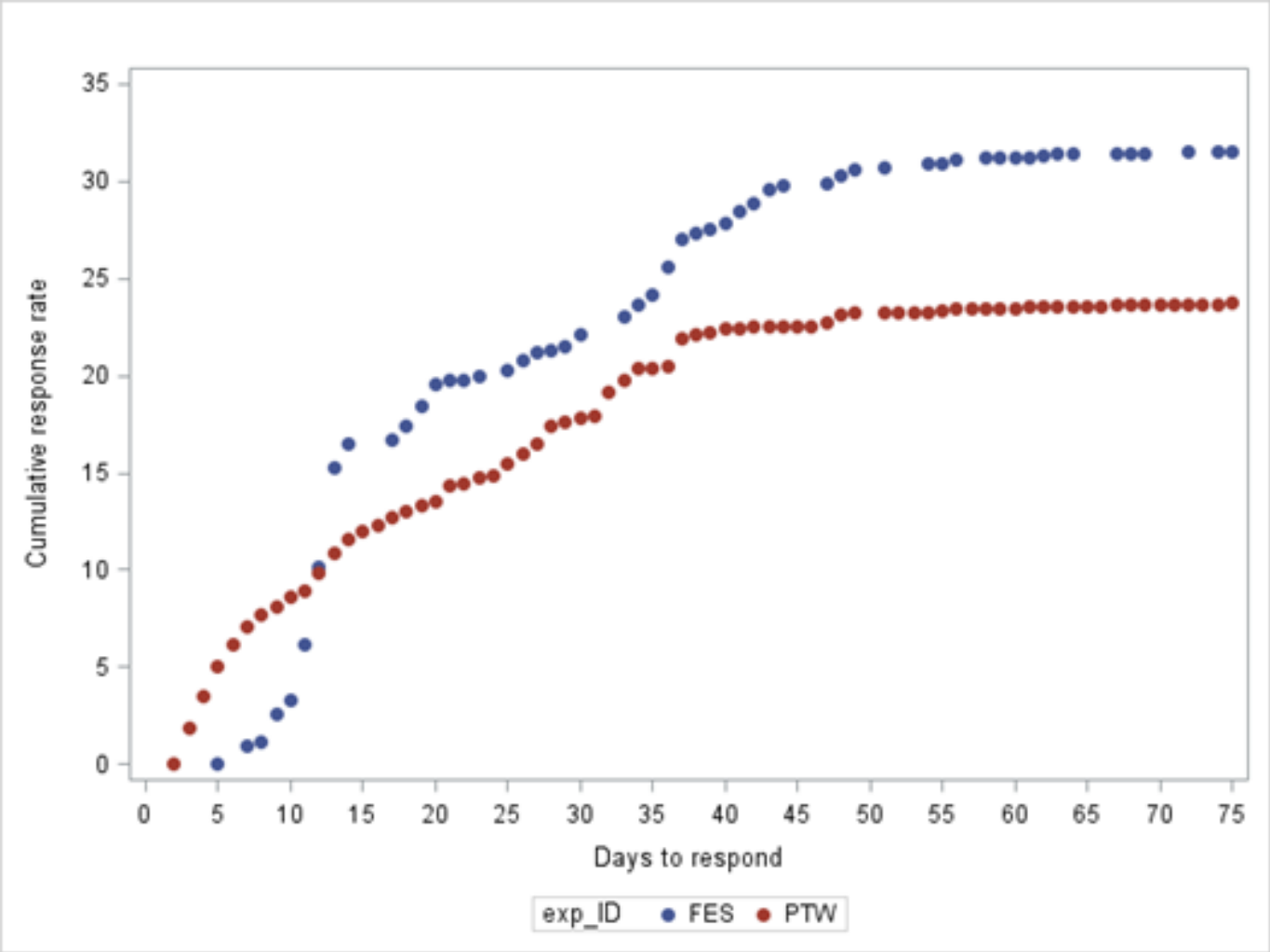
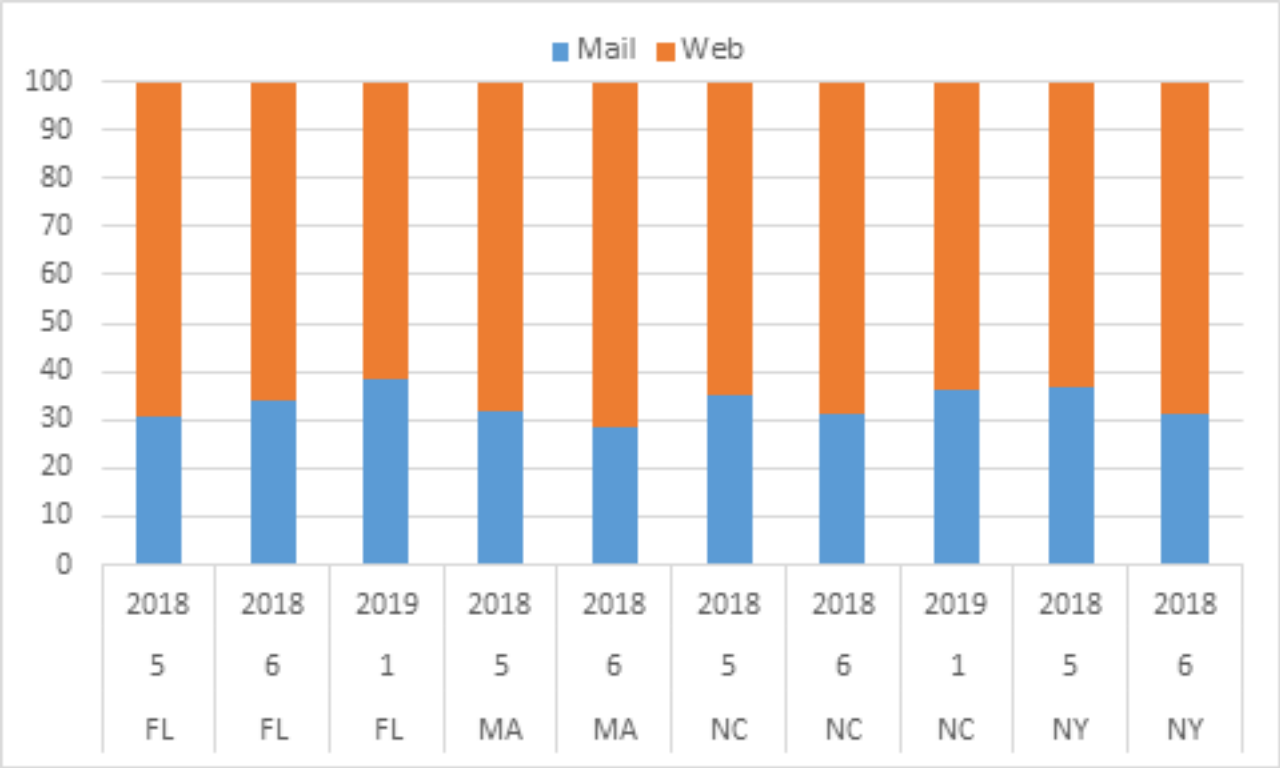


Figure 3 shows the final distribution of web-push responses by reporting mode. Overall, more than two thirds of web-push respondents used the web-based questionnaire. The percentage of respondents reporting online was fairly consistent among states, ranging from 66% (NC, NY and FL) to 70% (MA).

Figure 3. Distribution of web-push responses by reporting mode by state and reference wave.



Data Quality

In terms of data quality, we compared the frequency of data edits resulting from illogical values as well as item nonresponse for key survey measures. Table 2 describes illogical scenarios requiring an edit, and Table 3 provides editing rates for the FES and web-push designs, as well as for each of the data collection modes within the web-push design. Editing rates reflect the percentage of responding households that required a specific type of edit[1]. Overall editing rates for the FES and web-push designs were 4.95 and 3.10 percent, respectively. Within the web-push design, editing rates for the paper and pencil survey and web survey were 6.41 percent and 1.48 percent, respectively.

Table 2. Types of illogical values requiring a data edit.

Edit Type	Description
Extra People	The FES collects information for up to five individual household members. A record is flagged as illogical if the number of complete people is greater than the reported number of household members.
Extra Information	The number of complete people equals the reported number of household members, but the survey includes "extra", incomplete person-level information.
2-month fishing days > 12-month fishing days	The reported number of days fishing during the two-month reference period is greater than the reported number of days fishing during the previous 12 months.

Table 3. Data editing rates. Edits are not mutually exclusive, so the sum of records across edit types will not match the total number of records that required an edit.

	FES		PAPI		CAWI		Web Push Total	
	N	%	N	%	N	%	N	%
Total Cases	10,522		2,591		5,282		7,873	
Extra Information	305	2.90	89	3.43	1	0.02	90	1.14
Extra People	113	1.07	39	1.51	28	0.53	67	0.85
2-month fishing days > 12-month fishing days	124	1.18	22	0.85	17	0.32	39	0.50
Total	521	4.95	166	6.41	78	1.48	244	3.10

Table 4 provides item nonresponse rates for key survey items. As with editing rates, item nonresponse rates reflect the percentage of responding households that are missing at least one key data element. Key data elements include the reported number of household members and the number of shore and private boat fishing days during the two-month reference wave for each household member. In addition, a returned survey may be missing all data elements, including demographic and fishing information, for an individual household member (i.e. an "Entire Person" is missing). In these cases, the count of complete person sections is less than the reported number of household members.

Table 4. Item nonresponse rates. Survey items are not mutually exclusive, so the sum of records across items will not match the total number of records that were missing an item.

	FES		PAPI		CAWI		Web Push Total	
	N	%	N	%	N	%	N	%
Total Cases	10,522		2,591		5,282		7,873	
Number of Household Members	115	1.09	35	1.35	58	1.10	93	1.18
Entire Person	617	5.86	244	9.42	610	11.55	854	10.85
Missing Fishing Days	899	8.54	245	9.46	117	2.22	362	4.60
Total	1,313	12.48	368	14.20	705	13.35	1,073	13.63

Overall item nonresponse rates are similar between treatments; item nonresponse rates for the FES and web-push were 12.48 percent and 13.63 percent, respectively. However, the treatments differed with respect to the specific missing items. In the FES, item nonresponse was highest for the number of fishing days (shore and/or boat fishing). In the web-push, respondents were most likely to exclude all information for one or more household members. Differences between FES and web-push treatments are the result of differences in item nonresponse between the paper and online questionnaires.

Survey Measures

Within the web-push sample, we used multiple logistic regression to explore characteristics of households that responded to the survey via the web instrument (Table 5). Households with seniors and black-alone households had significantly lower odds of responding to the web survey than the paper survey. No other demographic characteristics were significant predictors of web response.

Table 5. Multiple logistic regression predicting web response (1) versus paper response (0) among all responders.

Household Attribute	Adjusted Odds Ratio (95% CI)
Wireless only	0.999 (0.821-1.216)
Own home	0.959 (0.765-1.202)
3+ household members	1.078 (0.825-1.409)
Child in household	1.173 (0.857-1.605)
Senior in household	0.49 (0.398-0.604)*
White only	1.043 (0.774-1.406)
Black only	0.639 (0.418-0.977)*
Hispanic	0.887 (0.64-1.23)

Table 6 compares weighted demographic distributions between the full FES and web-push samples. Distributions for the samples were similar for all demographic characteristics with the exception of the presence of seniors (p=0.0144), which was higher for the FES, and white alone (p=0.0054), which was higher for the web-push sample. Table 6 also compares estimated demographic characteristics to control values published by the U.S. Census Bureau. The direction and magnitude of differences between estimated and control values are similar for both survey designs. Both designs overestimated home ownership and the percent of households with seniors and underestimated households with children, mean household size and the percent of the population that identifies as black alone and Hispanic.

Table 6. Comparison of demographic composition between FES and web-push samples. Estimates are the average of weighted estimates, across states and waves. The weights used to compare demographic characteristics were adjusted for nonresponse, but do not include calibration adjustments to population control totals. Difference and significance values are for comparisons between survey designs.

Household Attribute	FES	Web Push	Difference	*p* -value	Control
Wireless Only (%)	51.1	52.9	-1.8	0.1133	51.2
Own Home (%)	77.5	77.8	-0.3	0.6282	62.3
3+ household members (%)	33.6	34.7	-1.1	0.1655	33.1
Child in Household (%)	20.7	20.4	0.3	0.7191	29.1
Senior in Household (%)	43.2	39	4.2	**0.0144**	31.1
White Only (%)	76.7	76.5	0.5	0.8884	74.5
Black Only (%)	8.5	6.8	1.7	**0.0389**	17
Hispanic (%)	10.8	11.4	-0.6	0.2566	17
Mean Household Members	2.38	2.42	-0.04	0.1633	2.6

In terms of key survey measures, we examined household fishing prevalence and mean fishing days per household (Table 7). We evaluated shore and private boat fishing separately, and unless otherwise noted, all estimates are for 2-month reference waves. FES estimates were larger than web-push estimates for all measures. However, differences between estimates were significant only for mean boat fishing days per household (difference of 0.83 boat fishing days per household) and shore fishing prevalence (difference of 1.34 percent). Comparisons

between FES and web-push designs for key survey measures by state and reference wave are provided in Appendix 3.

Table 7. Comparisons between FES and web-push designs for key survey measures. Estimates are the average of weighted estimates, across states and waves*.

Survey Measure	FES	Web Push	Difference	*p* -value
Boat Prevalence (%)	4.4	3.76	0.64	0.267
Mean Boat Fishing Days per Household	4.86	4.03	0.83	**0.0364**
Shore Prevalence (%)	5.76	4.42	1.34	**0.0025**
Mean Shore Fishing Days per Household	6.01	5.15	0.86	0.1287

As noted previously, FES and web-push samples were not significantly different with respect to most demographic characteristics (Table 6), and while samples were significantly different for the percentage of households with seniors and white alone, the differences were relatively small and not likely to explain large differences in survey measures. While household composition was similar, we did observe differences between treatments in reporting fishing participation by children – among households that included at least one child household member and reported at least one fishing day, a significantly higher proportion of households in the FES treatment reported that a child participated in fishing (Table 8). While significant, differences between FES and web-push treatments for child participation can explain only a small portion of the overall difference between treatments as child anglers accounted for only 5-15% of total fishing activity.*Comparisons between FES and web-push designs for key survey measures by state and reference wave are provided in Appendix 3.

Table 8. Comparison between FES and web-push designs for the percentage of fishing households with children that reported participation during the reference wave by at least one child household member.

Survey Measure	FES	Web Push	Difference	*p* -value
Child Boat Prevalence (%)	51.9	36.72	15.18	**0.0434**
Child Shore Prevalence (%)	57.87	37.24	20.63	**0.0308**

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[1] Values for Wireless Only, Own Home, 3+ Household Members, Child in Household and Senior in Household are the percent of households with the attribute. White Alone, Black Alone and Hispanic are the percent of the population with the attribute.

[2] Control value estimated from the National Health Interview Survey, administered by the

[1] A single household may require multiple types of edits as well as multiple instances of a single type of edit.

9. Discussion/Conclusions/Recommendations

The mail-only FES design achieved significantly higher response rates than the web-push design. This result is not surprising and is consistent with results from previous studies comparing mixed-mode and mail survey designs (Smyth et al. 2010, Messer and Dillman 2011, Lesser et al. 2016). In a meta-analysis of research studies, Groves (2006) demonstrated that nonresponse rate alone is not a strong predictor of the magnitude of nonresponse bias. In the present study, differences in response rates between treatments are quite large (7.2-11 percentage points), suggesting that **the risk for nonresponse bias is substantially higher in the web-push design than the mail-only design.**

While response rates were lower, the web-push design effectively pushed respondents to the online questionnaire; approximately 70% of respondents utilized the online instrument. This finding demonstrates the potential cost savings of the web-push design - at a production scale, we estimate that non-labor costs (e.g. printing, postage, materials) of the web-push design would be approximately 15% lower than the FES. However, the cost benefit of the web-push design is eliminated when we consider survey participation – the estimated cost of the web-push design would be approximately 15% higher than the FES on a per-complete basis. Patrick et al. (2018) and Messer and Dillman (2011) reported similar results when comparing costs for web-push and mail-push designs. At present, **transitioning to a web-push design would result either in a higher cost to achieve a desired effective sample size (i.e. a fixed level of precision) or, for a fixed cost, a reduced number of completed surveys.**

A second potential benefit of online surveys is improved data quality. Online instruments provide the capacity to include real-time editing, including logic checks, range checks, etc. Additionally, web instruments allow for complex skip patterns tailored to each respondent. In the present study, our goal was to maintain as much consistency as possible between paper and web instruments, so we did not include complex data editing functions into the web instrument. Despite efforts to maintain consistency, we did observe differences in data quality between web and paper instruments. **Across data collection modes, editing rates for the web-push sample were modestly lower than FES editing rates (4.95% vs. 3.10%).** However, editing rates for web responses were only 1.48%, even without built-in data editing processes.

Item nonresponse rates were also similar for FES and web-push samples (12.48% vs. 13.35%). However, the sources of missing items were different between the two treatments. For the FES, item nonresponse was highest for the number of fishing days during the wave (8.5%). In these cases, respondents provided demographic information, but failed to answer the fishing questions for one or more household members. In this scenario, we assume that the fishing questions are not applicable to the household member (i.e. they did not fish), and we impute zeros. For the web-push treatment, the nonresponse rate for fishing days was considerably lower at 4.6%. However, web-push respondents were more likely to exclude an entire household member than FES respondents (10.85% vs. 5.86%). It is not clear if household members are excluded because the substantive fishing questions are inapplicable or if

respondents are purposefully terminating surveys due to fatigue or even forgetting household members. In this case, we can assume that fishing questions are inapplicable, but we are unable to make judgements about household member demographic characteristics, which may affect weighting adjustments. The purpose of weighting adjustments is to reduce bias resulting from differential response among households with different characteristics – i.e. the goal is for the responding sample to accurately represent the population. **Weighting adjustments in the web-push design may be less effective as a result of higher item nonresponse for weighting variables.**

A third perceived benefit of online surveys and web-push designs is the accelerated timeframe in which data are available for analysis and estimation. As expected, we began receiving a substantial number of web responses within 3 days of the initial survey mailing. In contrast, we did not receive the first FES response until day 7. Consequently, web-push response outpaced the FES through the first 10 days of data collection. However, FES response rates eclipsed web-push response rates by day 12, and the median response time for the FES was a day shorter than that of the web-push design (14 days vs. 15 days). Currently, we produce preliminary effort estimates from surveys returned within approximately four weeks of the initial mailing[1]. **The FES design actually results in a larger number of responses than the web-push design within the preliminary estimation schedule.**

We observed significant differences between web-push and FES samples for key survey measures. FES estimates were larger than web-push estimates for all key survey measures, and differences between FES and web-push estimates were significant for mean boat fishing days per household and shore fishing prevalence. Differences between designs in reporting fishing activity for children may contribute to the observed differences in survey measures, but the magnitude of this effect is likely to be small. As noted above, differential measurement errors related to reporting mode may also contribute to the differences. De Leeuw (2018) suggests that the risk for differential measurement errors across self-administered modes is low if questions are similarly designed and administered. Similarly, Dillman et al. (2014) identify three factors that can result in differential measurement effects across survey modes, 1) presence/absence of an interviewer, 2) aural versus visual communication, and 3) differences in survey questions. The present study utilized self-administered questionnaires, so **differences in measurement between web and paper instruments could only have resulted from differences in question construction and/or administration.** We were careful to utilize similar instructions and question wording for the two instruments. However, the instruments deviated in how questions were presented to respondents. Specifically**, the web instrument was optimized for mobile devices, so respondents could only see one question at a time, while the paper questionnaire presents all of the questions as soon as the respondent opens the survey package.**

We also speculate that web and paper surveys differ with respect to the environments in which they are completed, and that these differences may contribute to differential measurement errors. For example, a paper questionnaire is a physical “thing” that may sit on a table or countertop for several days, attracting the attention of multiple household members, before it is completed and returned. In contrast, a web questionnaire may be a more personal experience, completed by a single individual, with little notice or input from other household members. In this respect, web surveys may be more similar to a telephone interview than a mail survey. In a study comparing telephone and mail survey estimates of recreational fishing activity, Andrews et

al. (2014) propose a type of screening error, which they refer to as a “gatekeeper effect”. According to the gatekeeper hypothesis, the individual who answers the telephone for an interview may not be the most knowledgeable about the survey topic and may subsequently screen the household out of the eligible sample, resulting in under-reports of household fishing activity. **We suggest that web surveys, which are likely to be completed by the individual who opens the mail, may be susceptible to similar errors, resulting in under-reporting of fishing activity.** Future research should focus on differential measurement errors between web and paper instruments.

The web-push design proved to be a reasonably effective method for collecting recreational fishing data. However, **unless response rates improve, the design is not a cost-effective alternative to the FES mail survey.** In addition, differences between the web-push and FES designs for estimates of key survey measures would disrupt the recently calibrated time series of recreational fishing catch and effort estimates. **We recommend additional testing of the web-push design, focusing on improving response rates and resolving differences between FES and web-push estimates, prior to consideration of the methodology as a valid alternative to the existing FES design.**

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[1] The FES estimation schedule is determined by the availability of data from the complementary Access Point Angler Intercept Survey (APAIS). Estimates from the APAIS, which are combined with FES estimates to estimate total catch, are generally available one month after the conclusion of each survey wave.

10. References

Andrews, R., J. M. Brick, and N. A. Mathiowetz. 2014. Development and Testing of Recreational Fishing Effort Surveys: Resting a Mail Survey Design. National Oceanic and Atmospheric Administration Fisheries, Office of Science and Technology, Silver Spring, Maryland.

Biemer, P.P., J. Murphy, S. Zimmer, C. Berry, G. Deng, and K. Lewis. 2018. Using Bonus Montetaryy Incentives to Encourage Web Response in Mixed-Mode Household Surveys. Journal of Survey Statistics and Methodology 6: 240-261.

Bucks, B., M.P. Couper, and S.L. Fulford. 2019. A Mixed-Mode and Incentive Experiment using Administrative Data. Journal of Statistics and Survey Methodology 0: 1-18.

Couper, M.P. 2011. The Future of Modes of Data Collection. Public Opinion Quarterly 75(5):889-908.

De Leeuw, E.D. 2018. Mixed-Mode: Past, Present, and Future. Survey Research Methods 12(2): 75-89.

Dillman, D., J. Smyth, and L. M. Christian. 2014. Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method (4th ed.), Hoboken, NJ: John Wiley & Sons.

Groves, R. M. Nonresponse Rates and Nonresponse Bias in Household Surveys. Public

Opinion Quarterly 70: 646-675.

Lesser, V.M., L.D. Newton, D.K. Yang, and J.C. Sifneos. 2016. Mixed-mode Surveys Compared with Single Mod Surveys: Trends in Responses and Methods to Improve Completion. Journal of Rural Social Sciences 31(3): 7-34.

Matthews, B., M. Davis, J. Tancreto, M. F. Zelenak, and M. Ruiter. 2012. 2011 American Community Survey Internet Tests: Results from Second Test in November 2011. American Community Survey Research and Evaluation Program, #ACS12-RER-21, May 14, 2012.

Messer, B. & Dillman, D. (2011). Surveying the General Public Over the Internet Using Addressed Based Sampling and Mail Contact Procedures. Public Opinion Quarterly 75(3), 429–457.

National Academies of Sciences, Engineering, and Medicine. 2017. Review of the Marine Recreational Information Program. National Academies Press, Washington, D.C.

Patrick, M.E., M.P. Couper, V.B. Laetz, J.E. Schulenberg, P.M. O'Malley, L.D. Johnston, and R.A. Miech. 2018. A Sequential Mixed-Mode Experiment in the U.S. National Monitoring the Future Study. Journal of Statistics and Survey Methodology 6:72-97.

Smyth, J.D., D.A. Dillman, L.M. Christian, and A.C. O'Neill. 2010. Using the Internet to Survey Small Towns and Communities: Limitations and Possibilities in the Early 21st Century. American Behavioral Scientist 53(9):1423–48.

11. Appendix

"Appendix C FES Web Push Comparisons by State and Wave", page 1

Figure C1. Comparisons between the FES (blue) and web-push (green) designs for private boat fishing prevalence.

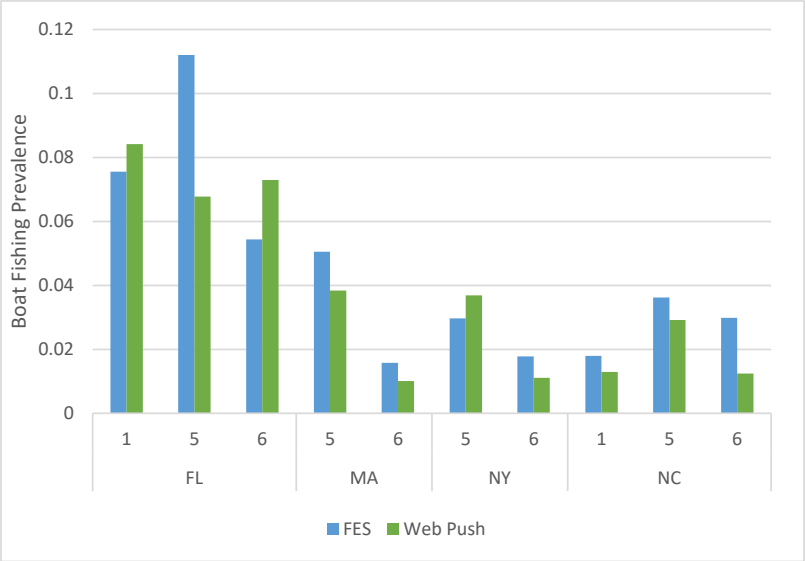


Figure C2. . Comparisons between the FES (blue) and web-push (green) designs for mean number of boat fishing days per household. Estimates are for those households that reported at least one day of boat fishing.

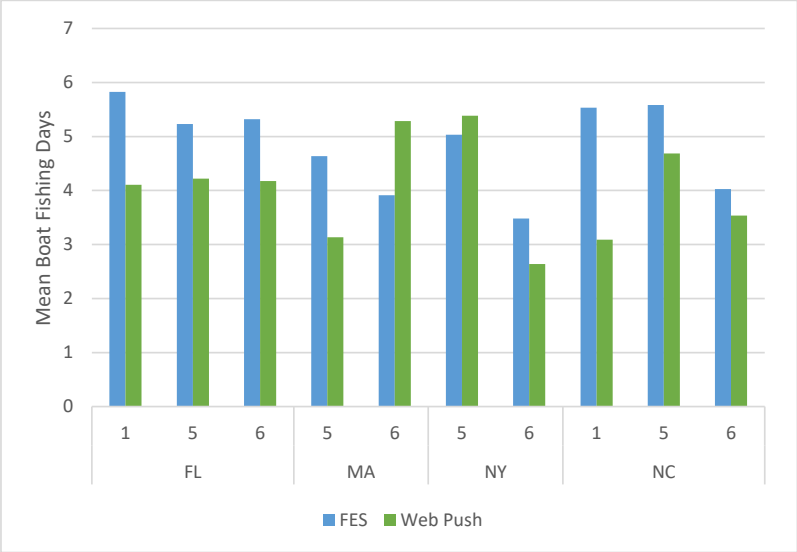
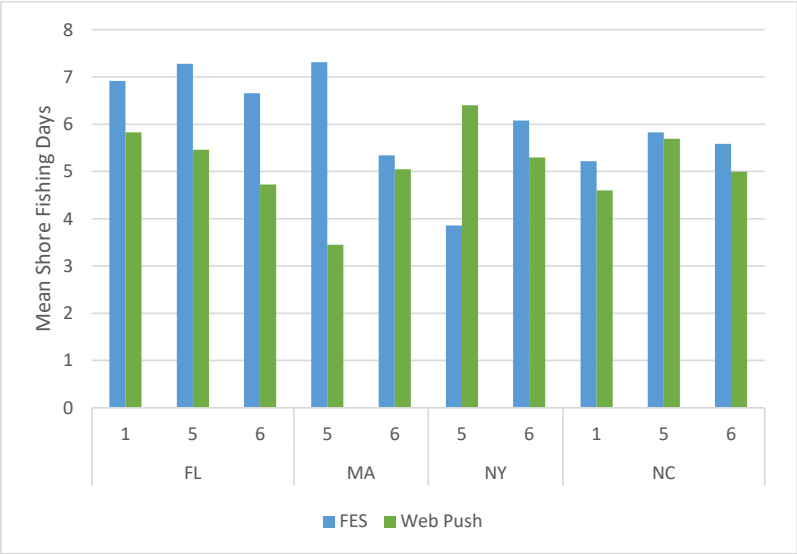


Figure C3. Comparisons between the FES (blue) and web-push (green) designs for shore fishing prevalence.

Figure C4. . Comparisons between the FES (blue) and web-push (green) designs for mean number of shore fishing days per household. Estimates are for those households that reported at least one day of shore fishing.



0835186348

HOUSEHOLD MEMBER 4

11 What is this person's gender?
- ☐ Male
- ☐ Female

12 How old is this person?
If less than 1 year, mark 0 years

☐☐ Age in years

13 Is this person of Hispanic, Latino, or Spanish origin?
- ☐ Yes, of Hispanic origin
- ☐ No, not of Hispanic origin

14 What is this person's race? Mark one or more boxes.
- ☐ White
- ☐ Black, African-American
- ☐ Asian
- ☐ American Indian or Alaska Native
- ☐ Native Hawaiian or other Pacific Islander

Please think only about recreational saltwater fishing in North Carolina.

15 How many days did this person go recreational saltwater fishing from the SHORE in North Carolina?

The shore includes docks, bridges, causeways, beaches, banks, or any other shore-based place or area. Do not include freshwater fishing.

- ☐ Did not recreational saltwater fish from shore in last 12 months ➔ ***Go to question 16***
- ☐☐ Number of days saltwater shore fishing in January and February of 2018
- ☐☐☐ Number of days saltwater shore fishing in last 12 months, including January and February

16 How many days did this person go recreational saltwater fishing from a private or rental BOAT that returned to shore in North Carolina?

Do not include freshwater trips or trips where a paid captain or crew helped locate and catch fish.

- ☐ Did not recreational saltwater fish from private boat in last 12 months
- ☐☐ Number of days saltwater boat fishing in January and February of 2018
- ☐☐☐ Number of days saltwater boat fishing in last 12 months, including January and February

If you have more people in your household, continue to Household Member 5. If you have answered for all people in your household, please return your survey.

301

HOUSEHOLD MEMBER 5

11 What is this person's gender?
- ☐ Male
- ☐ Female

12 How old is this person?
If less than 1 year, mark 0 years

☐☐ Age in years

13 Is this person of Hispanic, Latino, or Spanish origin?
- ☐ Yes, of Hispanic origin
- ☐ No, not of Hispanic origin

14 What is this person's race? Mark one or more boxes.
- ☐ White
- ☐ Black, African-American
- ☐ Asian
- ☐ American Indian or Alaska Native
- ☐ Native Hawaiian or other Pacific Islander

Please think only about recreational saltwater fishing in North Carolina.

15 How many days did this person go recreational saltwater fishing from the SHORE in North Carolina?

The shore includes docks, bridges, causeways, beaches, banks, or any other shore-based place or area. Do not include freshwater fishing.

- ☐ Did not recreational saltwater fish from shore in last 12 months ➔ ***Go to question 16***
- ☐☐ Number of days saltwater shore fishing in January and February of 2018
- ☐☐☐ Number of days saltwater shore fishing in last 12 months, including January and February

16 How many days did this person go recreational saltwater fishing from a private or rental BOAT that returned to shore in North Carolina?

Do not include freshwater trips or trips where a paid captain or crew helped locate and catch fish.

- ☐ Did not recreational saltwater fish from private boat in last 12 months
- ☐☐ Number of days saltwater boat fishing in January and February of 2018
- ☐☐☐ Number of days saltwater boat fishing in last 12 months, including January and February

Please return your survey in the enclosed postage-paid envelope.

RTI International
5265 Capital Boulevard, Raleigh NC 27690-1652

4

99999923

OMB#: 0648-0652
Exp. Date: 1/31/2020

North Carolina

Weather and Outdoor Activity Survey

Public reporting burden for this collection of information is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other suggestions for reducing this burden to Rob Andrews, NOAA Fisheries Service, 1315 East-West Hwy., Silver Spring, MD 20910.

No personally identifiable information will be collected through this survey. Responses will only be associated with a unique, randomly assigned identification code. Any public release of survey data will be without identification as to its source or in aggregate statistical form. All survey data will be stored on secured, password protected servers, and all transfer of survey data will utilize secure file transfer protocols.

1

0000014

6859186340

This survey should be filled out by an adult member of the household. Complete and return this form even if no one in your household participates in any of these activities.

START HERE

Please carefully follow the steps below when completing this survey.

- Use only a blue or black ink pen that does not blot the paper
- Make solid marks inside the response boxes
- Do not make other marks on the survey

Example

RIGHT WAY ☒ WRONG WAY ☒

1 How do members of this household obtain information about the weather, including current weather conditions, forecasts, and warnings? Mark all that apply.
- ☐ Television
- ☐ Radio
- ☐ Newspaper
- ☐ Internet
- ☐ Other

2 During the past 12 months, has anyone in this household had to evacuate or seek shelter due to a severe weather event, such as a tornado, hurricane, or thunderstorm?
- ☐ Yes
- ☐ No

3 In your area, how often do the advanced warnings you get for severe weather events allow you enough time to prepare properly?
- ☐ All the Time
- ☐ Some of the time
- ☐ Rarely
- ☐ Never

4 During the past 12 months, has anyone in this household visited a public beach, national seashore, coastal state park, or other coastal nature reserve or protected area?
- ☐ Yes
- ☐ No

5 During the past 12 months, has anyone in this household been freshwater fishing in North Carolina?
- ☐ Yes
- ☐ No

6 During the past 12 months, has anyone in this household been saltwater fishing in North Carolina?
- ☐ Yes
- ☐ No

7 Which of the following best describes how your household receives telephone calls?
- ☐ All are received on cell phones
- ☐ Most are received on cell phones
- ☐ Some are received on cell phones and some on landline phones
- ☐ Most are received on landline phones
- ☐ All are received on landline phones
- ☐ No calls are received on cell phones or landline phones

8 Which of the following best describes this house, apartment, or mobile home?
- ☐ Owned with a mortgage or loan
- ☐ Owned (without a mortgage)
- ☐ Rented
- ☐ Occupied without payment or rent

9 How long have you lived at this address?
- ☐ 1 year or less
- ☐ Less than 5 years, more than 1 year
- ☐ 5 years or more

10 How many people, including all adults and children, live in this household?

☐☐ Number of people

Please answer the next section for each member of your household, starting with yourself. Please answer for all people in your home, including people who fish and people who do not fish.

If you have more than 5 people living at this address, answer for the oldest members of the household.

Please use the calendars to help answer questions 15 and 16.

January						
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

February						
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28			

2

HOUSEHOLD MEMBER 1 (YOU)

11 What is your gender?
- ☐ Male
- ☐ Female

12 How old are you?
If less than 1 year, mark 0 years

☐☐ Age in years

13 Are you of Hispanic, Latino, or Spanish origin?
- ☐ Yes, of Hispanic origin
- ☐ No, not of Hispanic origin

14 What is your race? Mark one or more boxes.
- ☐ White
- ☐ Black, African-American
- ☐ Asian
- ☐ American Indian or Alaska Native
- ☐ Native Hawaiian or other Pacific Islander

Please think only about recreational saltwater fishing in North Carolina.

15 How many days did you go recreational saltwater fishing from the SHORE in North Carolina?

The shore includes docks, bridges, causeways, beaches, banks, or any other shore-based place or area. Do not include freshwater fishing.

☐ Did not recreational saltwater fish from shore in last 12 months ➔ ***Go to question 16***

☐☐ Number of days saltwater shore fishing in January and February of 2018

☐☐☐ Number of days saltwater shore fishing in last 12 months, including January and February

16 How many days did you go recreational saltwater fishing from a private or rental BOAT that returned to shore in North Carolina?

Do not include freshwater trips or trips where a paid captain or crew helped locate and catch fish.

☐ Did not recreational saltwater fish from private boat in last 12 months

☐☐ Number of days saltwater boat fishing in January and February of 2018

☐☐☐ Number of days saltwater boat fishing in last 12 months, including January and February

If you have more people in your household, continue to Household Member 2. If you have answered for all people in your household, please return your survey.

HOUSEHOLD MEMBER 2

11 What is this person's gender?
- ☐ Male
- ☐ Female

12 How old is this person?
If less than 1 year, mark 0 years

☐☐ Age in years

13 Is this person of Hispanic, Latino, or Spanish origin?
- ☐ Yes, of Hispanic origin
- ☐ No, not of Hispanic origin

14 What is this person's race? Mark one or more boxes.
- ☐ White
- ☐ Black, African-American
- ☐ Asian
- ☐ American Indian or Alaska Native
- ☐ Native Hawaiian or other Pacific Islander

Please think only about recreational saltwater fishing in North Carolina.

15 How many days did this person go recreational saltwater fishing from the SHORE in North Carolina?

The shore includes docks, bridges, causeways, beaches, banks, or any other shore-based place or area. Do not include freshwater fishing.

☐ Did not recreational saltwater fish from shore in last 12 months ➔ ***Go to question 16***

☐☐ Number of days saltwater shore fishing in January and February of 2018

☐☐☐ Number of days saltwater shore fishing in last 12 months, including January and February

16 How many days did this person go recreational saltwater fishing from a private or rental BOAT that returned to shore in North Carolina?

Do not include freshwater trips or trips where a paid captain or crew helped locate and catch fish.

☐ Did not recreational saltwater fish from private boat in last 12 months

☐☐ Number of days saltwater boat fishing in January and February of 2018

☐☐☐ Number of days saltwater boat fishing in last 12 months, including January and February

If you have more people in your household, continue to Household Member 3. If you have answered for all people in your household, please return your survey.

HOUSEHOLD MEMBER 3

11 What is this person's gender?
- ☐ Male
- ☐ Female

12 How old is this person?
If less than 1 year, mark 0 years

☐☐ Age in years

13 Is this person of Hispanic, Latino, or Spanish origin?
- ☐ Yes, of Hispanic origin
- ☐ No, not of Hispanic origin

14 What is this person's race? Mark one or more boxes.
- ☐ White
- ☐ Black, African-American
- ☐ Asian
- ☐ American Indian or Alaska Native
- ☐ Native Hawaiian or other Pacific Islander

Please think only about recreational saltwater fishing in North Carolina.

15 How many days did this person go recreational saltwater fishing from the SHORE in North Carolina?

The shore includes docks, bridges, causeways, beaches, banks, or any other shore-based place or area. Do not include freshwater fishing.

☐ Did not recreational saltwater fish from shore in last 12 months ➔ ***Go to question 16***

☐☐ Number of days saltwater shore fishing in January and February of 2018

☐☐☐ Number of days saltwater shore fishing in last 12 months, including January and February

16 How many days did this person go recreational saltwater fishing from a private or rental BOAT that returned to shore in North Carolina?

Do not include freshwater trips or trips where a paid captain or crew helped locate and catch fish.

☐ Did not recreational saltwater fish from private boat in last 12 months

☐☐ Number of days saltwater boat fishing in January and February of 2018

☐☐☐ Number of days saltwater boat fishing in last 12 months, including January and February

If you have more people in your household, continue to Household Member 4. If you have answered for all people in your household, please return your survey.

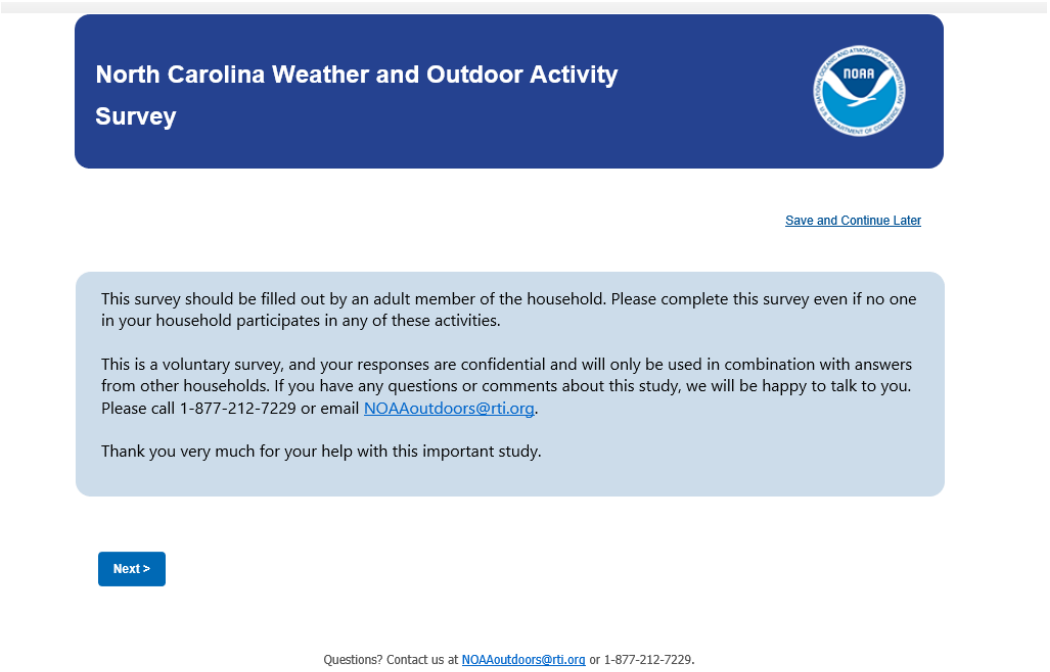
3

RTI International

NOAA FES Push to Web Survey Screenshots

Please note: Questions for household members 2-10 are identical. The order of shore fishing and boat fishing questions is randomized, however, the randomized order will be the same for all household members. There are two household members in this example. If information is entered for 10 household members, go to end.

INTRO



WEATHER

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

How do members of this household obtain information about the weather, including current weather conditions, forecasts, and warnings? **Select all that apply.**

- ☐ Television
- ☐ Radio
- ☐ Newspaper
- ☐ Internet
- ☐ Other

< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

EVAC

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

During the past 12 months, has anyone in this household had to evacuate or seek shelter due to a severe weather event, such as a tornado, hurricane, or thunderstorm?

- ○ Yes
- ○ No

< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

WARNING

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

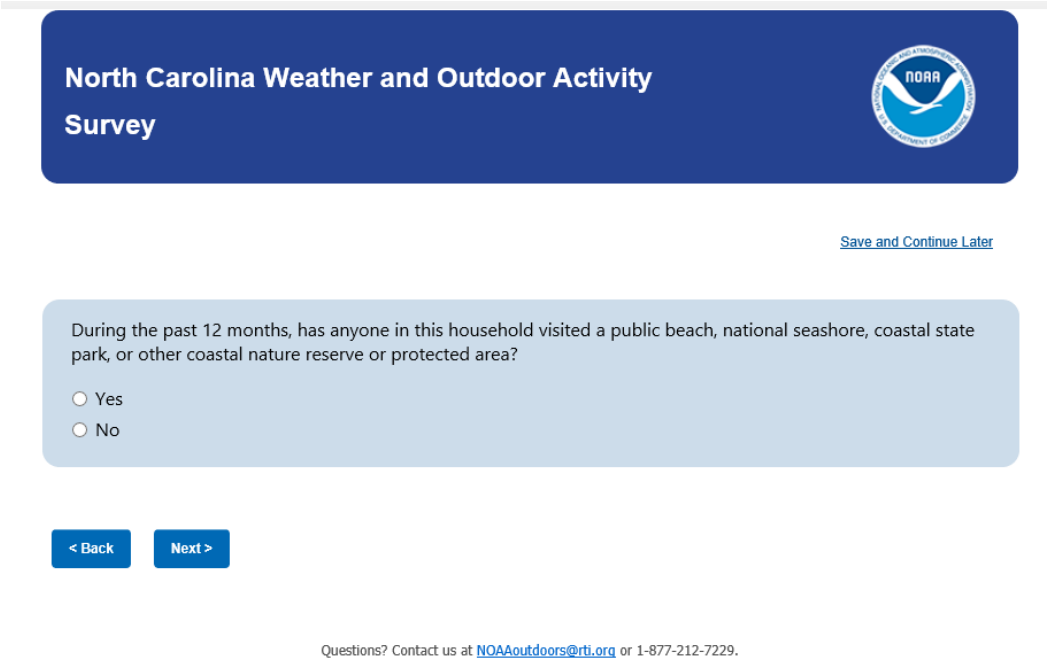
In your area, how often do the advanced warnings you get for severe weather events allow you enough time to prepare properly?

- All the Time
- Some of the time
- Rarely
- Never

< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

BEACH_FLAG


North Carolina Weather and Outdoor Activity Survey
Save and Continue Later
During the past 12 months, has anyone in this household visited a public beach, national seashore, coastal state park, or other coastal nature reserve or protected area?
Yes
No
< Back
Next >
Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

FRESH_FISH

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

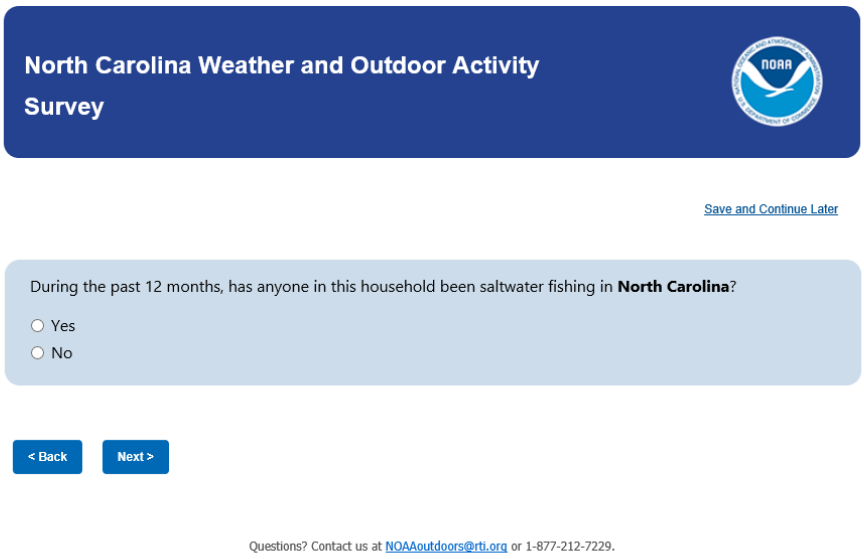
During the past 12 months, has anyone in this household been freshwater fishing in **North Carolina**?

- Yes
- No

< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

SALT_FISH


North Carolina Weather and Outdoor Activity Survey
Save and Continue Later
During the past 12 months, has anyone in this household been saltwater fishing in **North Carolina**?
Yes
No
< Back
Next >
Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

HH_PHN

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

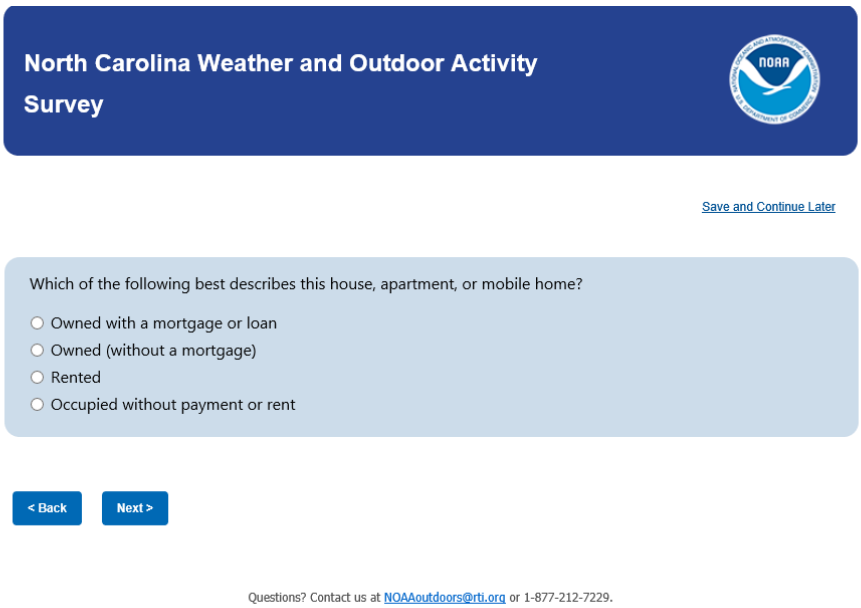
Which of the following best describes how your household receives telephone calls?

- All are received on cell phones
- Most are received on cell phones
- Some are received on cell phones and some on landline phones
- Most are received on landline phones
- All are received on landline phones
- No calls are received on cell phones or landline phones

< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

HH_DESC


North Carolina Weather and Outdoor Activity Survey
Save and Continue Later
Which of the following best describes this house, apartment, or mobile home?
Owned with a mortgage or loan
Owned (without a mortgage)
Rented
Occupied without payment or rent
< Back
Next >
Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

HH_YEARS

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

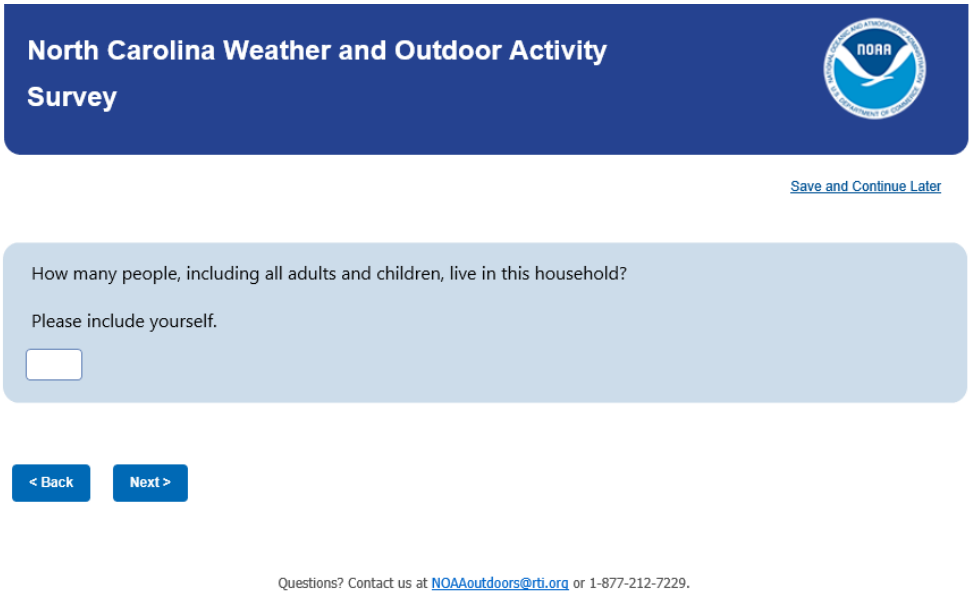
How long have you lived at this address?

- 1 year or less
- Less than 5 years, more than 1 year
- 5 years or more

< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

HH_MEMBERS



Allows zero but then goes to next question assuming respondent should ask HH Member 1 items.

ROSTERINTRO

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

The following section asks questions about you and each member of your household.

It also asks questions about different types of saltwater fishing activities, including **SHORE** fishing and fishing from a **BOAT** in **North Carolina**.

Please respond for each household member, even those who do not fish.

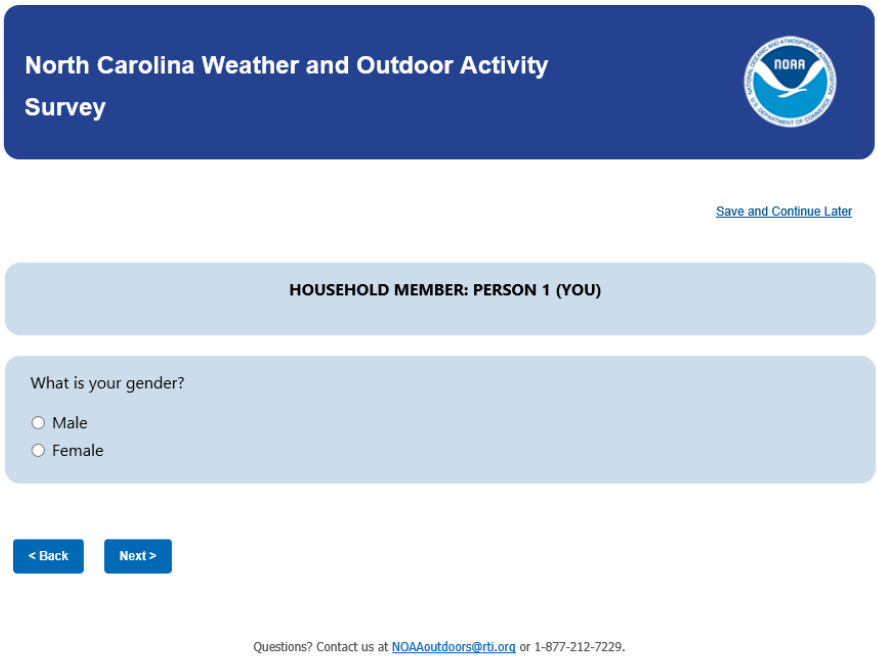
< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

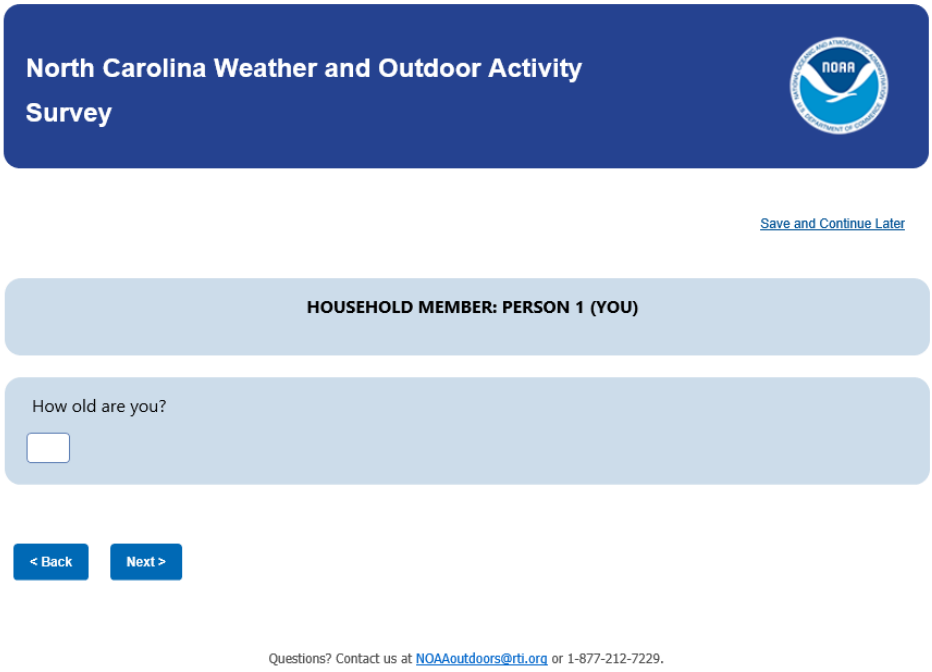
THIS BEGINS HOUSEHOLD ROSTER SECTION. AFTER LOOP ONE AND FOR ALL LOOPS 2-10, THE WORDING IS "this person" instead of "your". The second loop will include intro statement after checking to ensure there is an additional household member: "Now we'd like to ask about the next member of your household." GENDER_P(X).

HEADER IN QUESTION BOX FOR HOUSEHOLD LOOPS READS: "HOUSEHOLD MEMBER: PERSON 1 (YOU)" FOR 1ST LOOP AND "HOUSEHOLD MEMBER: "HOUSEHOLD MEMBER: PERSON X" FOR SUBSEQUENT LOOPS. This text is included in a separate box.

GENDER_P(1)


North Carolina Weather and Outdoor Activity Survey
Save and Continue Later
HOUSEHOLD MEMBER: PERSON 1 (YOU)
What is your gender?
Male
Female
< Back
Next >
Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

AGE_P(1)



LOGIC: 2 DIGITS, 0-99 LOOP 1, AND 0-99 FOR LOOPS 2-10

Note mobile response is validated, not restricted, so the respondent will see "Please enter a numeric value. Reponses can't be greater than 2 digits."

No out of range flag.

ORIGIN_P(1)

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

HOUSEHOLD MEMBER: PERSON 1 (YOU)

Are you of Hispanic, Latino, or Spanish origin?

- ○ Yes, of Hispanic origin
- ○ No, not of Hispanic origin

< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

RACE_P(1)

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

HOUSEHOLD MEMBER: PERSON 1 (YOU)

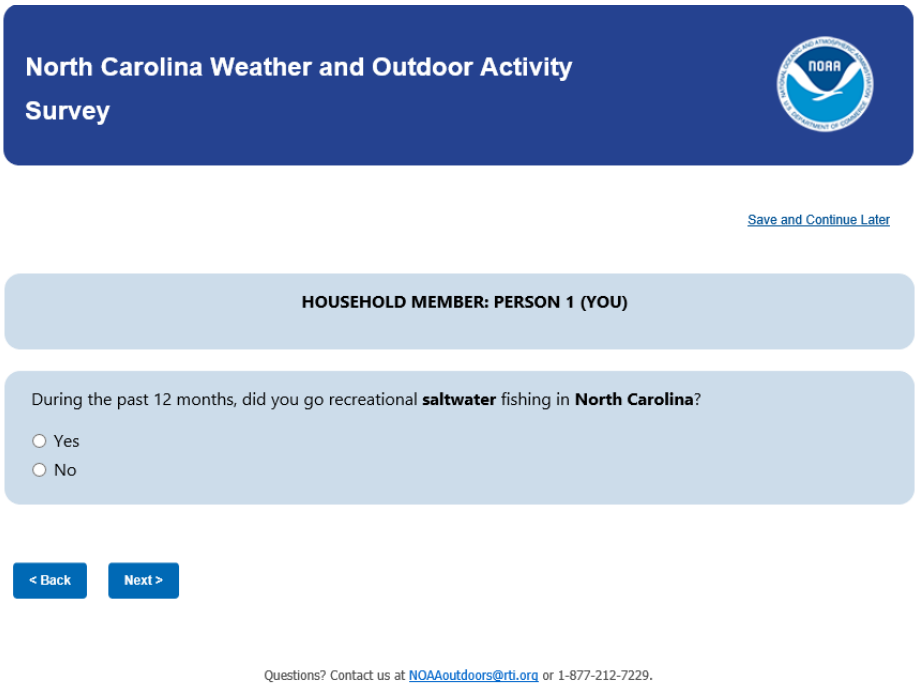
What is your race? **Select all that apply.**

- ☐ White
- ☐ Black, African-American
- ☐ Asian
- ☐ American Indian or Alaska Native
- ☐ Native Hawaiian or other Pacific Islander

< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

STATEFISH_P(1)



IF RESPONSE IS NO, SKIP OUT OF RANDOMIZED SETS SECTIONS TO CHECK TO SEE IF THERE IS ANOTHER HOUSEHOLD MEMBER (HH_MORE_P1)

RANDOMIZATION OF SHORE AND BOAT QUESTION SECTIONS BEGINS HERE. RANDOMIZATION OF SETS IS THE SAME ORDER FOR ALL MEMBERS IN A HOUSEHOLD.

SH_FLAG12PX

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

HOUSEHOLD MEMBER: PERSON 1 (YOU)

Please think only about recreational saltwater fishing in North Carolina.

During the past 12 months, did you go recreational saltwater fishing from the SHORE in North Carolina?

The shore includes docks, bridges, causeways, beaches, banks, or any other shore-based place or area. Do not include freshwater fishing.

- Yes
- No

< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

IF RESPONSE IS NO, SKIP TO BT_FLAG12PX. IF RESPONDENT SKIPS ITEM, "YES" BRANCHING WILL BE FOLLOWED. NUMBER OF DAYS ITEMS ASKED.

SH_TRIP_12PX

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

HOUSEHOLD MEMBER: PERSON 1 (YOU)

How many days did you go recreational saltwater fishing from the SHORE in North Carolina?

The shore includes docks, bridges, causeways, beaches, banks, or any other shore-based place or area. Do not include freshwater fishing.

Number of days saltwater shore fishing in last 12 months.

Number of days saltwater shore fishing in October and November of 2018.

< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

BT_FLAG12PX

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

HOUSEHOLD MEMBER: PERSON 1 (YOU)

Please think only about recreational saltwater fishing in North Carolina.

During the past 12 months, did you go recreational saltwater fishing from a private or rental BOAT that returned to the North Carolina shore?

Do not include freshwater trips or trips where a paid captain or crew helped locate and catch fish.

- ○ Yes
- ○ No

< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

IF RESPONSE IS NO, CHECK TO SEE IF ADDITIONAL HOUSEHOLD MEMBERS HH_MORE_P1

BT_TRIP12PX

North Carolina Weather and Outdoor Activity Survey

Save and Continue Later

HOUSEHOLD MEMBER: PERSON 1 (YOU)

How many days did you go recreational saltwater fishing from a private or rental BOAT that returned to the North Carolina shore?

Do not include freshwater trips or trips where a paid captain or crew helped locate and catch fish.

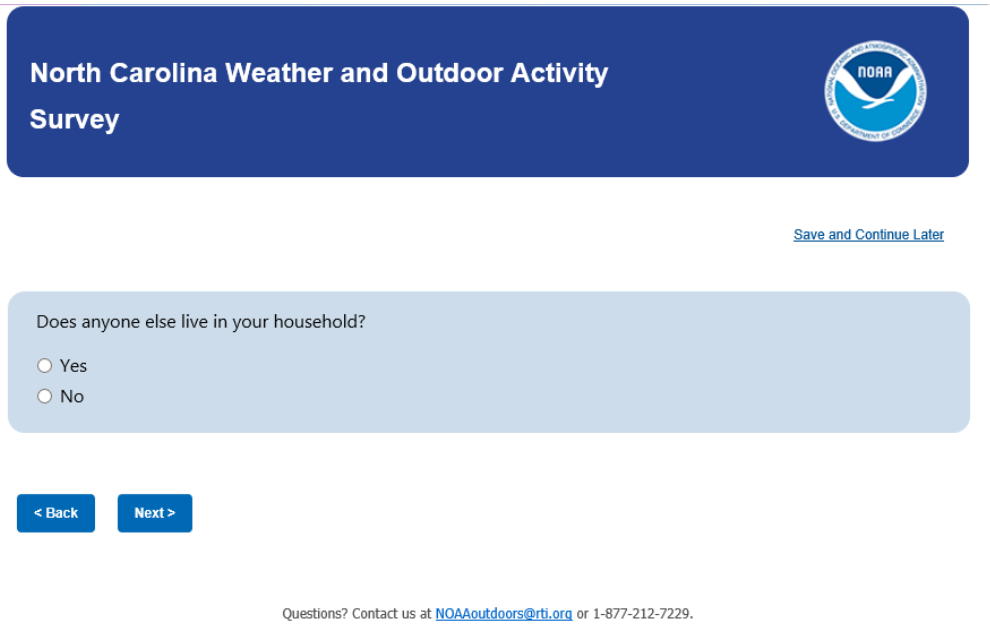
Number of days saltwater boat fishing in last 12 months.

Number of days saltwater boat fishing in October and November of 2018.

< Back Next >

Questions? Contact us at NOAAoutdoors@rti.org or 1-877-212-7229.

HH_MORE_P1



IF RESPONSE IS NO, GO TO END 2

Figure C1. Comparisons between the FES (blue) and web-push (green) designs for private boat fishing prevalence.

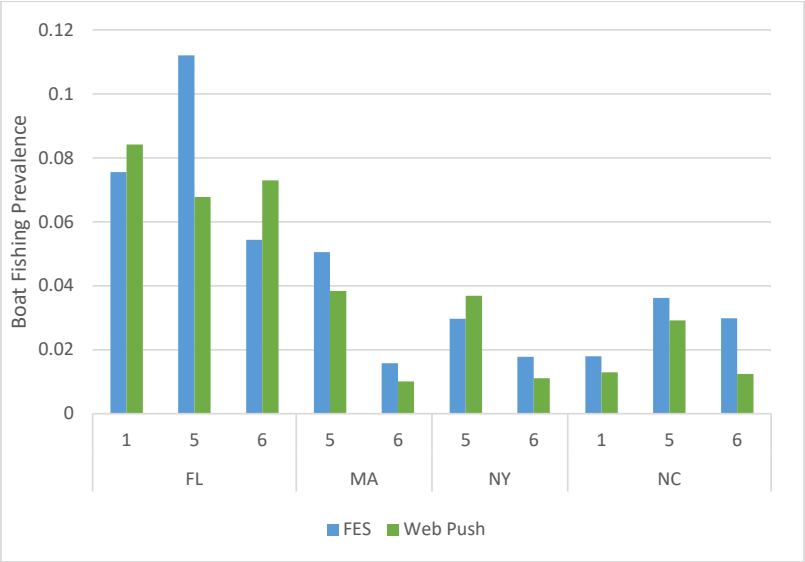


Figure C2. . Comparisons between the FES (blue) and web-push (green) designs for mean number of boat fishing days per household. Estimates are for those households that reported at least one day of boat fishing.

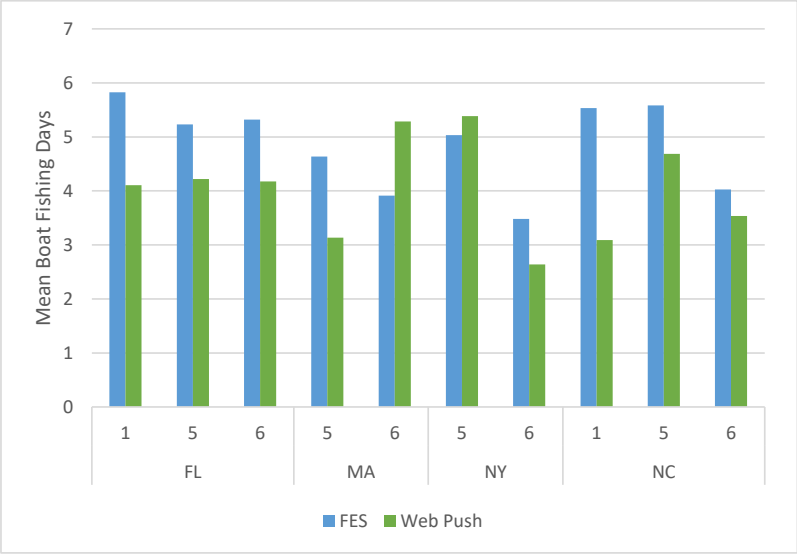


Figure C3. Comparisons between the FES (blue) and web-push (green) designs for shore fishing prevalence.

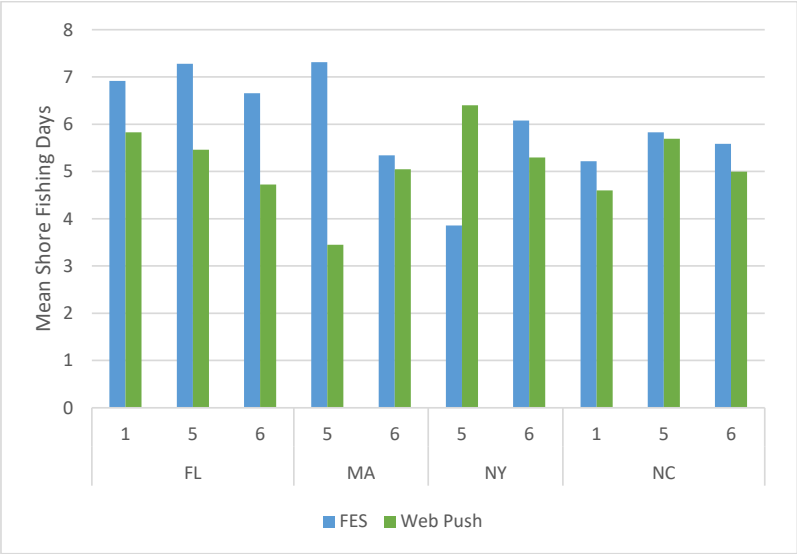



Figure C4. . Comparisons between the FES (blue) and web-push (green) designs for mean number of shore fishing days per household. Estimates are for those households that reported at least one day of shore fishing.