

STATE: Delaware

PROJECT NO: F-41-R-26

ANNUAL REPORT

Project Type: Research and/or Survey

Project Title: Delaware's Freshwater Fishery Management Program

Activity: **Freshwater Fishing Statistical Survey – Angler Mail Survey**

Period Covered: March 1, 2013 – February 28, 2014

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This project was funded under the Federal Aid in Fisheries Restoration Act of the U.S. Fish & Wildlife Service and completed by the Delaware Division of Fish & Wildlife, 89 Kings Hwy. Dover, DE 19901.

Objective

To determine sport fishing catch and effort in the fresh waters of Delaware.

Abstract

A statewide freshwater fishing survey was conducted to query a percentage of all licensed anglers (resident and non-resident) of their fishing activities in 2013. The survey, originally initiated in 1978, is conducted approximately every 5 years. A four-page questionnaire was sent to a percentage of anglers who obtained a Fisherman's Identification Network number and indicated on the application that they *intended* to freshwater fish in 2013. Overall, 2,511 survey forms were returned or completed online resulting in a response rate of 28% or about three in every ten anglers that received a survey. Data projections were tabulated individually and by the following angler groups for analysis: resident, non-resident, residents age 65 and older and seven-day tourist license holders. Residents age 65 and older were the most responsive group with 53% of those returning a survey. Responses were received from anglers who resided in all three Delaware counties, with the largest percentage (28%) from Sussex County. The majority of non-resident anglers resided in the surrounding states of Pennsylvania, Maryland and New Jersey although 23 states were represented. Over 80% of survey respondents reported angling activity in freshwater ponds. Three of the top ten most heavily fished ponds (number of angling trips) were located in state parks with camping sites and other amenities that would be expected to draw a large number of non-residents. The Nanticoke River system accounted for nearly 28% of all stream and river fishing activity while White Clay Creek supported the greatest proportion of trout angling (65%). Largemouth Bass were the most sought species in ponds, tidal streams and non-tidal streams by all angler groups. Freshwater anglers targeting warmwater species typically release their catch; over 96% of fish caught in rivers and streams were released and 98% of fish caught in public ponds were released. The majority of pond anglers fish from a boat (52.9%) while shoreline fishing was more popular with river and stream anglers (55.5%). Anglers were asked what fishing issues they thought were most important in Delaware and water quality was of most concern to all angler groups followed by the need for increased public access, fisheries management, litter/trash clean-up and fish stocking. The survey provided information that will be used for management of Delaware's freshwater fishery resources and also provided anglers an opportunity to communicate directly with Fisheries Section staff.

Activities

A statewide freshwater fishing survey was conducted to query a percentage of all licensed anglers (resident and non-resident) of their fishing activities in 2013. The sampling design used for the 2013 survey was developed in 2009, when a new recreational license was instituted for both tidal and non-tidal anglers, as well as recreational clammers and crabbers¹. Additionally, a Fisherman's Information Network (F.I.N.) number was mandated in 2009 for all anglers over 16 years of age in Delaware waters to comply with federal angler data requirements. The FIN requirement includes various groups not required to obtain a fishing license such as resident anglers age 65 and older, as well as those anglers covered by a boat license. The FIN number is obtained free of charge, either online or via telephone. Questions on the FIN application queried anglers about the type of angling planned (tidal waters, fresh waters, recreational clamming, recreational crabbing, and ocean waters beyond Delaware's 3-mile territorial sea). The combination of individuals required to obtain the recreational license as well as those required to obtain a FIN were the overall population used to select the sample population for the 2013 angler survey.

The sample population for the statewide angler survey obtained from the FIN database was limited to residents and non-residents who planned to participate in freshwater fishing. The database was culled of incorrect or questionable addresses and a sample of resident anglers (56%) who planned to fish freshwater only was selected in addition to a small portion (5%) of Delaware residents who planned both freshwater and tidal angling. A higher percentage of non-residents (100%) who planned to fish only freshwater were selected and a sample of non-resident anglers (8%) who indicated both fresh and tidal waters were selected to compensate for those who purchased a 7-day (tourist) fishing license. The 7-day license holders had not been included in any mail surveys prior to 2009 although they constitute about 30% of the total non-resident licenses purchased. A sample of resident anglers age 65 and older (35%) were selected regardless of fishing indications. This population of resident anglers age 65 and older had not been included in surveys prior to 2009 as they are exempt from license requirements. However, the FIN database gave access to this group of anglers; therefore, they were included in the sample population.

The first mailing (n=9,000) of the survey questionnaire (Figure 1) was sent out in early November, 2013. An option to fill the questionnaire out online was added to the survey in 2013. A link to the questionnaire (<http://de.gov/fisherinessurvey>) was provided on the paper copy sent to each

¹ Prior to January 1, 2008, fishing licenses were only required for non-tidal fishing activities

angler along with instructions to input a unique identification number (ID#) when filling out the online survey. The ID# was included so that responses could be linked to specific anglers in the database. A second mailing (approximately n=7,306) of the same questionnaire was sent to non-respondents in early February, 2014. Mailings returned due to incorrect addresses were removed from the survey population. Data from returned questionnaires was entered into a Microsoft Access® database.

An imbedded sample of 278 individuals within the survey population was randomly selected to address the issue of non-response bias as described for the 2009 survey (Martin et al. 2011). This group was selected in the same proportion of resident/non-resident anglers by angler type within the sample population. Following receipt of the majority of returns from both mailings of the survey questionnaire, non-respondents within this imbedded sample were mailed a stamped, pre-addressed postcard (Figure 2) asking 1) whether they fished in Delaware's freshwaters during 2013, and 2) whether they purchased a fishing license (either annual or 7-day). Attempts were made to contact non-respondents to the postcard survey via telephone or e-mail to obtain a response. Responses from the imbedded sample of anglers were used to determine the Probability of fishing (P) for residents and non-residents that fished in freshwater only, or in both non-tidal and tidal freshwater (Table 1). Separate Probability values were calculated for 7-day license holders (typically non-residents) and for residents age 65 and older who were not required to purchase a license.

The sampling protocol of the survey was based on a combination of the FIN database and the old freshwater fishing license database used for Delaware's historical mail surveys. Although the sample population of the historical license database did not include anglers who could legally fish in tidal freshwaters without a license, anglers could be defined numerically by the number of licenses sold. The use of the FIN database changed the determination of the freshwater (both non-tidal and tidal) fishing universe, as it also included saltwater anglers. Therefore, determination of the freshwater angling population was somewhat more complex than in surveys prior to 2009. As noted above, the sample population was selected depending on intended angling behavior when obtaining the FIN number (Table 2). Anglers were grouped into different categories by intended type of fishing (freshwater only or both freshwater and tidal), residency, and Delaware residents age 65 and older. The number of anglers within each of these "intention" groups could be obtained from the FIN database. However, the real number within each group had to be determined by actual fishing activity reported by respondents - as opposed to intended fishing activity. This was calculated using the percent of fishing activity from the three sets of respondents (survey form, postcard, telephone) within the imbedded sample. By multiplying the percent of fishing (i.e. active anglers among the respondents within each group type) by

the original number of anglers by group from the FIN database, the universe of that angler type was determined (Table 1). It should be noted that there was confusion among anglers as to what tidal fishing includes. Although tidal freshwater rivers were listed in Question 13 (Figure 1), many anglers included fishing activity in brackish to marine areas. Generally, data from strongly brackish rivers were not entered during the data entry phase of the survey. However, this specific location information was not available for postcard respondents. For that small group, it was assumed that people who checked trout and non-tidal or tidal with no saltwater fishing were freshwater anglers. In the future, any postcard survey format should include a question to address this problem.

The proportion of non-resident anglers purchasing a 7-day fishing license was determined separately for the fresh only and the both fresh and tidal waters groups using data from all non-resident respondents. For fresh only, 76 of 189 respondents (40%) purchased a 7-day license. For those intending to fish both fresh and tidal waters, 113 of 189 respondents (60 %) bought 7-day licenses. The “universe” of 7-day license holders within the non-resident populations was obtained by subtracting anglers who had purchased annual fishing licenses from the total non-resident groups (Table 2).

Respondents were initially grouped into seven different categories for data expansion by residency, planned type of fishing (i.e. fresh or both), age, and holders of 7-day license and were denoted as follows: Residents – freshwater only under age 65 (FR), freshwater only age 65 and older (FR65), both freshwater and tidal under age 65 (BR), freshwater and tidal age 65 and older (BR65); Non-residents – freshwater only annual license (FNR), 7-day license (NR7), fresh and tidal annual license (BNR) (Table 2). However, the number of residents within the age 65 and older groups (freshwater only and both freshwater and tidal) were pooled (R65) for determination of probability due to a small sample size (freshwater only 4, both 5).

Imputations of missing values for catch were used when anglers marked a box to indicate catch in the category (see Appendix for full methodology). If three or more values were available for all angler types at that location, the mean value for the category replaced the missing value. However, if fewer than three values were available at that location, responses from all bodies of water for all six angler groups for the species of concern were used to calculate a mean catch rate.

A slightly different method was used to impute effort. In some instances there was no response to questions requiring a numeric response (e.g. when an angler reported catching fish at a pond but left the number of days fished blank). The preferred option used the average number of trips taken by the angler group of concern for the same water body and for the species listed. A second option used the pooled number of trips taken for all six angler groups for the same body of water for the species listed.

If neither of those options were available, a missing value for effort was replaced with the value of 1, reasoning that if an angler reported catching fish, he/she must have been to the area to fish at least once.

The question regarding “species sought” provided three answer choices in descending order. To calculate the rank of each species, the top species listed by each angler was assigned three points, second choice was assigned two points, and the third choice was assigned one point. Species were then ranked by total score from all anglers of that type, i.e. pond or river/stream.

Trout angler data was based on trout fishing activity reported on the survey form. The 2003 survey modified trout effort and catch projections by the proportion of anglers that purchased a trout stamp (Martin and Whitmore 2005). However, it was decided that because anglers needed a trout stamp for only part of the year (April – June 30 in trout streams; first Saturday in March – March 30 in trout ponds), trout stamp possession was not valid for the calculation of trout effort and catch. Therefore the proportion that purchased a trout stamp (26.9% in 2003) was eliminated from data projections for trout catch and effort in 2013.

Data Expansions

Previous expansion methodologies (Martin and Whitmore 2005) of fishing effort based on the sample population responses were modified for this survey. As noted above, the determination of the angling universe within five of the angler types (FR, BR, R65, FNR, and BNR) was obtained by multiplying P (probability of fishing from the imbedded sample population) by the original universe of that angler type from the FIN database. The universe of 7-day license holders was determined by calculating the proportion of FNR and BNR anglers who had purchased a 7-day license. These proportions were used to calculate the number of 7-day license holders within the FNR and BNR groups. The P value for those respondents who reported a 7-day license was then used to determine the proportion of active anglers within that select group (Table 1).

Historically the P value was included in the expansion calculation to modify the angling population and account for inactive anglers. However, since P was used in the calculation of the active angler universe for each angler type, the calculations of projected participants, effort and catch were made as follows:

$$F = Y * \text{mean value} * \text{angler universe}$$

Where **F** was the expansion of the value of interest (trips, catch by species, etc.) for that angler group ; **Y** was the number of anglers who reported fishing the location (pond, river, trout stream) divided by the number of active anglers within that group (“total went” from Table 2); **Mean value** was the average value of the characteristic of interest for those who fished within that angler group (i.e. days fished at that site, catch by species, etc.); and **Angler universe** was the calculated universe within that angler group obtained by multiplying P by the number within that group from the FIN database (Table 1).

The number of participants within each group was obtained using the formula above without the mean value, for example, the number of participants of Hearn's FR anglers was:

$$\text{FR Participants} = Y * \text{angler universe or } 12/412 * 1458 = 42$$

The following calculation of the number of Largemouth Bass *Micropterus salmoides* caught in Hearn's Pond during 2009 by resident anglers (FR and BR) was:

$$\text{FR Hearn's bass} = 12/412 * 19.0833 * 1458 = 810.4$$

$$\text{BR Hearn's bass} = 23/344 * 20.2038 * 21,911 = 29,598.2$$

Resident angler bass catch from Hearn's Pond was:

$$\text{FR Hearn's bass} + \text{BR Hearn's bass} = 810.4 + 29,598.2 = 30,409$$

Results and Discussion

Responses were received from 2,511 anglers following the two mailings resulting in an overall response rate of 28.0%. The response rate for the 2013 survey was comparable to the 2009 survey which had a 28.8% response rate (Martin et al. 2011). The majority of responses were from returned paper surveys, with few (6.2%) anglers filling out the online survey. The response rate varied from a low of 15% among non-resident ‘freshwater only’ anglers to a high of 62% for 7-day license holders that fish in both non-tidal and tidal freshwater (Table 1). The response rate for Delaware residents age 65 and older was comparable (53%) to the response received for this group in the 2009 survey (62%). Prior to 2009, residents 65 and older were not included in the survey as they were not required to obtain a license. Differences between angler groups validate separate calculations of fishing effort projections for the six angler sets.

Data from the 2,511 survey forms were used to estimate fishing effort and catch in Delaware's freshwaters. All effort (trips) and catch (number of fish) projections were tabulated by angler group and then pooled. The pooled results for all angler groups are included in Tables 4-9, and 11A-12, while the individual angler group data are provided in the Appendix. Preliminary projections of angling effort by pond resulted in much higher than expected number of trips for several locations. A review of the raw data showed that occasional respondents fished at some sites much more often than the "typical" angler. Although all effort data were used in the calculations, the sites impacted by extremely active anglers were marked with an asterisk to indicate that the number of trips (and catches which are based on trips) have been biased by these anglers. The protocol to address this issue was to flag any site with one or more anglers reporting 100 or more trips to that location. In 2013, only Noxontown Pond fit the criteria.

Warmwater Ponds

Public Ponds

Over 80% of survey respondents reported angling activity in freshwater ponds during 2013, which has been the most popular type of fishing exhibited by anglers from all angler groups since the surveys began (Martin et al. 2011). Resident and non-resident active anglers (i.e. those who participated in angling during the survey year) were more likely to have fished in public ponds² than any other freshwater location (82.9% overall) as were residents age 65 and older (76.1%) and 7-day license holders (86.3%) (Table 3). Projected estimates of catch and effort by pond were tabulated separately by angler group and then pooled to get the overall projections (Table 4). The total public pond angling effort of 247,595 trips was a slight increase, although similar, to the estimated public pond angling effort tabulated for the 2009 survey. The ten most heavily fished (number of angler trips) public ponds in 2013 were: Lums Pond, Silver Lake (Dover), Trap Pond, Coursey Pond, Killens Pond, Millsboro Pond, Hearn's Pond, Blairs Pond, Becks Pond, and Moores Lake. Of these ten ponds, an increase in effort from the 2009 survey was noted for Blairs Pond (78.9%), Coursey Pond (65.7%), Lums Pond (32.8%), Moores Lake (25.3%), Killens Pond (20.5%) and Becks Pond (18.4%) (Table 5). Changes in effort varied by pond between the 2009 and 2013 surveys, however, an increase in effort occurred for 20 of the 35 public ponds listed. Effort increased substantially (>100%) from 2009 for five of the ponds including: Raccoon Pond (482.3%), Wagamons Pond (210%), Derby Pond (195%), Horsey Pond (174.9%) and Abbotts Pond

² The ponds referred to as 'Public' are those listed in Question 9 of the survey and are in general owned by local, state or federal government agencies.

(159.2%). Angling effort has continued to decrease for Griffith Lake and Haven Lake since the 2003 survey. There were no obvious reasons for the decline in effort at these two ponds during 2013. Haven Lake was one of the top five most popular (ranked by angler hours) Largemouth Bass fishing tournament sites in Delaware during 2013 (Stetzar 2014).

Estimated effort was tabulated by pond separately for resident and non-resident anglers, and combined (Table 6). Non-resident anglers fished most heavily (number of trips) at Masseys Mill Pond, Millsboro Pond, Haven Lake, Trap Pond and Lums Pond. The State Park ponds (Lums and Trap) have camping sites and other amenities that would be expected to draw larger numbers of non-residents. Millsboro Pond and Haven Lake are both easily accessible from major highways and are fairly large in relation to other Delaware ponds at 101 and 82 acres respectively. Massey Mill Pond, although just 30 acres in size and not near any major highways, is only a few miles from the Delaware/Maryland border. One non-resident angler in particular conducted 30 separate fishing trips to the pond. Non-resident effort was not reported for Tubmill Pond or Portsville Pond and very little effort (<10 trips) was projected for Tussock Pond, Fleetwood Pond and Bellevue Pond. All of these ponds, with the exception of Fleetwood Pond, are relatively small at less than 15 acres in size. There is no boat ramp and shoreline access is limited at Fleetwood Pond. It is also not in close proximity to any major highways which could account in part for the limited use by non-resident anglers. Seven day license holders were most active at Lums Pond (4,334 angler trips), Trap Pond (1,954 angler trips) and Killens Pond (1,189 angler trips) which are all located within State Parks that offer camping sites or cabin rentals. Residents age 65 or older made the most angling trips to Lums Pond (2,113) followed by Chipman Pond (1,430), Millsboro Pond (1,422) and Wagamons Pond (1,240). All of these ponds have good boat access and are greater than 40 acres in size (Appendix).

Angling trips per acre were also calculated and resulted in different rankings of the ponds (Table 7). The top five ponds that supported the most fishing trips per acre were (in descending order): Becks Pond (369 trips/acre), Blairs Pond (338 trips/acre), Moores Lake (307 trips/acre), Derby Pond (304 trips/acre), and Andrews Lake (261 trips/acre). Fleetwood Pond only supported (17 trips/acre) which could be due to limited access along the shoreline and no boat launching facilities. Trips per acre were also low (<50 trips/acre) at Tussock Pond (35 trips/acre) and Waples Pond (34 trips/acre). The water level of Tussock Pond drops substantially during typical hot, dry summers making the boat ramp unusable. Waples Pond is bisected by a major highway (Delaware Route 1) thus accessing the entire pond may require launching at two different boat ramps, one on the northbound side of highway and one on the southbound side of the highway. Both launching areas are unimproved but the shallow

water depth and soft substrate at the launching area on the southbound side of the highway is not suitable for motorized boats although kayaks, canoes and small car top boats could be launched. It is also possible to float these smaller watercraft under the highway bridge that separates the pond.

Catch grouped by species varied between ponds but sunfish³ *Lepomis* spp., were the most dominant species (431,515 fish) reported by anglers, followed by Largemouth Bass *Micropterus salmoides* (340,348 fish) and 270,330 crappie⁴ *Pomoxis* spp. (Table 4). Other species reported by anglers fishing in public ponds included: Chain Pickerel *Esox niger*, White Perch *Morone americana*, Yellow Perch *Perca flavescens*, catfish⁵, and Common Carp *Cyprinus carpio*. Largemouth Bass were the most dominant species reported by anglers fishing the public ponds in 2009 (Martin et al. 2011). In 2013, even though the overall catch of sunfish was higher, Largemouth Bass still comprised 36.4% of all fish reported from the public ponds. Catch rates (CPUE or bass/trip) for Largemouth Bass ranged from 13.72 bass/trip at Horsey Pond to 1.50 bass/trip at Newton Pond (Appendix). Newton Pond is popular for trout fishing and catch per trip ranked high for that species (see Trout Fishing below). In comparison, the CPUE range for Largemouth Bass for public ponds in the 2009 survey was 4.76 bass/trip at McColley Pond to 2.01 at Noxontown Pond.

Catch per trip (all species combined) for public pond fishing of warmwater species was highest at Horsey's Pond (13.72 fish/trip), followed by Records Pond (10.03 fish/trip), Craigs Pond (9.39 fish/trip) and McGinnis Pond (8.65 fish/trip)(Appendix). The high catch rate at Records Pond indicates re-stocking efforts have been successful following a draw down to stream level in October of 2012. Total catch (all species combined and regardless of effort) was highest at Horsey Pond (96,663 fish) closely followed by Lums Pond (93,646 fish). Other ponds with a high number of fish caught were Trap Pond (69,902 fish) and 62,132 fish from Silver Lake in Dover. Catch per trip was lowest at Newton Pond (1.0 fish/trip) and Maseys Mill Pond (1.53 fish/trip). Low angler catch statistics at Maseys Mill Pond was not surprising as the fish community continues to rebuild after the pond was drawn down to stream level in August of 2011 for an approaching tropical storm. Although the pond was restocked in 2011 and 2012 with Bluegill, Golden Shiners *Notemigonus crysoleucas* and Largemouth Bass fingerlings, a fish community assessment in 2014 revealed a low abundance of most species (Stetzar 2015a).

Other ponds

³ A reference to 'sunfish' in this report includes species in the family *Lepomis*.

⁴ Both White Crappie *Pomoxis annularis* and Black Crappie *Pomoxis nigromaculatus* occur in Delaware.

⁵ A reference to 'catfish' in this report include: Brown Bullhead *Ameiurus nebulosus*, Yellow Bullhead *Ameiurus natalis*, Channel Catfish *Ictalurus punctatus*, and White Catfish *Ameiurus catus*.

Some survey respondents provided information about catch and effort at ponds not listed on the survey form. Public access to these ponds varied from open access, such as ponds on county owned land, to private ponds with very limited access. Some ponds have boat ramps in addition to shoreline access although in some cases the pond owners only allow access to select members of the public. Because data for these ponds was not specifically requested as part of the survey, effort from all respondents may not have been captured. Therefore, projected catch and effort pertaining to these ponds is included in a separate table (Table 8). Wyoming Mill Pond, a private pond with some public shoreline access via a town park located in Kent County, supported the most angler trips (3,571) followed by Smalleys Pond (2,705 angler trips) which is a private pond adjacent to New Castle County owned land that provides some public access along the shoreline. Total catch was highest for Reynolds Pond (34,701 fish), a privately owned pond with limited public access, followed by Smalleys Pond (13,523 fish). Catch per trip was highest for Reynolds Pond (70.53 fish/trip), Clendaniel Pond (52.59 fish/trip) which is privately owned, Diamond Pond (46.53 fish/trip) which is private but the owners allow some public access, and Cabbage Pond (42.22 fish/trip) which is privately owned; all occur in the vicinity of Milton. Total catch was highest for sunfish (29,867 fish) followed by Largemouth Bass (29,153) and Chain Pickerel (20,722 fish). The majority of projected trips were made by resident anglers (87.7%) with the smallest percent from 7-day license holders (1.2%) and 4.1% from non-resident anglers (Table 9). A lack of local knowledge of the ponds and limited public access likely played a role in the low percentage of non-residents that conducted fishing trips to the ponds. In addition, many of the ponds are not in close proximity to resort areas or within municipal boundaries.

Additional pond fishing information

The mode of fishing in the ponds was primarily by boat (52.9%) although this was only a slight majority over the 47.1% of angling reported from the shore (Table 10). The 2009 angler survey revealed a higher percentage of angling by boat in the ponds (56.6%) compared to shore angling (43.4%). Similar to findings from the 2009 survey, fishing activity in the ponds was reported for all months with a peak between May and August (Table 10).

Streams and Rivers

Eleven tidal streams in Delaware's coastal plain providence, four Piedmont streams, and the Chesapeake and Delaware Canal were listed on the survey form for anglers to document fishing activities. Effort reported for all angler groups in rivers and streams in 2013 (143,344 angler trips)

declined by 7% from 2009, when effort expended in these same water bodies included 154,209 angler trips (Tables 11A-11C). The most heavily fished river/stream by all angler groups was the Nanticoke River system which accounted for 29.3% of all stream and river fishing activity (Table 11C). This river system also supported the most fishing effort in 2009. Fishing effort is heaviest at this river likely due to the Largemouth Bass population and the extensive use of the river for bass fishing tournaments (Stetzar 2015b). Tournaments also serve to familiarize avid bass anglers with this fishery. The Broadkill River and Marshyhope Creek were also popular fishing areas (based on the number of angler trips) and the most popular piedmont streams were the Brandywine Creek and Christina River. The Broadkill River was the second most popular stream with non-resident anglers (Appendix) possibly due to proximity to Delaware's coastal resort areas. In addition, there are public access areas upstream near the first dam and downstream near the mouth with many miles in-between of relatively undeveloped shoreline, which provides ample woody debris and other structural habitat where some fish species tend to congregate.

Fish catches differed somewhat between Piedmont streams and coastal plain rivers, although White Perch and sunfish were among the top four most abundant fishes reported by anglers in both providences (Tables 11A-11C). White Perch (135,350 fish), Largemouth Bass (123,341 fish) sunfish (67,046 fish), and catfish (67,588 fish) were the top four most abundant fishes reported by coastal plain river anglers, while sunfish (39,872 fish), Smallmouth Bass *Micropterus dolomieu* (17,769 fish), catfish (16,861 fish) and White Perch (13,931 fish) were the top four most abundant fishes reported by Piedmont stream anglers. White Perch catches were highest from the Nanticoke River (54,575 fish) and the Broadkill River (28,005 fish) which greatly surpassed the catch from the Leipsic River (6,947 fish). The Leipsic River was cited as having the highest White Perch catch reported during the 2009 angler survey. The Nanticoke River supported the highest number of river caught Largemouth Bass, nearly 80%, (Table 11A-11C), and also supported the highest number of river caught Striped Bass *Morone saxatilis* (48.7%). Smallmouth Bass were the second most abundant fish species (sunfish were the most abundant) caught in Piedmont streams in 2013, which was a marked difference from the 2009 survey in which this species was not in the top four. The majority of Smallmouth Bass were caught in the Brandywine River which also supported the highest number of Piedmont Stream caught sunfish.

Catch per trip (all warmwater species combined) for river and stream fishing was highest for Red Clay Creek (7.05 fish/trip) followed by Marshyhope River (6.51 fish/trip) and the Nanticoke River (6.06 fish/trip) (Appendix). Total catch (all species combined and regardless of the number of trips) was

highest by far for the Nanticoke River (254,606 fish) followed by the Broadkill River (68,931 fish) and Marshyhope River (61,354 fish).

Most anglers reported fishing from shore (55.5%) rather than from a boat (44.5%) in the rivers and streams in contrast to the mode of fishing reported by pond anglers (Table 10). As noted during the 2009 survey, river angling peaked between May and August although some activity took place during every month (Table 10).

Trout Angling

Freshwater trout⁶ fishing in Delaware is limited to a put-and-take fishery with six designated trout streams in northern New Castle County, and two ponds, one in each of Kent and Sussex Counties (Table 12). The proportion of all anglers that reporting fishing for trout in designated streams was 22% with residents age 65 and older the most active group (23.9%) (Table 3).

White Clay Creek has been the most popular trout fishing area since the first survey in 1976 (Martin and Whitmore 2000). In 2013, angler trips to White Clay Creek constituted nearly 65.5% of all trout fishing effort, continuing this trend (Table 12). Consequently, White Clay Creek also provides the most public land available to anglers. The Christina River was the second most popular location although effort (3,655 angler trips) was much reduced compared to White Clay Creek. Newton Pond, a renovated borrow pit that opened in 2009, supported more trout fishing than Tidbury Pond and effort (2,408 angler trips) was greater than four of the six designated trout streams.

Nearly 63,000 catches of trout were reported, with the majority (78%) from White Clay Creek (Table 12). As expected, the highest rate of catch per trip occurred in the White Clay Creek (2.20 trout/trip), followed by 1.94 trout/trip from the Brandywine River (includes the stocked Beaver Run and Wilsons Run). Trout fishing took place year round with a peak in activity during April-June and a secondary peak in October (Table 10). This coincides with opening season in the streams during early April and an additional stocking that takes place on White Clay Creek in October. Periodic stockings occur from April to the early part of May, with most frequent stockings in the White Clay Creek.

Angler Fishing Behaviors

Overall, release rates were high (over 94%) for all groups of anglers whether pond or river/stream fishing (Table 13). The lowest release rate was for Common Carp (80%) caught in ponds by resident anglers. Non-resident anglers fishing in ponds also reporting harvesting 18% of Yellow Perch,

17% of White Perch, and 13% of crappie. This same angler group also reported harvesting 22% of Yellow Perch, and 17% of White Perch caught in rivers and streams. Resident anglers 65 and older reported harvesting 11% of White Perch in rivers and streams. Anglers with 7-day tourist licenses reporting releasing 100% of all species caught in rivers and streams. Largemouth bass release rates by both pond and river/stream anglers was between 98-100% which is consistent with previous surveys (Martin et al. 2011).

The majority of anglers expressed 'no preference' when asked which three fish species they targeted while fishing in ponds and in rivers and streams (Table 14). Of those who indicated a preference, Largemouth Bass were the most sought species in ponds, tidal streams and non-tidal streams by all angler groups (resident, non-resident, residents age 65 and older and seven-day license holders). Largemouth Bass were also the most preferred species reported during the 2009 survey (Martin et al. 2011). In addition to Largemouth Bass; crappie, sunfish and Chain Pickerel were the other warmwater species most favored by pond anglers while Striped Bass, White Perch and Smallmouth Bass were most favored by stream anglers.

Angler Demographics

Angler demographic information included residence (city and state) and birth year. Unlike previous surveys, gender information was not required for obtaining a FIN or fishing license. Response rates and mean age were tabulated for all angler groups (Table 10) and by type of fishing. The average age of survey respondents was 47 years for resident, 55 years for non-resident, 71 for residents aged 65 and older, and 51 for seven-day license holders. Resident trout anglers represented the youngest group of respondents (mean age 45.1 years) and trout anglers age 65 and older (mean age 71.7 years) the oldest. Trout anglers that held a 7-day license were the youngest group of respondents during the 2009 survey (mean age 39.7 years), while river anglers aged 65 and older (mean age 61.8 years) were the oldest group of respondents (Martin et al. 2011).

Responses were received from anglers who resided in all three Delaware counties, with the largest percentage (28%) from Sussex County (Table 15). The majority of non-resident freshwater anglers reside in surrounding states, including: Pennsylvania (16%), Maryland (7%), and New Jersey (3%), although another 23 states were represented. The survey database did not parse anglers according to sex; however, previous surveys revealed that women comprise just a small percentage of the freshwater angling community (Martin et al. 2011). The 2013 demographics appear to be very similar in that regard.

⁶ Primarily Brown Trout *Salmo trutta* and Rainbow Trout *Oncorhynchus mykiss*.

Angler Concerns

It is often difficult to determine the concerns of the angling public. Since 1997, surveys have included a section to list issues of concern. An open-ended question “*What fishing issues do you think are most important in Delaware?*” was asked at the end of the survey. Results were categorized by issue type and parsed by angler group (Table 16). The concerns expressed by anglers were similar to those relayed during the 2009 survey (Martin et al. 2011). Water quality issues were the number one concern with all angler groups, including fish consumption advisories, pollution, and weed control. Increased boat and shore access, litter/trash clean-up, fisheries management, and fish stocking were among the top five categories of concern. Other fisheries issues that ranked high were size and creel limits and promotion of catch and release fishing. Angler groups had similar issues and

Angler correspondence

A summary of results was drafted and sent to 601 anglers who had provided an e-mail address so they could receive notification when a survey summary was available on-line (39 of the e-mail addresses were sent back as ‘undeliverable’). The summary was posted on the Division of Fish and Wildlife’s website at: <http://de.gov/recfishing> and once this report is finalized it will be posted as well. Correspondence was also sent to nearly 50 anglers who posed specific questions about a variety of fisheries related issues. Efforts were made to provide helpful answers to all of the questions posed and to thank anglers for taking the time to respond to the survey.

Recommendations

1. Maintain the methodology developed for the 2013 survey and conduct the survey again in 2018. Evaluate the possibility of conducting the survey in an online format, at least for a portion of the sample population where email addresses are available.
2. Add “*Did not fish in 2018*” as the first option of Question 1 on the survey for those anglers who obtained a FIN, but did not fish. This may reduce the number of surveys that are returned by respondents with no response to any of the questions.
3. At the bottom of Page 4 of the survey, anglers are asked if they would like to receive a notice when the report summary is available on-line. A sentence should be added to indicate how long it might take before the results are available. Survey respondents call within 4-6 weeks of sending the survey

back inquiring about the summary. The results are not available for almost a year post-survey due to data compilation and analysis

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Table 1. Angler groups used for selection of sample population and data projections for the 2013 Freshwater Fishing Survey. Residents over age 64 were polled to include those intending to fish freshwater only and those selecting both freshwater and tidal angling. Seven-day (non-resident) license holders could not be separated from the non-resident groups until a response was received describing the license type obtained and total number* were calculated.

Resident	Freshwater Only	Both Fresh & Tidal	Pooled Resident
	< age 65	< age 65	=>age 65
Universe	3,226	38,675	5,899
% sampled	56%	5%	35%
Sample Size	1,804	1,943	2,074
Respondents	312	371	1,096
Response Rate	17%	19%	53%
Non-respondents	1,492	1,572	978
Imbedded Sample			
Mail Respondents	11	14	34
Postcard Respondents	12	13	20
Email Respondents	1	1	0
Telephone Respondents	12	11	0
Total	36	39	54
No. Active Anglers	27	22	24
P (probability of fishing)	0.75	0.56	0.44
Estimated Universe	2,420	21,817	2,622
Non-Resident			
	Freshwater Only	Both Fresh & Tidal	7-day License*
Universe	1,304	23,904	
% sampled	100%	8%	
Sample Size	1,304	1,875	
Respondents	202	341	189
Response Rate	15%	18%	
Non-respondents	1,102	1,534	
Non 7-day Lic Holders	117	212	
% Non 7-day	58%	62%	
Corrected Universe	755	14,861	9,592
Imbedded Sample			
Mail Respondents	10	10	
Postcard Respondents	6	10	
Email Respondents	0	3	
Telephone Respondents	5	17	
Total	21	40	189
No. Active Anglers*	10	8	75
P (probability of fishing)	0.48	0.20	0.40
Estimated Universe	360	2,972	3,806
Total Freshwater Universe:	33,996		

Table 2. Summary of angler universe by angler group and number who went angling by location.

Angler Group	Indicated Fishing Activity Grouping	Corrected	Sample Size	Number of Responses	Total Went	Total Number Actively Fishing		
		Angler Universe				Ponds	Tidal Rivers	Trout Waters
Resident < 65	Freshwater Only	2,420	1,804	312	266	234	72	56
Resident < 65	Freshwater & Tidal	21,817	1,943	371	242	200	136	61
Non-Resident < 65	Freshwater Only	360	1,304	202	155	135	29	30
Non-Resident < 65	Freshwater & Tidal	2,972	1,875	341	96	60	47	22
7-Day Non-Resident	Pooled Both Groups	3,806	3,179	189	80	69	17	12
Resident >= 65	Pooled Both Groups	2,622	2,074	1,096	448	341	190	107

Table 3. Summary of respondents to the 2013 Freshwater Fishing Survey by location and angler group.

	Resident/non-resident annual	Residents age 65 & older	7-day license holder	TOTAL
No. stating they fished DE waters 2013	759	448	80	1,287
No. fished public ponds	629	341	69	1,039
	82.9%	76.1%	86.3%	
No. fished private ponds	210	110	13	335
	27.7%	24.6%	16.3%	
No. fished rivers/streams	284	190	17	491
	37.4%	42.4%	21.3%	
No. fished trout streams	169	107	12	288
	22.3%	23.9%	15.0%	

Table 4. Estimated catch and effort from public ponds by all freshwater angler groups in Delaware, 2013. An asterik indicates inclusion of extremely active angler in data projections.

Public pond	Angler trips	Largemouth bass	*Crappie	**Sunfish	Chain Pickerel	White Perch	Yellow Perch	***Catfish	Carp	Other fishes	Total catch	Catch per trip
Abbotts Pond	3,982	3,742	1,230	5,191	4,378		55				14,596	3.67
Andrews Lake	4,571	4,227	2,585	7,535	1,317		956	18			16,638	3.64
Becks Pond	9,570	4,084	5,997	11,903	1,484	270	833	886			25,457	2.66
Bellevue Pond	1,464	1,937	358	1,187				5			3,487	2.38
Blairs Pond	9,645	11,707	8,799	15,604	8,564	59	240	9		59	45,041	4.67
Canal Pond	2,199	1,528	524	335	29			2,254			4,670	2.12
Chipman Pond	5,222	14,343	4,882	8,729	2,182		1,243			64	31,443	6.02
Concord Pond	6,144	9,740	11,465	9,578	12,745	29	18	469		36	44,080	7.17
Coursey Pond	13,429	7,630	11,044	16,846	718	37	29	32	451		36,787	2.74
Craigs Pond	1,778	10,003	870	4,376	1,353			12		88	16,702	9.39
Derby Pond	7,033	13,017	7,113	14,503	7,342	7	1,230	451		28	43,691	6.21
Fleetwood Pond	517	1,851	192	211	18		6				2,278	4.41
Garrisons Lake	8,468	8,541	4,724	9,618	497	1,422	902	1,273		234	27,211	3.21
Griffith Lake	3,339	5,390	1,115	4,945	1,296	148	483	90		108	13,575	4.07
Haven Lake	7,149	12,986	2,348	7,440	3,087	1,448	487	451		361	28,608	4.00
Hearns Pond	9,749	21,527	22,654	3,270	4,563	181	41	6		275	52,517	5.39
Horsey Pond	7,046	13,723	39,896	37,597	3,899	62	1,161	180		145	96,663	13.72
Ingrams Pond	6,060	10,624	8,324	5,204	4,571		770	452		139	30,084	4.96
Killens Pond	11,014	15,993	9,932	25,420	1,767	512	468	1,556		452	56,100	5.09
Lake Como	1,703	985	208	5,915	51			5,527			12,686	7.45
Lums Pond	22,134	21,804	21,522	38,401	1,553	850	820	2,956	299	5,441	93,646	4.23
Masseys Mill Pond	3,966	2,399	784	2,595	142		6	145			6,071	1.53
McColley Pond	3,678	10,169	6,955	9,984	1,136	180	236	154	270		29,084	7.91
McGinnis Pond	7,107	12,427	12,928	27,898	6,462	340	1,044	6	361	7	61,473	8.65
Millsboro Pond	10,571	11,618	8,355	9,263	13,105	6	1,991	64		45	44,447	4.20
Moore's Lake	8,333	5,124	11,774	16,944	989		422	2,220		5	37,478	4.50
MudMill Pond	5,359	3,667	3,044	11,852	513	182		32	188		19,478	3.63
Newton Pond	2,434	2,023	226	1,199	180					12	3,640	1.50
Noxontown Pond*	9,363	16,751	9,596	4,176	4,321	2,701	1,052	199		23	38,819	4.15
Portsville Pond	1,983	3,516	451	1,262	1,442						6,671	3.36
Raccoon Pond	1,963	2,182	1,405	4,075	298						7,960	4.06
Records Pond	4,747	8,387	11,054	21,642	2,982	1,545	1,533	451		23	47,617	10.03
Silver Lake (Dover)	17,014	10,029	11,387	29,213	487	45	5	10,435	76	455	62,132	3.65
Silver Lake (Milford)	1,519	849	373	3,197	244		100	270		6	5,039	3.32
Trap Pond	14,148	17,097	17,616	31,073	3,134		812	135		35	69,902	4.94
Trussum Pond	3,100	12,581	4,522	5,394	2,970		6	6			25,479	8.22
Tubmill Pond	663	403	9	1,361	77			90			1,940	2.93
Tussock Pond	300	476	270	451	5						1,202	4.01
Wagamons Pond	7,404	22,261	3,428	15,460	1,441	219	1,609	90			44,508	6.01
Waples Pond	1,727	3,007	371	668	507						4,553	2.64
Totals	247,595	340,348	270,330	431,515	101,849	10,243	18,558	30,924	1,645	8,041	1,213,453	4.90

* includes both White Crappie *Pomoxis annularis* and Black Crappie *Pomoxis nigromaculatus*

** includes species in the family *Lepomis*.

*** includes: Brown Bullhead *Ameiurus nebulosus*, Yellow Bullhead *Ameiurus natalis*, Channel Catfish *Ictalurus punctatus*, and White Catfish *Ameiurus catus*.

Table 5. Changes in number of trips by resident and non-resident anglers in Delaware ponds over time. Bold indicates use of one or more extremely active anglers (number of trips to site is > 99) at the pond. Ponds ranked in decreasing order by percent of change between 2009 and 2013 effort projections. Shading indicates increased effort between two adjacent years.

Decreased effort from 2009 to 2013					Increased effort from 2009 to 2013						
	2003	Percent change	2009	Percent change	2013		2003	Percent change	2009	Percent change	2013
Tubmill	822	478.8	4758	-89.8	487	Raccoon	723	-58.6	299	482.3	1,741
Tussock	326	295.7	1290	-78.5	277	Wagamons	7467	-73.6	1973	210.0	6,116
Records	5864	227.0	19174	-77.3	4,345	Derby	3243	-31.5	2223	195.4	6,567
Silver L (M)	751	344.6	3339	-66.8	1,109	Horsey	3809	-38.7	2335	174.9	6,418
Hearns	1298	1917.8	26178	-66.0	8,892	Abbotts	2543	-49.3	1289	159.2	3,341
Massey	3586	160.7	9348	-59.6	3,778	McGinnis	5903	-46.8	3142	99.3	6,261
Garrison	6691	174.6	18376	-59.6	7,431	McColley	4053	-56.1	1778	82.2	3,239
Mudmill	5857	100.9	11768	-58.4	4,901	Blairs	5312	-9.9	4788	78.9	8,566
Griffith	5684	-7.4	5263	-53.8	2,430	Courseys	8429	-9.7	7612	65.7	12,616
Millsboro	6156	205.0	18776	-51.3	9,149	Trussum	1243	42.9	1776	65.3	2,936
Ingram	5505	72.1	9423	-49.2	4,783	Waples	3304	-67.2	1083	43.8	1,557
Canal	3704	1.8	3772	-43.3	2,140	Concord	2893	41.0	4080	36.6	5,575
Como	3083	-27.5	2236	-27.0	1,633	Portsville	1498	-1.9	1469	35.0	1,983
Haven	9914	-14.6	8471	-21.9	6,612	Lums	20212	-31.3	14109	32.8	18,736
Silver L (D)	9248	101.8	18667	-17.3	15,430	Chipmans	2718	-5.9	2557	31.6	3,364
Noxontown	8308	8.1	8982	-7.1	8,343	Moores	6596	-5.6	6229	25.3	7,806
Trap	8088	43.5	11605	-2.7	11,291	Killen	8650	-11.3	7672	20.5	9,248
						Becks	24656	-69.5	7510	18.4	8,893
						Craigs	1743	-27.5	1264	11.5	1,409
						Andrews	3190	26.8	4046	7.0	4,331

Table 6. Resident and non-resident (annual license holders) angling effort in ponds and rivers and streams, 2013.

Location	Resident trips	Non-resident trips	Percent Non-resident
Ponds			
Abbotts Pond	2,949	392	11.7
Andrews Lake	4,231	100	2.3
Becks Pond	8,430	463	5.2
Bellevue Pond	1,299	9	0.7
Blairs Pond	8,162	404	4.7
Canal Pond	2,002	138	6.4
Chipmans Pond	2,921	443	13.2
Concord Pond	5,379	196	3.5
Courseys Pond	12,524	92	0.7
Craigs Pond	1,371	38	2.7
Derby Pond	6,422	145	2.2
Fleetwood Pond	334	2	0.6
Garrisons Lake	7,335	96	1.3
Griffith Pond	2,331	99	4.1
Haven Lake	5,991	621	9.4
Hearns Pond	8,734	158	1.8
Horseys Pond	6,204	214	3.3
Ingrams Pond	4,446	337	7.0
Killens Pond	9,034	214	2.3
Lake Como	1,588	45	2.8
Lums Pond	18,127	609	3.3
Masseys Pond	2,811	967	25.6
McColleys Pond	3,203	36	1.1
McGinnis Pond	6,020	241	3.8
Millsboro Pond	8,288	861	9.4
Moores Lake	7,485	321	4.1
MudMill Pond	4,858	43	0.9
Newton Pond	2,085	62	2.9
Noxontown Pond	7,804	539	6.5
Portsville Pond	1,983	0	0.0

Table 6. continued

Location	Resident trips	Non-resident trips	Percent Non-resident
Ponds			
Raccoon Pond	1,713	28	1.6
Records Pond	3,987	358	8.2
Silver Lake (Dover)	15,411	19	0.1
Silver Lake (Milford)	1,083	26	2.3
Trap Pond	10,597	694	6.1
Trussum Pond	2,679	257	8.8
Tubmill Pond	487	0	0.0
Tussock Pond	270	7	2.5
Wagamons Pond	5,708	408	6.7
Waples Pond	1,470	87	5.6
Rivers			
Appoquinimink Creek	2,624	0	0.0
Blackbird Creek	2,218	0	0.0
Brandywine River	13,504	2,074	13.3
Broadkill River	11,225	2,624	18.9
C & D Canal	7,743	1,155	13.0
Christiana River	10,653	102	0.9
Leipsic River	3,841	62	1.6
Marshyhope River	8,872	159	1.8
Mispillion River	8,187	526	6.0
Murderkill River	6,581	0	0.0
Nanticoke R/Broad Creek	38,032	930	2.4
Primehook River	705	155	18.0
Red Clay Creek	90	0	0.0
Smyrna River	947	0	0.0
St. Jones River	3,021	0	0.0
White Clay Creek	6,128	60	1.0

Table 7. Total trips and trips per acre for public Delaware ponds, 2013.

Pond	Total trips	Acres	Trips/Acre	Rank
Lums	22,134	189.3	117	
Silver Lake (Dover)	17,014	157.2	108	
Trap	14,148	88	161	
Courseys	13,429	58.1	231	8
Killens	11,014	75.1	147	
Millsboro	10,571	101	105	
Hearns	9,749	53.4	183	
Blairs	9,645	28.5	338	2
Becks	9,570	25.9	369	1
Noxontown	9,363	158.6	59	
Garrison	8,468	85.9	99	
Moores	8,333	27.1	307	3
Wagamons	7,404	41.1	180	
Haven	7,149	82.5	87	
McGinnis	7,107	31.3	227	9
Horseys	7,046	46.3	152	
Derby	7,033	23.1	304	4
Concord	6,144	76.8	80	
Ingrams	6,060	24.4	248	6
Mudmill	5,359	60	89	
Chipmans	5,222	52.4	100	
Records	4,747	91.9	52	
Andrews	4,571	17.5	261	5
Abbotts	3,982	16.9	236	7
Masseys	3,966	30.4	130	
McColleys	3,678	49	75	
Griffith	3,339	32.2	104	
Trussum	3,100	58.7	53	
Newton	2,434	11	221	10
Portsville	1,983	14.5	137	
Raccoon	1,963	13.5	145	
Craigs	1,778	11.9	149	
Waples	1,727	50.6	34	
Como	1,703	42	41	
Silver Lake (Milford)	1,519	28.5	53	
Tubmill	663	4.8	138	
Fleetwood	517	31	17	
Tussock	300	8.6	35	

Table 8. Estimated catch and effort by all freshwater angler groups from ponds that were not listed on the 2013 Freshwater Fishing Survey form.

Name of Pond	Angler trips	Largemouth Bass	Crappie	Sunfish	Chain Pickerel	White Perch	Yellow Perch	Catfish	Carp	Other fishes	Total catch	Catch per trip
Banning Park Pond	27	9		109							118	4.37
Betts Pond	5	35			23						58	11.60
Bohemia Pond	2	14									14	7.00
Burton Pond	12	12									12	1.00
Carousel Pond	471	280	190	1,047				9			1,526	3.24
Clendaniel Pond	180	2,705		4,057	2,705						9,467	52.59
Cabbage Pond	215	2,266	1,100	2,881	2,289		541				9,077	42.22
Diamond Pond	279	1,167	2,900	6,466	1,999		451				12,983	46.53
Dragon Run Pond	182	546									546	3.00
Judge Morris Estate Pond	19	44	2	107				5			158	8.32
Levels Pond	108	361									361	3.34
Primehook Pond	59	70	59			1,756					1,885	31.95
Red Mill Pond	155	56	571	476		2		48		5	1,158	7.47
Reynolds Pond	492	9,085	4,531	10,214	9,038		1,815	18			34,701	70.53
Silver Lake (Rehoboth)	270	361									361	1.34
Smalley Pond	2,705	9,015			4,508						13,523	5.00
Spring Mill Pond	18			70							70	3.89
Town Pond	18			182							182	10.11
Unidentified Pond	27		9	18							27	1.00
Williams Pond	151	674	155	464	133						1,426	9.44
Wyoming Mill Pond	3,571	2,453	928	3,776	27		6	53			7,243	2.03
Totals	8,966	29,153	10,445	29,867	20,722	1,758	2,813	133	0	5	94,896	10.58

Table 9. Projected trips to ponds not listed on the 2013 Freshwater Fishing mail survey, parsed by angler group.

Private ponds	Resident Anglers	Non-residents	Combined	Resident over 64	7-day non-resident	Total trips
Trips	117,131	5,456	122,587	9,382	1,570	133,539
Percent	87.7%	4.1%	91.8%	7.0%	1.2%	
Participants	7,832	696	8,528	644	618	9,790

Table 10. Average age of Delaware anglers by angler type, fishing mode, and fishing activity by month and location.

Angler Group	All Respondents	Pond Anglers	River Anglers	Trout Anglers
Residents	47.2	47.2	47.0	45.1
Non-Residents	55.0	55.5	55.7	56.0
Over-65	71.2	70.9	70.9	71.7
7-Day	50.8	54.0	53.8	59.0

Percent of Anglers

Mode	Pond	River
Boat	52.9	44.5
Shore	47.1	55.5

Percent of Activity

Months fished	Pond	River	Trout
JAN	1.3%	1.3%	0.8%
FEB	1.6%	2.0%	1.4%
MAR	4.9%	4.8%	5.6%
APR	11.0%	10.0%	28.0%
MAY	14.3%	13.9%	21.9%
JUN	16.4%	15.4%	13.1%
JUL	14.9%	15.0%	6.6%
AUG	13.7%	13.9%	5.1%
SEP	10.9%	11.4%	5.8%
OCT	6.7%	7.1%	7.3%
NOV	3.0%	3.5%	3.2%
DEC	1.4%	1.8%	1.4%

Table 11A. Estimated catch and effort from Piedmont rivers and streams by all freshwater angler groups in Delaware, 2013.

River/stream	Angler trips	Catfish	Chain Pickerel	Crappie	Largemouth Bass	Smallmouth Bass	Striped Bass
Brandywine River	17,118	2,337	18	136	3,642	16,042	507
Christina River	11,277	14,497		361	3,948	254	3,138
Red Clay Creek	172				198	451	6
White Clay Creek	6,945	27		55	570	1,022	73
Totals	35,512	16,861	18	552	8,358	17,769	3,724

	Sunfish	White Perch	Yellow Perch	Other fishes	Total catch	Catch per trip
Brandywine River	23,039	5,035	18	4,425	55,199	3.22
Christina River	12,660	8,753	1,983	255	45,849	4.07
Red Clay Creek	59	47		451	1,212	7.05
White Clay Creek	4,114	96		5,089	11,046	1.59
Totals	39,872	13,931	2,001	10,220	113,306	3.19 mean

Table 11B. Estimated catch and effort from Coastal Plain rivers and streams by all freshwater angler groups in Delaware, 2013.

River/stream	Angler trips	Carp	Catfish	Largemouth Bass	Striped Bass	Sunfish	White Perch
Delaware Estuary							
Appoquinimink River	2,770		1,089	226	541		1,622
Blackbird Creek	2,218		2,254				270
Broadkill River	15,870		4,791	9,887	2,767	12,812	28,005
C&D Canal	9,646	45	12,938	1,471	804	149	7,996
Leipsic River	4,020		3,652		541	180	6,947
Mispillion River	9,138	88	3,103	1,499	2,049	6,944	20,017
Murderkill River	6,681	721	2,891	2,440	6	268	5,585
Primehook Creek	1,141			2,347	23	241	3,416
Smyrna River	1,006	12	117	12	631	41	2,496
St. Jones River	3,928	152	6,428	105	82	787	4,223
Totals	56,418	1,018	37,263	17,987	7,444	21,422	80,577
			Yellow Perch	Other fishes	Total Catch	Catch per trip	
Appoquinimink River		23	6	3,507	1.27		
Blackbird Creek				2,524	1.14		
Broadkill River		5,032	5,637	68,931	4.34		
C&D Canal			213	23,616	2.45		
Leipsic River				11,320	2.82		
Mispillion River		660	1,066	35,426	3.88		
Murderkill River			457	12,368	1.85		
Primehook Creek			364	6,391	5.6		
Smyrna River				3,309	3.29		
St. Jones River		59	914	12,750	3.25		
Totals		5,774	8,657	180,142	3.19 mean		

Table 11C. Estimated catch and effort from Coastal Plain rivers and streams by all freshwater angler groups in Delaware, 2013.

River/stream	Angler trips	Carp	Catfish	Chain Pickerel	Largemouth Bass	Striped Bass	Sunfish
Chesapeake Watershed							
Marshyhope River	9,427			931	42,153	41	18,031
Nanticoke River/ Broad Creek	41,987	451	30,325	5,866	63,201	10,658	27,593
Totals	51,414	451	30,325	6,797	105,354	10,699	45,624
		White Perch	Yellow Perch	Other fishes	Total catch	Catch per trip	
Marshyhope River		198			61,354	6.51	
Nanticoke River/ Broad Creek		54,575	2,207	59,730	254,606	6.06	
Totals		54,773	2,207	59,730	315,960	6.15	mean

Table 12. Estimated trout catch and effort from designated trout streams and ponds by all freshwater angler groups in Delaware, 2013.

Trout Waters	Participants	Angler Trips	Trout Caught
Streams			
White Clay Creek	3,902	22,332	49,053
Christina River	1,007	3,655	6,496
Beaver Run	529	1,557	2,889
Wilson's Run	468	1,413	1,575
Mill Creek	492	1,084	1,068
Pike Creek	216	685	-
Ponds			
Newton Pond	587	2,408	1,393
Tidbury Pond	444	958	240
Totals		34,092	62,714

Table 13. Average release rate of the most popular species of fish in freshwater ponds and rivers for resident, non-resident, over-65, and seven day anglers in Delaware, 2013.

Ponds	Resident Anglers	Non-Resident Anglers	Over-65 Resident Anglers	Seven Day Anglers
	Percent Released	Percent Released	Percent Released	Percent Released
Carp	80	100	100	
Catfish	97	93	93	99
Crappie	96	87	93	95
Largemouth Bass	99	99	99	100
Pickereel	98	98	98	100
Smallmouth Bass	100		100	
Sunfish	98	96	97	95
White perch	97	83	90	100
Yellow perch	98	82	92	100
Overall	98	94	96	98

Rivers/streams	Resident Anglers	Non-Resident Anglers	Over-65 Resident Anglers	Seven Day Anglers
	Percent Released	Percent Released	Percent Released	Percent Released
Carp	93	100	100	
Catfish	96	91	93	
Crappie	96	93	91	100
Largemouth Bass	98	100	100	100
Pickereel	97	100	100	
Rock Bass	100	100		
Smallmouth Bass	100	100	99	100
Striped Bass	100	100	100	100
Sunfish	98	99	99	100
Trout		100	99	
White perch	91	83	89	100
Yellow perch	95	78	91	
Overall	96	95	95	100

Table 14. Species sought by resident, non-resident, over-65, and seven day anglers fishing in freshwater ponds and rivers/streams in Delaware during 2013.

Ponds

Resident Anglers Species Sought	Non-Resident Anglers Species Sought	Over-65 Resident Anglers Species Sought	Seven Day Anglers Species Sought
No Preference (38%)	No Preference (40%)	No Preference (36%)	No Preference (48%)
Largemouth Bass (35%)	Largemouth Bass (34%)	Largemouth Bass (33%)	Largemouth Bass (27%)
Crappie (11%)	Crappie (11%)	Crappie (14%)	Crappie (8%)
Sunfish (7%)	Sunfish (5%)	Pickereel (6%)	Sunfish (7%)
Pickereel (5%)	Pickereel (4%)	Sunfish (6%)	Pickereel (3%)
Other (5%)	Other (5%)	Other (5%)	Other (7%)

Rivers/streams

Resident Anglers Species Sought	Non-Resident Anglers Species Sought	Over-65 Resident Anglers Species Sought	Seven Day Anglers Species Sought
No Preference (49%)	No Preference (62%)	No Preference (50%)	No Preference (69%)
Largemouth Bass (17%)	Largemouth Bass (13%)	Largemouth Bass (12%)	Largemouth Bass (21%)
Striped Bass (8%)	Smallmouth Bass (5%)	White Perch (10%)	Crappie (2%)
Catfish (7%)	Sunfish (4%)	Striped Bass (8%)	Other (8%)
White Perch (6%)	Catfish (4%)	Catfish (5%)	
Other (13%)	Other (12%)	Other (15%)	

Table 15. Demographic data on respondents from the Delaware 2013 fishing survey.

State	County (DE)	Respondents	Percent
Delaware	Sussex	704	28.0
	New Castle	651	25.9
	Kent	419	16.7
Pennsylvania		391	15.6
Maryland		180	7.2
New Jersey		65	2.6
Virginia		27	1.1
New York		20	0.8

State	Respondents	< 5 percent
Arizona	1	
California	3	
Connecticut	2	
Washington DC	4	
Florida	4	
Illinois	3	
Indiana	1	
Massachusetts	2	
Michigan	4	
Minnesota	1	
Missouri	2	
Nevada	2	
North Carolina	7	
Ohio	2	
South Carolina	2	
Tennessee	1	
Texas	4	
Utah	1	
Vermont	3	
West Virginia	4	
Wisconsin	1	

Table 16. Issues of concern to anglers in Delaware waters, 2013, by angler group.
 Bold indicates top five issues listed overall.

Issue	Residents	Non-Residents	Over Age 65	7-Day Licensees	Overall
<i>Water Quality</i>					
Water quality/fish advisories	105	32	97	16	250
Weed control	32	18	31	1	82
Silt & turbidity	1	4	1	0	6
Remove geese	0	0	1	0	1
<i>Access</i>					
Increase boat & shore access	44	25	40	5	114
Improve & maintain boat ramps	26	11	26	1	64
<i>Enforcement</i>					
Improve/increase	33	15	23	5	76
Boating safety problems	2	3	7	2	14
<i>Facilities</i>					
Litter/trash clean-up	44	10	30	3	87
Dredge ponds	9	6	5	1	21
Parking & security	14	7	7	1	29
<i>Fishery Issues</i>					
Management	33	26	30	7	96
Stock fish	30	21	31	2	84
Size & creel	25	17	30	0	72
Promote catch & release	21	13	23	6	63
Increase conservation	9	7	7	3	26
Invasive species	10	7	5	0	22
Stock trout	16	5	14	0	35
Limit tournaments	4	1	1	0	6
<i>Other</i>					
Fees & licenses	14	11	10	5	40
Information & education	8	6	7	2	23
Promote youth angling	5	3	3	0	11
Misc.	54	33	61	9	157

Figure 1. Fishing survey questionnaire mailed to a percentage of all licensed anglers (resident and non-resident) who indicated they *intended* to fish in Delaware’s non-tidal and tidal freshwater areas in 2013.

**PLEASE FILL OUT AND RETURN THIS SURVEY FORM
EVEN IF YOU DID NOT FISH IN 2013**

ID#:

Dear Angler,

You have been selected to provide important fishing information that will allow the Delaware Division of Fish and Wildlife to better prioritize and focus our management and access activities. This survey is sent to only one in every ten licensed anglers, so your response is especially important. This survey will only take a few minutes to complete, fold, and return (we pay postage) or you can fill it out online at <http://de.gov/fisherisurvey> using the ID# on the top of this page. Use only YOUR fishing experiences in 2013. If you **did not fish** in 2013 please answer questions 1-3 below and send the form back to us (or complete the questions on-line at the link provided above). All answers will be kept in strict confidence. If you would like to receive a summary of the survey results, check the box on the last page.

1. Which activities did you participate in 2013 in Delaware waters? Please check all that apply:

- Non-tidal fishing (ponds & non-tidal streams); Tidal **freshwater** river/stream fishing
 Freshwater trout; Saltwater fishing (includes tidal **salt water**); Clamming; Crabbing

2. Did you purchase an:

- **annual** fishing license? Yes No
 - a **7-day** fishing license? Yes No

3. In your household, how many legally unlicensed persons fished in Delaware’s waters in 2013?
 _____ over 65 years (residents only) _____ under 16 years _____ ‘other’ exempted

If you did not fish in Delaware’s freshwaters in 2013, please fold and return.

Freshwater Trout Fishing

4. Did you purchase a 2013 trout stamp? Yes No

If you fished for trout please fill out the section below using the streams listed and answer questions 5-8, then go to the next page. If you **did not** fish for trout in 2013 please check this box and then go to the next page.

Stream Name*	No. trips	No. Trout Caught

***Streams: Christina, White Clay, Mill Creek, Pike Creek, Beaver Run, Wilsons Run, Tidbury Pond, Newton pond**

5. How many hours did you spend trout fishing on an average trip? _____ hours.

6. Did you fish in the Fly Fishing Only section on White Clay? Yes No

7. Did you keep your trout catch? Yes No Some

8. Circle the months below that you fished for freshwater trout in DE streams:

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Freshwater Pond Fishing

9. Did you fish in any of Delaware’s **public** ponds (listed below) in 2013? Yes No

If yes, please fill in the table below as much as possible - the names of the public ponds are listed below.
If you did not fish in a Delaware pond, go to question 14 (next page):

Pond Name	No. days fished	Number caught				Others: <i>pickerel</i>	Fill in	as	needed
		bass	crappie	sunfish					
<i>Example Abbotts</i>	<i>5</i>	<i>12</i>	<i>2</i>	<i>21</i>	<i>3</i>				

If you fished more ponds, just list the information on a plain sheet of paper & enclose with survey form.

Public Ponds*

- | | | | | | | |
|----------|-----------|-----------|-----------|-----------|-------------------|----------|
| Abbotts | Lake Como | Garrisons | Killens | Moores | Silver L (Dover) | Wagamons |
| Andrews | Concord | Griffith | Lums | MudMill | Silver L(Milford) | Waples |
| Becks | Courseys | Haven | Masseys | Newton | Trap | |
| Blairs | Craigs | Hearns | McColleys | Noxontown | Trussum | |
| Canal | Derby | Horseys | McGinnis | Raccoon | Tubmill | |
| Chipmans | Fleetwood | Ingrams | Millsboro | Records | Tussock | |

10. Circle the month(s) below that you fished in public ponds in 2013:

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

11. What fish species are you trying to catch while pond fishing?
 1st choice _____ 2nd choice _____ 3rd choice _____

12. Did you mostly fish the public ponds from a boat or from shore/pier ? Check one

13. How many days did you spend fishing in **private** ponds (those not listed above) in Delaware this year? _____ days.

Freshwater River/Stream Fishing

14. Did you fish in Delaware’s **freshwater** tidal or non-tidal rivers this year? Yes No
 If Yes, please fill out the following table, using the names of the rivers and streams listed below.

River or stream*	No. days fished	Number caught:					
		Lm bass	sunfish	white perch	Others: <i>Striped bass</i>	Fill in	as needed
<i>Example: Nanticoke</i>	<i>5</i>	<i>17</i>	<i>6</i>		<i>2</i>		

Streams/Rivers

- | | | |
|------------------------|------------|-------------|
| Nanticoke R/ Broad Crk | Blackbird | Misphillion |
| Broadkill | Smyrna | Murderkill |
| Brandywine | Leipsic | White Clay |
| Christina | St. Jones | Red Clay |
| C&D Canal | Marshyhope | Primehook |
| Appoquinimink | | |

15. Circle the month(s) that you fished in tidal or non-tidal freshwater rivers in 2013:

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

16. What fish species were you trying to catch while stream or river fishing?

1st choice _____ 2nd choice _____ 3rd choice _____

17. Did you mostly fish the rivers from a boat or from shore/pier Check one

Catch and Release

18. What overall percentage of the following species did you release?

Species	Percent released - ponds	Percent released – rivers
Largemouth bass		
Crappie		
Sunfish/bluegill		
Pickrel		
White perch		
Yellow perch		
Catfish		
Other? list		

19. What fishing issues do you think are the most important in Delaware?

- a. _____
- b. _____
- c. _____

Questions or Comments:

Check here to receive a notice when the report summary is available online

Your email address: _____

Figure 2. Front of postcard sent to a random sample of non-respondents of a fishing survey mailed to anglers (non-resident and resident) who indicated they intended to freshwater fish in Delaware in 2013.

<p style="text-align: center;">Freshwater Angler Survey Final Notice</p> <p style="text-align: right;"></p> <p>Dear Angler, Our 2013 fishing survey is nearing completion and we have not received your response. Your response is important in helping us compile accurate estimates. Therefore, we need you to please return your completed survey soon and fill out this postcard immediately.</p> <p style="text-align: center;">Did you fish in Delaware's Freshwaters during 2013? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p style="text-align: center;">Did you purchase a Delaware fishing license? <input type="checkbox"/> Annual <input type="checkbox"/> 7 Day <input type="checkbox"/> Legally Exempt <input type="checkbox"/> No</p> <p style="text-align: center;">Thank you for your cooperation and timely response.</p> <p style="text-align: center;">Edna Stetzar, Fisheries Biologist</p>
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