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**NANTICOKE RIVER WATERSHED  
BOATING ASSESSMENT STUDY**

**LOAN COPY ONLY**

by

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## EXECUTIVE SUMMARY

### Introduction

This report, *Nanticoke River Watershed Boating Assessment Study*, provides a baseline study of the water body to characterize users and provide insight into the attitudes of users and shoreline residents. The study was a cooperative effort of the University of Delaware Sea Grant Marine Advisory Service, Maryland Department of Natural Resources, Chesapeake and Coastal Watershed Service, Delaware Department of Natural Resources and Environmental Control, Division of Fish and Wildlife, and the Nanticoke Watershed Alliance.

The study sought to understand the magnitude of the various activities occurring on the water and determine the extent to which conflicts or safety problems exist between users, to assess peak-use boating patterns using a Geographic Information System (GIS) data base, to collect attitudinal information from various groups to determine their perceptions of recreational and commercial boating on the river, and to assess the possible impact of recreational boating activity on the natural resources of the watershed.

### Methods

To accurately and completely characterize the resource and the boating activity that was occurring on the river, a number of specific procedures were initiated

and completed. These individual tasks were intended to collectively provide a thorough picture of conditions on the river and its tributaries. The data collection procedures were multi-faceted and included an on-site field survey of recreational users (n=100); mail surveys of riparian property owners (n=164), commercial shipping companies (n=7), tug/barge operators (n=17) and commercial watermen (n=3); and aerial flights to count and observe on-water boating activity (n=8).

Data collected were analyzed in a number of distinct ways. Initially, frequency distributions for all questions were tabulated separately for each of the survey instruments that were distributed. Where possible, subpopulations of users were identified to compare and examine responses to similarly asked questions. Initially, the on-site survey of boaters and a subpopulation of residents who also boated on the Nanticoke River and tributaries were examined for the variables that they had in common. In addition, both residents and boaters in the field study were asked a few key questions about the environmental conditions of the river and their opinions of preferred management strategies for the river and its tributaries.

### Boater Profile and Activity Patterns

On-site boaters were primarily from the two states bordering the river, Delaware (55%) and Maryland (40%). The majority of these boaters operated powerboats (95%).

The average size boat was 18.4 feet with an average engine horsepower of 113 hp. Almost one-half (48%) reported that they carried some type of communication device with them while boating. Of these, 48% carried VHF radios and 43% carried cellular telephones on their boats. Nanticoke River boaters had considerable boating experience. The on-site survey boaters averaged 18.6 years of experience, with more than 34% indicating that they had more than 20 years of experience operating a boat. The average number of years operating on the river was 12 years. About 29% of the boaters had more than 20 years' experience, and approximately 55% of the boaters had less than 10 years navigating the river. The majority of the on-site boaters rated their boating skill level as either intermediate (39%) or advanced (41%). Thirty-seven percent of them indicated that they had taken a boater safety education course.

Fifty-nine percent of those responding to the landowner survey indicated that they boated on the Nanticoke River and its tributaries. Forty percent of these boaters owned one boat, and 50% owned two or more boats. Sixty-seven percent of the boats owned by the respondents were powerboats (either inboard or outboard), and 16% were non-powered rowboats, canoes, or kayaks. The average length of the boat they used most often was 19.9 feet with an average engine horsepower of 122 hp. More than one-half (52%) of the landowner boaters carry some type of marine communication device with them while they boat, with the majority carrying a VHF radio (54%), followed by cellular phones (37%). Landowning boaters had an average of 30.5 years of boating experience, with 65% indicating they had more than 20 years of

boating experience. Sixty-four percent of the respondents rated themselves as either advanced or expert boaters. Forty-seven percent indicated that they had taken a boater safety education course.

The average number of days boating for on-site boaters in 1995 was 19.8 days. The largest percentage of on-site boaters boated between 5 and 10 days (33%), followed by those who boated fewer than 5 days (22%) (70% of this group of boaters indicated they did not boat on the river in 1995). A similar number boated between 11 and 20 days (20%). Eight percent of the on-site boaters indicated that they boated on the river 50 days or more the previous year. Landowner boaters, on average, reported greater boating participation than on-site boaters. They responded that they boated an average of 34.8 days in 1995. Of this total, 23% boated between 5 and 10 days, and 18% boated fewer than 5 days, (with 53% of these boaters indicating no days of boating in 1995). Thirty percent of landowner boaters indicated they boated more than 30 days in 1995, compared with only 16% of on-site boaters.

Nanticoke River boaters are primarily warm-weather boaters, according to those who were interviewed during the on-site field survey. The majority of the recreational boating activity occurs between June 1 and September 30. July and August are peak months, with 96% of boaters indicating they boat on the river in these months. Use remains high during September, with 84% reporting participation, but drops off noticeably in October (57%) and further in November (25%). Of all the boating activities that boaters could engage in while on the Nanticoke River and its tributaries,

fishing (51%) was the activity that was mentioned most often by on-site boaters. Cruising (34%) was the next most popular boating activity on the river, followed by waterskiing/tubing (16%) and sightseeing (16%). Six percent of the respondents indicated they also swam from their boats in the river.

### GIS Analysis

The GIS phase of the study focuses on map data generated from the eight aerial flights conducted during the 1996 boating season. All of the data collected from each flight were aggregated into one GIS map. The intent of aggregating the aerial observation data was to depict recreational boating activity throughout the summer months and not just for a single day. By aggregating the data, areas of the river that were used most often by certain groups of boaters could be readily identified.

The total observations for the eight aerial flights were relatively light. They averaged 96 sightings per day, with a range of 47 to 160. The Delaware Nanticoke-Broad Creek area had the highest number of total activity sightings (n=245), followed closely by the southern-most section of the river, at the mouth of the Chesapeake Bay, with 244 activity sightings. These two river segments accounted for 64% of the total activity observed over the eight days of aerial flights. The Marshyhope Creek accounted for another 18% of the total activity, the Maryland-Upper area accounted for 13% and only 5% of the total boating activity was observed in the Maryland-Middle area.

The recreational use patterns examined in this spatial analysis include

fishing, cruising, waterskiing, jetskiing, swimming, sightseeing, sailing, crabbing, sailboarding, and canoeing/kayaking. Fishing was the predominant activity observed during the aerial flights, comprising 42% of the total sightings. Fishing was the top-rated activity on six of the eight aerial flight days. This was followed by cruising boats (25%) and waterskiing (13%). Waterskiing (and tubing behind boats) represented 13% of all the activity observed. Jetskiing (5%), swimming from boats (4%), sightseeing (3%), sailing (3%), crabbing (2%), canoeing/kayaking (2%) and sailboarding (<1%) represented the remainder of activities that were observed through this phase of the study.

### Boating Quality

Boaters primarily use the Nanticoke River and its tributaries to participate in specific recreational activities with their watercraft. However, there are other attributes that also make the water body an attractive resource to enjoy. Overall, the reason that received the highest response rate by on-site boaters was its peaceful location (80%). This was followed closely by the scenic quality of the river and its tributaries (75%), adequate water depth (74%), close to their home or where they were staying (73%), and there were adequate channel markers on the river (71%). The lowest rated reason for boating on the Nanticoke River, according to on-site boaters, was good swimming (32%). Landowning boaters' top choices for boating on the river included opportunities to observe wildlife (79%), there was not a lot of other boating (76%) and the river's wide channel (69%). The reasons least likely to influence boating on the river included

adequate channel markers (16%) and adequate water depth (24%).

On-site boaters rated boating conditions on the river the day they boated. A five-point scale was used, with 1=strongly disagree and 5=strongly agree. Three statements received fairly strong agreement from respondents in the field. They included *I thoroughly enjoyed my boat trip today* (4.38 mean response rating and 96% agreed or strongly agreed); *boating conditions on the river and its tributaries were safe* (4.08 mean response rating and 89% agreed or strongly agreed); and *there are adequate law enforcement patrols on the river and its tributaries* (3.41 mean response rating and 58% agreed or strongly agreed).

The statements that boaters tended to disagree with were those that pointed towards negative behavior by boaters on the water or unsafe boating conditions. These included *I nearly had an accident on the river because of crowded conditions* (1.55 mean response rating and 1% agreed or strongly agreed); *commercial boat traffic created conditions that were hazardous* (1.65 mean response rating and 0% agreed or strongly agreed); *the behavior of other boaters interfered with the quality of my boating experience* (1.80 mean response rating and 9% agreed or strongly agreed); and *the noise of other boats reduced my enjoyment on the river and its tributaries* (1.87 mean response rating and 0% agreed or strongly agreed).

Boaters were also asked to rate the quality of their overall boating trip on the day they were interviewed using a 10-point scale, with a rating of 10 signifying a perfect trip. The mean response rating for all on-site

boaters was 8.3, with 83% of the respondents rating the day's boating experience a level of 8 or greater.

### **Crowding**

Oftentimes, crowded boating conditions may lead to boater conflicts and possibly accidents. With this in mind, on-site boaters were asked to rate the crowding levels on the river the day they were interviewed using a 9-point scale, with 1=not at all crowded and 9=extremely crowded. Fifty percent of the responding boaters indicated the lowest level of crowding (1), and no boaters indicated the highest (9). The mean crowding level was 2.4 on the 9-point scale. When landowning boaters rated their perceptions of crowding using the same 9-point scale, they rated the river 3.23 on average. Sixty-five percent of the respondents rated the crowding low (between 1 and 3), 22% rated it medium (between 4 and 6), and 13% rated the crowding high (between 7 and 9). It is important to note that residents were asked to describe the level of crowding throughout the boating season compared to on-site boaters who were asked to provide their daily impression of conditions. This may, in part, explain the higher average rating for landowners (3.2) than for on-site boaters (2.4).

### **Boating Impacts**

Thirty-eight percent of property owners reported heavy (9%) or moderate (29%) recreational traffic along the river. Forty-four percent indicated they felt the recreational traffic was light, and 19% had no opinion. Property owners also indicated whether recreational boating contributed to

any of a series of negative factors on or near their property. They were most likely to respond that boaters always or sometimes caused pollution and litter in the river (38%), shoreline erosion (36%), disturbance to wildlife (32%), and safety hazards on the river (32%). They indicated recreational boaters were least likely to cause damage to docks and piers (18%).

### **Commercial Shipping**

When asked to describe the level of commercial traffic (barges, tugs, etc.) on the river, only 17% of property owners surveyed indicated that they felt it was heavy or moderate. Fifty-eight percent indicated they felt it was light, while another 25% had no opinion on the level of commercial traffic. Property owners were provided a list of negative factors that may be caused by commercial shipping traffic along the river and near their property. They were asked to indicate whether commercial activity always, sometimes, seldom, or never contributes to the factors identified. The landowners also had the option of indicating no opinion, if they were unsure of the effect of shipping on a certain factor. Shoreline erosion (21%) was the factor that property owners most often felt was always or sometimes caused by commercial shipping activity. Water turbulence was the next most highly rated factor; 10% of the owners indicated that it was always or sometimes caused by shipping traffic. Invasion of privacy (2%) and uncomfortable noise levels (3%) were rarely attributed to shipping traffic according to property owners.

### **Environmental Concerns**

When asked to rate the overall environmental quality of the river and its tributaries over the past 10 years, or since they have been visiting the river, 24% of on-site boaters felt that it was improving, 16% indicated they felt it was deteriorating and 60% felt that it was not changing very much or were not sure. When the boaters were asked to rate the conditions of the living resources (e.g., fish, crabs, clams) in the river, one-quarter felt they were improving, 28% reported they felt they were deteriorating and 47% felt they were not changing very much or were not sure of the condition of the resources.

Twenty percent of landowners felt that the environmental quality was improving, 12% indicated they felt it was deteriorating, and 68% felt that it was not changing very much or were unsure. When owners were asked to rate the conditions of the living resources in the river, 12% felt they were improving, 40% reported they felt they were deteriorating, and 48% felt they were not changing very much or were not sure of the condition of the resources.

On-site and landowner boaters were given the opportunity to rate the level of pollution along the river on a 9-point scale, ranging from 1=not at all polluted to 9=extremely polluted. Overall, the mean pollution rating for the river, as perceived by on-site boaters, was 3.45. One-fourth of these boaters (27%) felt the river was not at all polluted (scale values of 1 or 2), while the majority (52%) considered it slightly polluted (values of 3 or 4). Only 21% gave pollution ratings above 4 on the 9-point scale, and just 3% reported values of 8 or 9,

corresponding to an evaluation of extremely polluted. The average rating for landowner boaters was 3.86. Forty-eight percent rated the pollution level low (values between 1 and 3), 45% rated it medium (values between 4 and 6), and 7% rated river pollution high, with scale values between 7 and 9.

### **User Conflicts**

When on-site boaters were asked if they felt there were any conflicts between users of the river, 26% indicated they felt there were conflicts. However, only 3% of responding boaters reported that they had observed any boating accidents within the last year which were due to conflicts between users. All landowners were asked if they felt there were any conflicts. Twenty-two percent reported that they felt there were conflicts. Like the on-site boaters, only 3% of property owners had observed any boating accidents within the last year due to conflicting uses on the river. Twenty-seven percent of tug/barge operators responded that they encountered conflicts with recreational vessels (e.g., close calls, near accidents, or other navigation problems) within the past year. However, only 14% indicated that they had observed a boating accident within the last year which was a result of conflicts between users.

### **Management Considerations**

A series of management options were presented both to boaters interviewed in the field, and to landowners through the mail survey. With no surprise, the management option that gained nearly complete support from on-site boaters was prohibiting all discharges of pollutants into the water; 96% of all respondents favored this option.

Eighty-four percent of landowning boaters favored this option, and 74% of non-boaters supported it, making it the most favored option by both groups of landowners.

Other management options that received considerable support from on-site boaters and dealt with protecting the river's resources included establishing off-limit zones to protect sensitive resources (74%), restrictions on building and development (66%), and restricting boat use in shallow waters to prevent scouring and resource degradation (63%). These same options had considerably less appeal to landowners. Forty-eight percent of non-boaters favored off-limit zones, and only 38% of landowning boaters favored this option. Restrictions on building and development were fairly close for both segments of landowners (52% for boaters and 44% for non-boaters) but still less than the support noted by the on-site group of boaters.

Both boating groups (82% of on-site boaters and 72% of landowning boaters) overwhelmingly opposed limiting the number of boats using the river. A majority of non-boaters (51%) also opposed this measure. There was very little support for this option from any of the responding groups. There was also major opposition to limiting the size and power of boats using the river from both boating groups (77% of on-site boaters and 69% of landowning boaters). Non-boaters (40%) favored this measure considerably more than the boating groups. Zoning the river to provide for specific uses in designated places received limited support from on-site boaters (39%) and considerably less support from landowners (22% of boaters and 27% of non-boaters). A majority of both boating groups opposed this



option (57% of on-site boaters and 67% of landowning boaters).

The option of placing stricter limits on harvesting fish, crabs, and clams, etc. consistently received the lowest level of support from each responding group (34% of on-site boaters, 31% of landowning boaters, and 39% of non-boaters). Again, it is noteworthy that a majority of both boating groups (51% for each group) opposed this option.

Finally, 43% of the responding shipping firm representatives suggested certain changes along the river. These suggestions included enforcing no-wake zones near commercial loading areas and regulations that would give a high priority to commercial shippers' use of the river. Seventy-one percent of the tug and barge operators also suggested specific changes they would like to see along the Nanticoke River. These suggestions included such things as additional dredging at certain locations; better buoy markers, especially lighted markers and buoys that can withstand ice conditions on the river, and warning signs to alert small-boat owners of the commercial shipping traffic that navigates the river.

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# NANTICOKE RIVER WATERSHED BOATING ASSESSMENT STUDY

## INTRODUCTION

### BACKGROUND

In February 1995, members of the Nanticoke Watershed Alliance (NWA) corresponded with officials in both the Maryland Department of Natural Resources (DNR) and the Delaware Department of Natural Resources and Environmental Control (DNREC) requesting that a boat traffic study be conducted on the Nanticoke River. The NWA noted that it was concerned about the effects of recreational and commercial boat traffic on the river. These concerns centered around the effects of boat traffic on pollution, wake, noise, impacts on wildlife, submerged aquatic vegetation, shoreline erosion, human population, and water and air quality.

In the ensuing months, communications between NWA members and officials from the two state natural resource agencies continued, in order to better define the issues and develop a scope of work for a proposed study to assess boating conditions on the river and its main tributaries. At the suggestion of Delaware DNREC Secretary Christophe Tulou, the University of Delaware Sea Grant Marine Advisory Service (UDSGMAS) was also informed of the proposed study and invited to join in the discussion. By mid-July 1995, the UDSGMAS had forwarded correspondence to the NWA Executive Director, Lisa Jo Frech and offered its services to help address the issues that had been defined.

In September 1995, the NWA organized a boat trip on the Nanticoke River to enable resource officials from Maryland and Delaware and other interested parties to become more familiar with the river and its resources. This river trip also gave members of the NWA an opportunity to further describe their intent for the proposed boat traffic study.

During the winter of 1995 and spring of 1996, the UDSGMAS attended a series of meetings with members of the NWA, Delaware DNREC and Maryland DNR to discuss the possibility of working together to assess boating conditions on the Nanticoke River and its tributaries. During the discussions, Maryland DNR indicated that it had funds to devote to the study. In further conversations with officials in Delaware DNREC's Division of Fish and Wildlife, additional funds were obtained to support the project. The UDSGMAS took the lead in developing a proposal to outline a scope of work. Close working relationships were maintained throughout the entire project with the MD DNR, NWA, and DE DNREC.

The overall goals of the study, as outlined by the UDSGMAS, were to assess current activities occurring on the river, identify conflicts in waterway use, describe unsafe boating

behavior or safety problems, and to the extent possible, note any environmental impacts occurring as a result of vessel traffic.

### NANTICOKE WATERSHED CHARACTERIZATION

The Nanticoke River is considered one of the least spoiled rivers of the Chesapeake Bay even though agriculture, industry, and other development continue to increase along its shores. The river begins in central Delaware and winds in a southwesterly direction, traversing Maryland's Eastern Shore, serving as the dividing line for Dorchester and Wicomico counties and eventually draining into Tangier Sound and the Chesapeake Bay (Figure 1). The main portion of the river is approximately 30 miles in length and drains 266,000 acres of Delaware and 125,000 acres of Maryland (Naughten, 1996). The Nanticoke River is fed by some sizeable tributaries such as the 20-mile-long Broad Creek, which begins east of Delmar, Delaware, and flows northwest through Laurel, Delaware, to meet the river near the Nanticoke Wildlife Refuge (Goggin and Blosser, 1987). Both Broad Creek and the Nanticoke River begin as freshwater resources but eventually become brackish waters in their southern portions due to the tidal influence of the Chesapeake Bay. The diversity of habitat along the river supports a variety of wildlife and attracts people from throughout the region to participate in various activities on its waters and shores.

Wildlife, particularly birds, flourish on the Nanticoke River. The various ecosystems of the river support osprey, falcons, migrating waterfowl (e.g., black ducks, canvasbacks, mallards, and teals), heron, kingfisher, fox, deer, turtles, snakes, raccoon, muskrat, nutria (so abundant that they are considered a pest species), beaver, otters, owls, and exotic spiders (Naughten, 1996). The endangered symbolic bird of America, the bald eagle, can even be found thriving on the river. Forests on the banks of the river provide homes for much of the wildlife, while at the same time protecting the river from pollutants that may leach into its waters. Vast wetlands also border the shore of the river (22% of the land surface of the watershed), supporting a variety of wildlife in a scenic setting. The river's waters provide habitat and breeding areas to a variety of fish and shellfish, including American shad, striped bass, largemouth bass, white and yellow perch, pickerel, catfish, seatrout, bluefish, blue crabs, oysters, and clams (Naughten, 1996).

The river, rich in wildlife and scenery, creates a demand for recreational activities on its waters including pleasure boating and fishing. Largemouth bass fishing occurs from April through November, with the Delaware Bass Anglers Sportsman Society (B.A.S.S.) Federation and other organizations sponsoring numerous bass fishing tournaments on the river throughout the year. In 1996, there were 45 tournaments held on the Nanticoke River/Broad Creek (including the Marshyhope Creek), attracting 750 anglers. In seven of the last eight years, this region has been the most popular bass fishing tournament location in Delaware (Delaware DNREC, 1997). See Appendix Q for additional information on bass fishing tournament participation in this area.



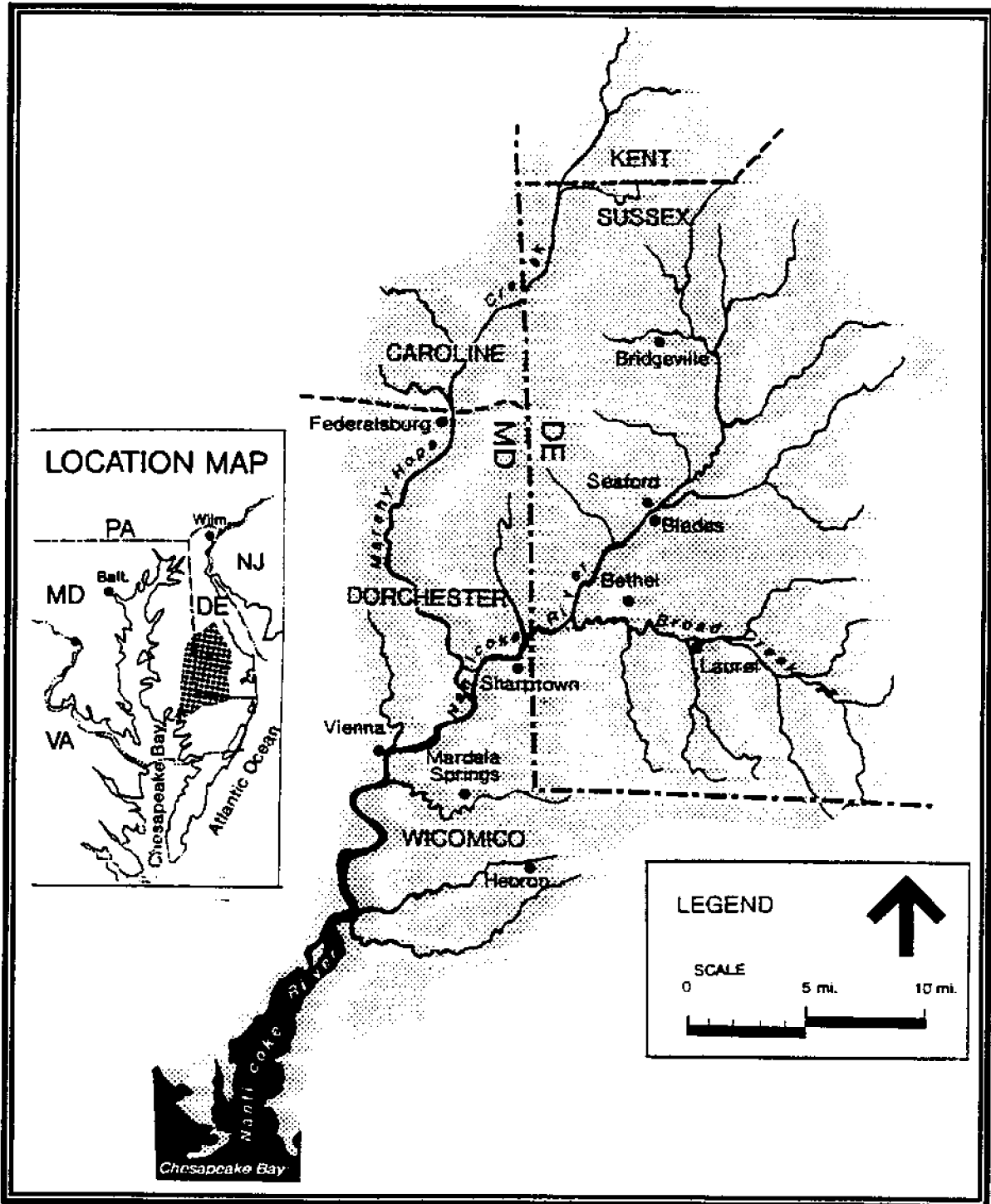


Figure 1. Nanticoke River Watershed

There is also a great deal of fishing not associated with tournaments or clubs occurring on the Nanticoke River. The marshes and creeks feeding the river provide excellent canoe and kayak locations, while the wider, winding banks of the river, particularly in the southern portion, provides ample space for powerboating and sailing. In addition to fishing and pleasure boating, wildlife watching, waterskiing, and swimming are also popular Nanticoke River recreational activities.

Adding to the abundant recreational opportunities, the river also offers the opportunity for history lessons on Native Americans, tall ships, steamboats, slave-running, piracy, and the Underground Railroad. The Nanticoke watershed is host to a variety of properties listed on the National Register of Historic Places, including Harriet Tubman's birthplace (Naughten, 1996). In addition to historic locations, the watershed offers designated park and wildlife areas managed by environmental and governmental organizations, such as the Blackwater National Wildlife Refuge managed by the U.S. Fish and Wildlife Service.

### NANTICOKE RIVER BOATING ACCESS

Recreational boating is one of the most popular activities engaged in by individuals recreating on the Nanticoke River. The types of activities and size of boats vary, often depending on the geographic location on the river. There are several boating access facilities located along the river and its tributaries in Maryland and Delaware to serve boaters. They include the following:

#### Maryland Locations

- Nanticoke Harbor--located on the river in Nanticoke, Maryland. The site contains a boat basin with 66 slips, a two-lane boat ramp, one pier, and parking for 100 cars and trailers.
- Cove Road Recreation Area--located between Nanticoke and Bivalve, Maryland. This site provides shoulder parking and access for car-top boats only.
- Cedar Hill Park Marina--located on the river in Bivalve. The facility has 152 slips, a two-lane boat ramp, three piers, and parking for 145 cars and trailers.
- Tyaskin Park--located on the river in Tyaskin, Maryland. The site includes a boat ramp.
- Wetipquin Ramp--located on the river in Tyaskin. The site includes a two-lane ramp, two piers, and parking for 14 cars and trailers.

- Vienna Ramp--located on the river in Vienna, Maryland. The site contains a one-lane ramp and parking for 18 cars and trailers at the nearby fire station.
- Mardela Springs--located on Barren Creek in Mardela Springs, Maryland. The site contains a one-lane ramp and parking for 20 cars and trailers.
- Cherry Hill Beach--located on the river at Sharptown, Maryland. The site contains a one-lane ramp (the Sharptown public ramp), two piers, and parking for 30 cars and trailers.
- Federalsburg VFW--located on the Marshyhope Creek in Federalsburg, Maryland. The site contains a two-lane ramp, two piers, and parking for 20 cars and trailers.
- Federalsburg Marina--located on the Marshyhope Creek in Federalsburg. The site contains a one-lane ramp, two piers, and parking for 57 cars and trailers.

#### Delaware Locations

- Phillips Landing--located on the Broad Creek west of Bethel, Delaware (near the confluence with the Nanticoke River) and managed by the Delaware DNREC. It contains three ramps, one floating dock, and parking for 53 vehicles and 27 boat trailers.
- Seaford Public Boat Ramp--located on the river in the town of Seaford, Delaware. There is a two-lane ramp and parking for 24 vehicles and 17 boat trailers.
- Walker's Marina--a private marina located up Lewes Creek, south of Seaford. The facility has 21 slips, a boat repair shop, and gasoline and diesel fuel are available.

#### RIVER ZONING CLASSIFICATION

The Nanticoke River and its major tributaries encompass a large geographic area. The water body, in fact, is too large and diverse to examine as a single unit. For purposes of this study, the river and its tributaries were organized into five distinct zones (Figure 2). This made it possible to characterize the extent of boating activity in identifiable geographic areas. The identified zones include the following:

- **Maryland-Lower (MD-Lower)**--This area begins at the mouth of the river and extends northward to Chapter Point (an identifiable geographic point on the east side of the river). This lower section of the river is characterized by its broad width. The width of the river in this zone ranges from about 1-3/4 miles at the mouth to about 2,100 feet at Chapter Point. In some locations it is nearly 2 miles wide.
- **Maryland-Middle (MD-Middle)**--This area extends from Chapter Point and proceeds north to the town of Vienna, Maryland. This section of the river meanders considerably, and large tracts of wetlands buffer the shoreline. The width for this section of the river ranges from 650 feet to approximately 2,650 feet, with an average of about 1,800 to 2,000 feet.
- **Maryland-Upper (MD-Upper)**--This section of river extends from Vienna north to the Maryland/Delaware border. This area has two towns along the river (in addition to Vienna, Sharptown, Maryland, is a short distance to the north). River width ranges from 600 feet to about 1,800 feet. The average width of this section of river is in the 1,200 to 1,300 foot range.
- **Marshyhope Creek**--This major tributary of the river converges with the Nanticoke River south of Sharptown and extends northward to the town of Federalsburg, Maryland, a distance by water of over 15 miles. The creek meanders through pristine marsh and forested areas. It is about 800 feet wide, at its mouth, and maintains this width for nearly three-quarters of its distance. The creek begins to narrow to 200 feet or less as it nears Federalsburg.
- **Delaware Nanticoke-Broad Creek**--This river segment is the only one entirely in Delaware and extends from the Maryland/Delaware state line northward to the major community of Seaford, Delaware. The two sections that make up this area are quite unique. First, there is extensive residential development along the Nanticoke shoreline and the town of Seaford also has considerable commercial and industrial development. This section of the river ranges in width from about 450 feet to approximately 1,200 feet. The average width falls between 700 and 800 feet. The second section, Broad Creek, is the narrowest tributary in the study area. It converges with the Nanticoke River south of Woodland, Delaware. It is also very pristine and meanders to the east through the towns of Bethel and Laurel, Delaware. The creek ranges in width from about 125 feet at its narrowest point to over 600 feet at its widest point.

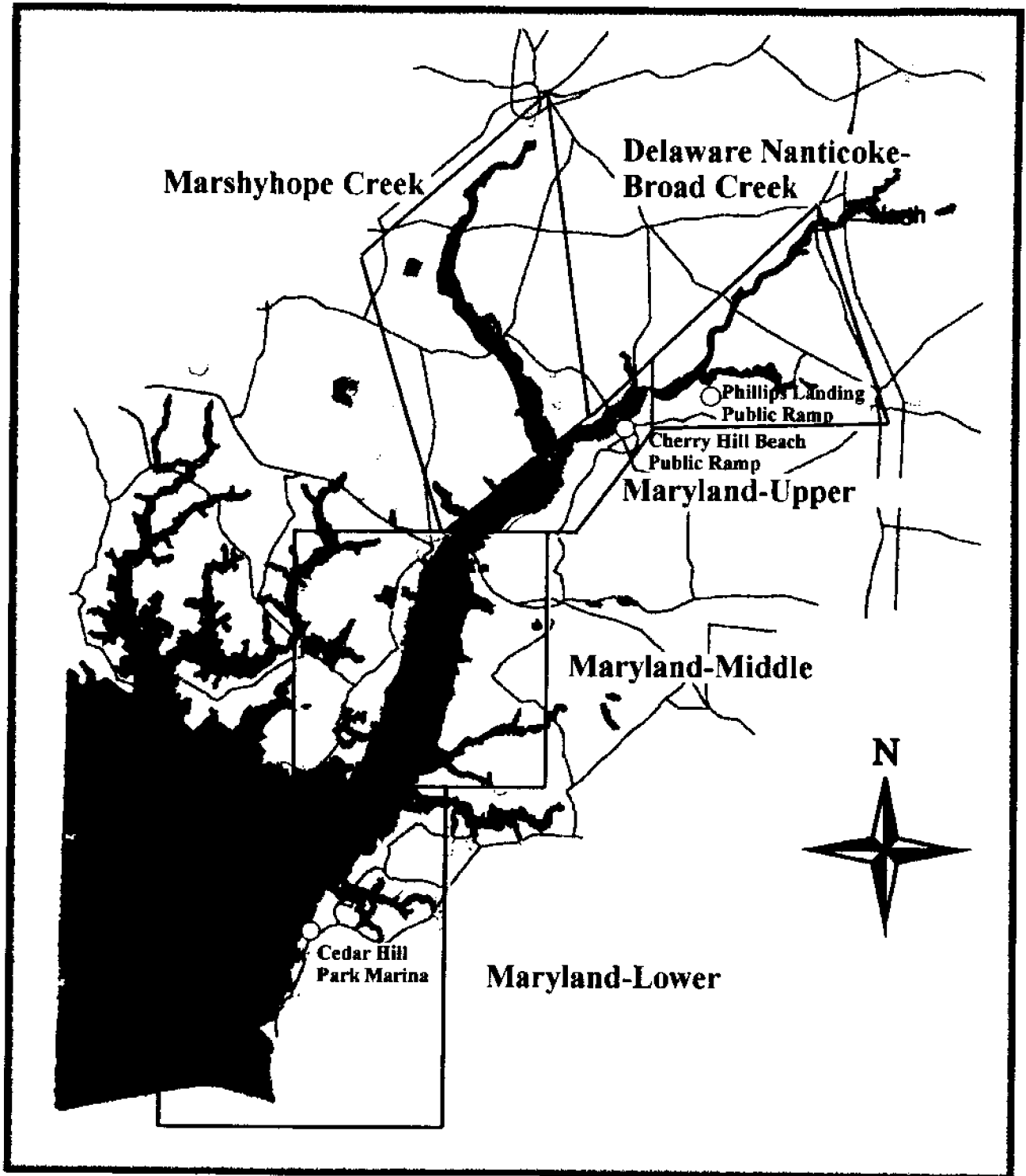


Figure 2. Nanticoke River Zoning Classification and On-site Field Survey Locations

## STUDY OBJECTIVES

Prior to this study, data on Nanticoke River users and the activities they engage in were limited. This project will therefore serve as an important baseline study of the water body to characterize users and provide insight into attitudes of these users and shoreline residents. The specific objectives of the study were:

1. to understand the magnitude of the various activities occurring on the water and determine the extent to which conflicts or safety problems exist between users;
2. to assess peak-use boating patterns using a Geographic Information System (GIS) data base for display and analysis of the collected aerial data;
3. to collect attitudinal information from various groups to determine their perceptions of recreational and commercial boating on the river;
4. to assess the possible impact of recreational boating activity on the natural resources of the watershed.

## METHODS

The boating assessment study of the Nanticoke River was quite complex in its design. In order to accurately and completely characterize the resource and the boating activity that was occurring on it, a number of specific tasks (data collection procedures) were initiated and completed. These individual tasks were all intended to be "snapshots" that collectively would provide a thorough picture of conditions on the river and its tributaries. The following tasks made up the scope of work for this project.

### DATA COLLECTION

The data collection procedures were multi-faceted and included an on-site field survey of recreational users; mail surveys of riparian property owners, commercial shipping companies, tug/barge operators and commercial watermen; and aerial flights to count and observe on-water boating activity.

#### On-site Field Survey of Recreational Boaters

Recreational boaters were interviewed after completing their boating trips on the river during specified days during the 1996 boating season. The field survey commenced on the July 4 weekend to correspond with the initial aerial flight performed by the Maryland DNR. The data collection was completed on 17 sampling dates between July and September. Investigations by field interviewers revealed that three primary access sites along the Nanticoke River had the highest usage. These sites were considered to be representative of the type of boating activity occurring on the river and became the focus of the on-site survey sample. There were two sites in Maryland, Cedar Hill Park marina (30% of the interviews) and Sharptown public ramp (25% of the interviews); and one site in Delaware, Phillips Landing (45% of the interviews). One hundred interviews were collected during the months of July (35%), August (55%), and September (10%). The majority of the interviews (81%) were collected between the hours of 2:00 p.m. and 6:00 p.m., as boaters were returning from their day of boating.

#### Mail Survey of Watershed Property Owners

Property owners living within the Nanticoke River watershed in both Maryland and Delaware were interviewed by mail. The names and addresses used for the mailings were provided by members of the Nanticoke Watershed Alliance. Questionnaires were mailed to 369 residents on August 23, 1996. Of this total, 199 were mailed to Delaware residents and 170 were mailed to Maryland residents. A postcard reminder (mailed September 5, 1996) and a second complete follow-up mailing (mailed September 19, 1996) were sent to residents who had not previously responded. There were some mail delivery problems associated with the mailing lists (primarily for the Maryland sample). Nineteen of the 199 Delaware mailings and 56 of the 170

Maryland mailings were returned as undeliverable mail (wrong or incomplete addresses, occupant had moved, etc.). A total of 164 residents returned usable survey instruments. Once the undeliverable mail was accounted for, an overall response rate of 56% was attained.

Residents with property along the Nanticoke River and its tributaries had owned their land an average of 27 years. Thirty percent of the owners had owned their property for 10 years or less, and 24% owned their property for more than 30 years. Sixty-nine percent of the owners had a house or dwelling on the property, and about three-quarters of these owners lived in these residences year-round. The average distance from the dwelling to the river was 323 feet. More than half (52%) of the owners lived 100 feet or less from the river. Of those respondents who did not use their Nanticoke River dwelling as their primary residence, 50% lived in other Delaware towns and 44% lived in other towns in Maryland.

#### On-water Reconnaissance Trips

Two on-site reconnaissance trips were made by boat to become familiar with the environmental resources and geographic features of the water body. They were also important to help gauge boating use patterns. The river trips were critical to the overall study in that they resulted in a modification of the project's work plan. Instead of making additional boat trips to assess peak boating activity and record use patterns, aerial flights were scheduled to collect this information. The main reason for this modification was the extensive length of the river and its tributaries, which would have made it difficult to complete on-water data collection in a timely manner.

#### Aerial Flight Observations

Aerial flights with trained observers were conducted to document the on-water activities on selected days during peak boating times of the day. The aerial flights took place between July 6 and September 21, 1996. A total of eight flights were completed. The first flight by Maryland DNR took place on Saturday, July 6. A state helicopter was used to complete a fly-over of the entire study area to photograph and record boating activity while it was occurring. A set of 77 slides were produced from this flight, along with a detailed map of where the photos were taken. Seven additional aerial flights were subsequently completed by a commercial flight service stationed in Georgetown, Delaware. This firm was selected due to its staff's familiarity with the water body and previous experience documenting boating activity for other parties. The flight observer was provided with a map of the study area and instructed to record type and location of boating activity on the map. Each of the aerial flights was conducted, on a weekend day, during the peak boating times of the day (between 11:30 a.m. and 2:30 p.m.).



### Commercial Shipping Survey

A one-page mail survey was developed to collect information from commercial shippers who use the river to transport various products. Eleven companies were identified as using the river for shipping, and officials from seven of these companies responded to the survey. In addition, the executive director of the Delmarva Water Transport Association assisted in collecting information from firms and businesses that use the river for transporting goods and products.

### Tug/Barge Operator Survey

A two-page mail survey was developed for tug/barge operators working on the river. The survey collected their observations of boating conditions on the river. The survey instruments were mailed to shipping companies to forward to their operators. A total of 15 operators responded to this phase of the data collection.

### Commercial Watermen Survey

A survey instrument was developed and printed in the Maryland *Waterman's Gazette* (September 1996 issue) to gain input from commercial watermen about their uses of and concerns about the Nanticoke River and its tributaries. Due to the limited success of this initial task (only three watermen responded), follow-up survey materials were mailed to a local watermen's organization chapter president for his distribution to local watermen who fish the river. This second effort again proved futile, as no completed survey instruments were returned. Due to the poor response rate for this phase of the study, no statistical analysis of watermen responses could be completed.

## DATA ANALYSIS

Data collected through the various sampling efforts were analyzed in a number of distinct ways. Initially, frequency distributions for all questions were tabulated separately for each of the survey instruments that were distributed (on-site boater survey, resident mail survey, commercial shipper mail survey, tug/barge operator mail survey and watermen survey). These frequencies are reported throughout the report and shown on the copies of the survey instruments included in Appendices J through N.

Where possible, subpopulations of users were identified to compare and examine responses to similarly asked questions. There were two elements of the various survey efforts where this was possible. Initially, the on-site survey of boaters and a subpopulation of residents who also boated on the Nanticoke River and tributaries were examined for the variables that they had in common. In addition, both residents and boaters in the field study were asked a few key questions about the environmental conditions of the river and their opinions of preferred

management strategies for the river and its tributaries. These comparisons are also examined in the report.

A final method of data analysis was to map and subsequently examine the spatial distribution of boating activity along the river and adjacent creeks using a Geographic Information System (GIS). This included obtaining a basemap from the Chesapeake Bay Foundation, who had built a data base on the Chesapeake Bay and its tributaries. The basemap and natural resource data layers, including data on rare, threatened, and endangered species, state and county boundaries, wetlands, and major roadways, were electronically transmitted. The recreational boating data (type and location of activity) acquired from the eight aerial flight sampling days were manually digitized and analyzed. The resulting point-pattern maps (Figures 8-12) depict aggregate activity use on various segments of the river and creeks. The overall goal of using GIS technology in water-use planning is to help identify areas of intense use and areas where conflicting uses may occur.

## RESULTS

### RECREATIONAL BOATING ON THE NANTICOKE RIVER

Recreational boating on the Nanticoke River and its tributaries is diverse and growing in popularity. Although the number of access sites are relatively few for such a large water body, and this tends to limit the uses, all indications suggest that resource agency officials in both Maryland and Delaware are anticipating boating to continue to grow. Facility improvements have been made, or are underway, at Nanticoke Harbor boat ramp in Maryland and at the Seaford public ramp in Delaware. In addition, a 75-slip marina is proposed to be developed in Blades, Delaware, a short distance south of Seaford.

As recreational boaters continue to discover the benefits and enjoyment of recreating on the Nanticoke River and its tributaries, it is likely boating traffic will intensify. These study results can provide an initial baseline for managers to monitor future boating growth and impacts.

#### Descriptive Profile of Boaters and Boats Used

On-site boaters were primarily from the two states bordering the river, Delaware (55%) and Maryland (40%). The majority of these boaters operated powerboats (95%). The average size boat was 18.4 feet with an average engine horsepower of 113 hp (Table 1). Almost one-half (48%) reported that they carried some type of communication device with them while boating. Of these, 48% carried VHF radios and 43% carried cellular telephones on their boats.

Fifty-nine percent of those responding to the landowner survey indicated that they boated on the Nanticoke River and its tributaries. Forty percent of these boaters owned one boat, 50% owned two or more boats, and the remaining 10% reported owning no boats of their own. Sixty-seven percent of the boats used most often by the respondents were powerboats (either inboard or outboard); 16% were non-powered rowboats, canoes, or kayaks; and the remaining 16% were "other" boats, which were mostly work-related boats or skiffs. Although jetskis were never selected as the boat used most often, 8% of the landowner boaters reported also owning at least one jetski. The average length of the boat used most often was 19.9 feet with an average engine horsepower of 122 hp (Table 1). More than one-half (52%) of the landowner boaters carry some type of marine communication device with them while they boat, with the majority carrying a VHF radio (54%), followed by cellular phones (37%).

Nanticoke River boaters had considerable boating experience. The on-site survey boaters averaged 18.6 years of experience, with more than 34% indicating that they had more than 20 years of experience operating a boat (Table 1). On-site boaters were also asked about their experience boating on the Nanticoke River. The average number of years operating on the river was 12 years. About 29% of the boaters had more than 20 years' experience, and approximately

55% of the boaters had less than 10 years navigating the river. The majority of the on-site boaters rated their boating skill level as either intermediate (39%) or advanced (41%). Thirty-seven percent of them indicated that they had taken a boater safety education course.

Landowning boaters had an average of 30.5 years of boating experience, with 65% indicating they had more than 20 years of boating experience. Sixty-four percent of the respondents rated themselves as either advanced or expert boaters. Forty-seven percent indicated that they had taken a boater safety education course (Table 1).

### Boat Use Patterns

Since the study was being conducted during the summer of 1996, and boaters were still engaged in their seasonal boating patterns, both on-site and landowner boaters were asked about the total number of days they boated on the river the previous year (1995). The average number of days boating for on-site boaters in 1995 was 19.8 days (Figure 3). The largest percentage of on-site boaters boated between 5 and 10 days (33%), followed by those who boated fewer than 5 days (22%) (70% of this group of boaters indicated they did not boat on the river in 1995). A similar number boated between 11 and 20 days (20%). Eight percent of the on-site boaters indicated that they boated on the river 50 days or more the previous year.

Landowner boaters, on average, reported greater boating participation than on-site boaters. They responded that they boated an average of 34.8 days in 1995. Of this total, 23% boated between 5 and 10 days, and 18% boated fewer than 5 days, (with 53% of these boaters indicating no days of boating in 1995). Thirty percent of landowner boaters indicated they boated more than 30 days in 1995, compared with only 16% of on-site boaters (Figure 3).

Both groups of boaters were also asked to project their Nanticoke River boating activity level for 1996. Initially, a small group of on-site boaters (the first 27 interviewed) were asked to indicate whether they would boat more, less, or at about the same level as 1995. Forty-eight percent noted that they would boat more than in 1995; one-third indicated that they would boat about the same number of days; and 19% reported that they would boat fewer days than the previous year.

Table 1. Descriptive Profile of Nanticoke River Boaters and Boats

<b>Boat/Boater Characteristics</b>	<b>On-site Boaters (n=100)</b>	<b>Landowner Boaters (n=86)</b>
<b>Boat Length (feet)</b>	<b>Percentage</b>	<b>Percentage</b>
8-15	6	22
16-17	32	20
18-19	29	18
20-25	30	31
26 or more	2	9
Average	18.4 ft.	19.9 ft.
<b>Horsepower</b>		
0-25	6	27
26-50	18	13
51-100	24	9
101-150	37	28
151-200	8	9
more than 200	7	14
Average	113 hp	122 hp
<b>Carry Marine Communication Device</b>	48	52
<b>Type of Device</b>		
VHF	48	54
Cellular Phone	42	37
CB	10	10
<b>Years Boating Experience</b>		
1-5	20	7
6-10	15	7
11-20	31	20
more than 20	34	65
Average	18.6 yrs.	30.5 yrs.
<b>Self-rated Skill Level</b>		
Novice	9	4
Intermediate	39	33
Advanced	41	43
Expert	12	21
<b>Taken Boater Safety Education Course</b>	37	47

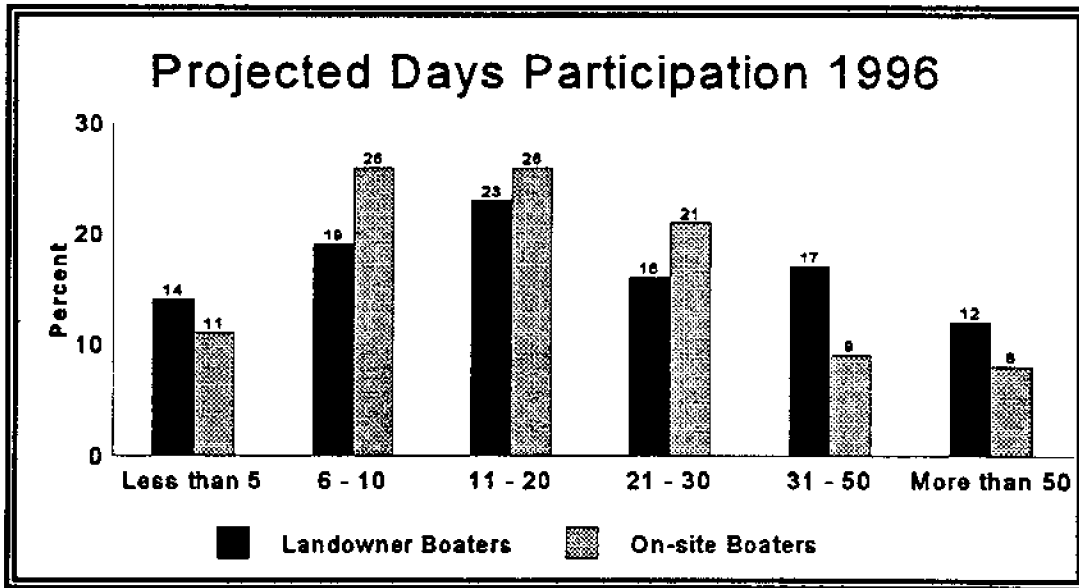
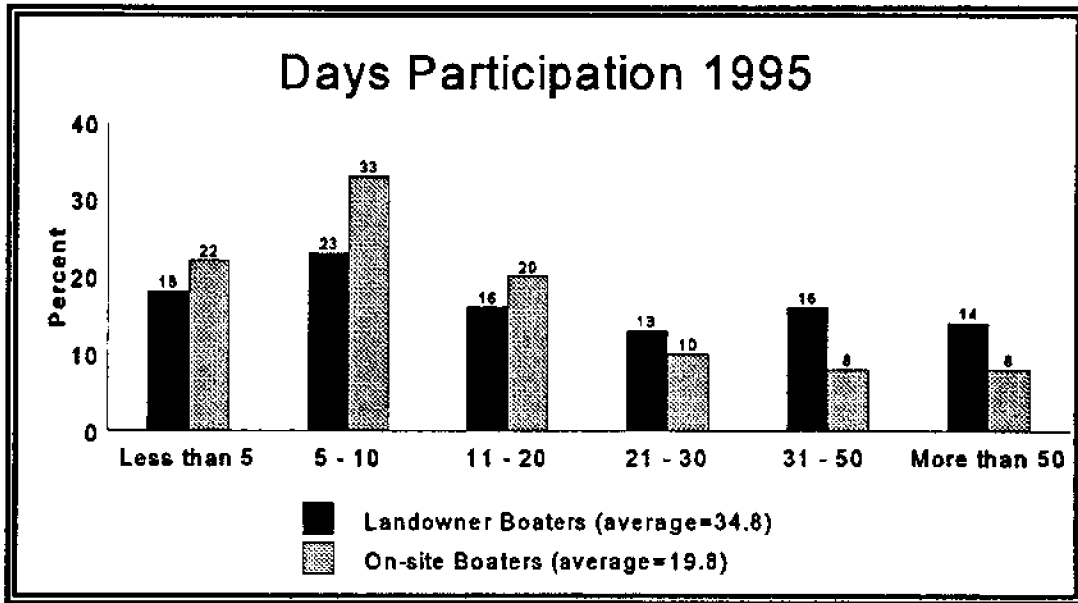


Figure 3. Boating Participation on the Nanticoke River by Landowner and On-site Boaters

After the first 27 interviews the wording of the question was changed to gain additional information from the remaining sample of boaters who were interviewed. Subsequently, on-site boaters were asked to quantify the number of days they intended to boat in 1996. Twenty-six percent of the on-site boaters indicated that their boating participation would be between 5 and 10 days and 11 and 20 days, respectively. Another 21% noted that they would boat between 21 and

30 days. Seventeen percent of the on-site boaters reported that they would boat more than 30 days in 1996.

When landowner boaters were asked to project their level of boating activity through the end of 1996, 14% indicated that they would boat fewer than 5 days, 19% indicated that they would boat between 5 and 10 days, and 23% of the respondents reported that they would boat between 11 and 20 days during the year. Sixteen percent indicated they would boat between 21 and 30 days, and 29 percent reported that they would boat more than 30 days in 1996. Results of this more detailed questioning about projected boating participation confirmed the pattern of the initial questions, suggesting that most Nanticoke River boaters planned to spend at least as much time on the river in 1996 as they had during 1995.

Nanticoke River boaters are primarily warm-weather boaters (Figure 4), according to those who were interviewed during the on-site field survey. The majority of the recreational boating activity occurs between June 1 and September 30. July and August are peak months, with 96% of boaters indicating they boat on the river in these months. Use remains high during September, with 84% reporting participation, but drops off noticeably in October (57%) and further in November (25%). Springtime use follows a similar pattern, with about one-fifth of the boaters beginning their river use in March (21%), nearly half using the river in April (47%), and almost three-fourths on the river in May (72%). Very limited recreational boating activity occurs during the winter months between December and February.

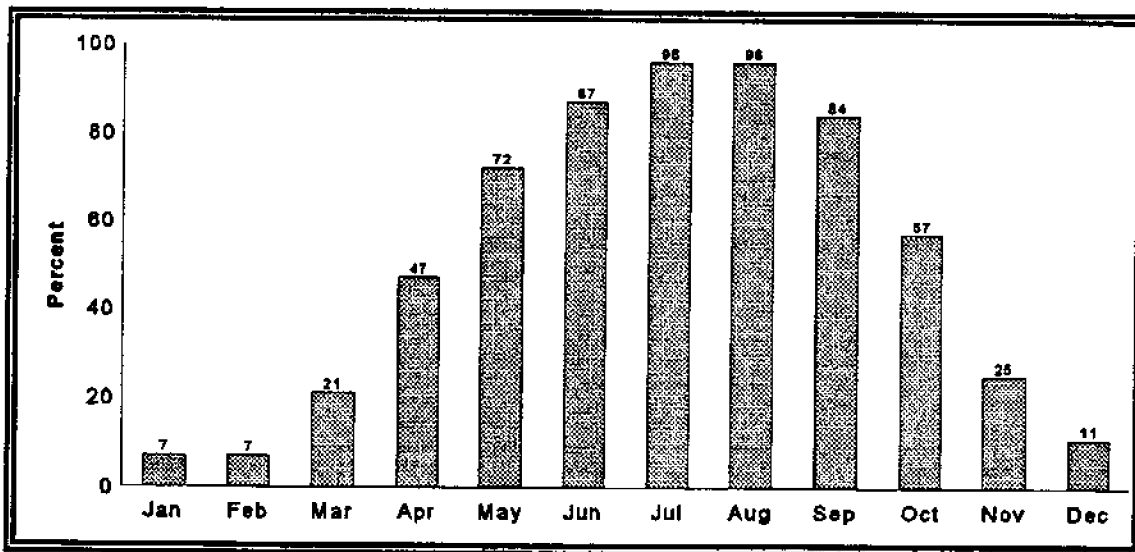


Figure 4. Seasonal Participation in Recreational Boating by On-site Boaters

The majority of on-site boaters interviewed (53%) indicated that they boated mostly on weekends (Figure 5). Another 26% indicated weekends and weekdays equally, and 21% noted that they boated mostly on weekdays. Landowner boaters had somewhat different boating patterns. More of them indicated that they were more likely to boat on weekends and weekdays equally (46%), rather than just on weekends (31%) or just weekdays (21%).

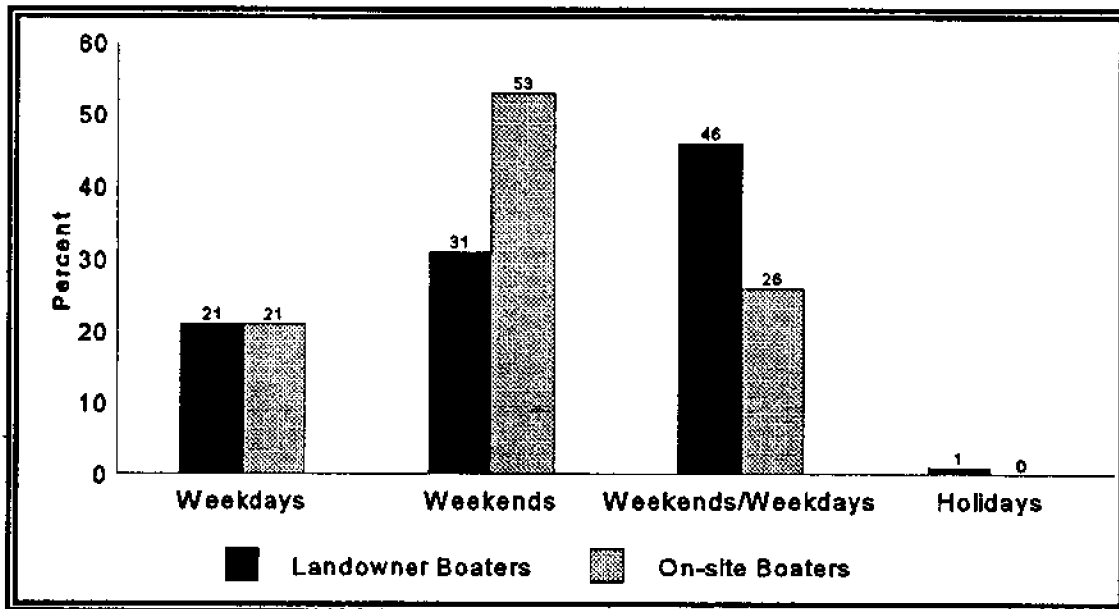


Figure 5. Daily Boating Patterns on the Nanticoke River by Landowner and On-site Boaters

Of all the boating activities that boaters could engage in while on the Nanticoke River and its tributaries, fishing (51%) was the activity that was mentioned most often by on-site boaters (Figure 6). Cruising<sup>1</sup> (34%) was the next most popular boating activity on the river, followed by waterskiing/tubing (16%) and sightseeing (16%). Six percent of the respondents indicated they also swam from their boats in the river. When on-site boaters were asked to indicate what their primary activity was the day they were interviewed, it closely paralleled the responses for the

<sup>1</sup>Cruising and sightseeing might appear to be similar activities, but for the purposes of this report, cruising is defined as boats moving between activities and/or from their point of departure to their boating location. Sightseeing, on the other hand, is an activity in itself and is usually done for the pleasure and benefit of enjoying the scenic nature and qualities of the river and its various natural amenities. A key identifying distinction can be the slower speed at which the sightseeing boater is moving.



overall activity participation. Fishing (49%), cruising (25%), and waterskiing/tubing (15%) were the primary activities mentioned most often. When boaters were asked what their secondary activities were for the day they were interviewed, sightseeing (43%) and cruising (30%) were mentioned frequently. Fishing (7%) and swimming (7%) were also mentioned as secondary activities by those who reported more than a single boating activity.

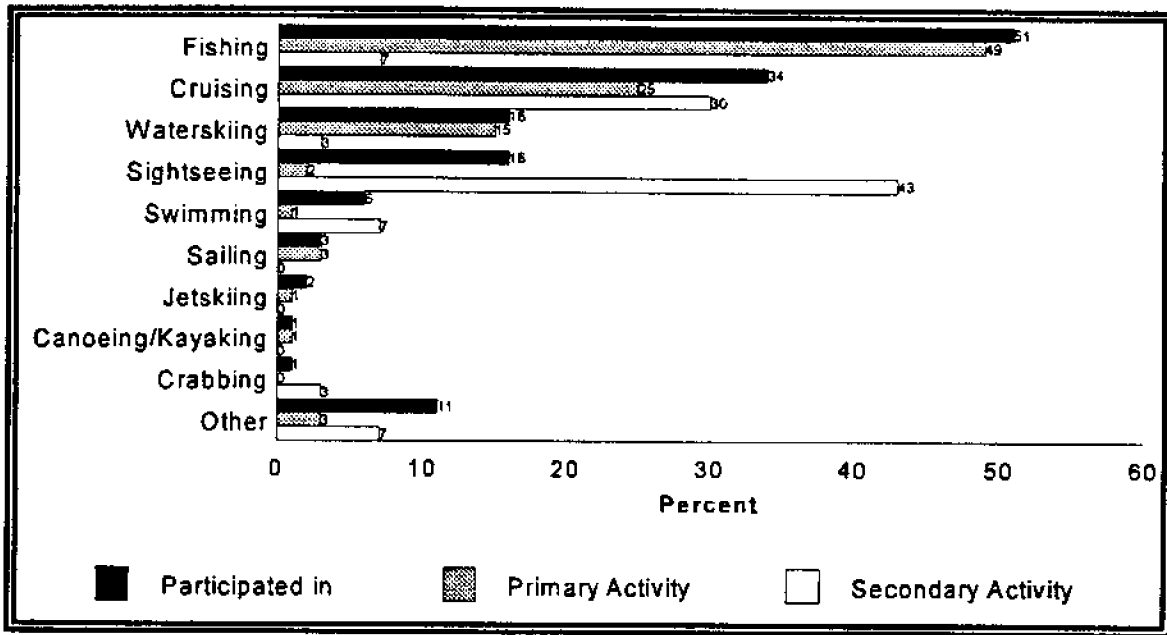


Figure 6. Activity Participation Patterns by On-site Boaters

The average size of a boating group, in the on-site sample, was 2.8 people, with the most common boating group size consisting of two people (39%). The composition of the boating groups was diverse, with families (41%) the largest group make-up, followed by family/friends (27%) and friends (18%).

The majority of the boaters interviewed in the field survey used public boat ramps to launch their boats. There are a number of reasons why boaters select certain ramps. When boaters were asked why they used the particular ramp they were using on the day they were interviewed (Table 2), two-thirds of all respondents (66%) mentioned that it was close to their home or where they were staying, followed by the site being well-maintained (60%). Other important reasons why the particular ramp was selected included parking safety (58%), ease of ramp use (56%), adequate parking (54%), minimal ramp traffic (53%), and proximity to desired destinations on the river (52%).

Table 2. On-site Boaters' Reasons for Using Nanticoke River Launch Ramps

Reasons	Percentage Responding Yes (n=87)
Close to home/other accommodations	66
Well-maintained launch site	60
Safe place to park car/trailer	58
Ease of ramp use	56
Adequate parking	54
Minimal ramp traffic	53
Close to desired destinations on river	52
Other reasons	32

Boaters in the field survey were shown a map and asked to indicate where they had boated on the river during the course of that day's outing. For purposes of this phase of the study only, the map boaters were shown was divided into four geographic zones. Zone 1 (Lower Maryland Nanticoke) extended from the mouth of the river north to Chapter Point, Maryland; zone 2 (Mid - Upper Maryland Nanticoke) extended from Chapter Point northward to the Delaware/Maryland state line; zone 3 (Delaware Nanticoke-Broad Creek) included the portion of river from the Maryland/Delaware state line, northward to Seaford and the Broad Creek; and zone 4 (Marshyhope Creek) included the creek in its entirety (see map in Appendix P). These zones correspond to the river zoning classification presented earlier (Figure 2) with the exception that the middle and upper Maryland zones in the original classification were combined in the field survey zone maps.

The Delaware Nanticoke and Broad Creek region was the busiest section of the river according to field survey respondents. Fifty-six percent of the respondents indicated that they had boated in this section of the river on the day they were interviewed. Thirty-three percent of the respondents boated in the Lower Maryland Nanticoke region. Nineteen percent of the boaters indicated they boated in the Mid-Upper Maryland Nanticoke region on the day they were interviewed, and 15% boated in the Marshyhope Creek. The number of respondents boating in various river sections, however, may reflect where the sampling took place more than the actual use levels for the various sections.

Another useful way to report this data is to identify which sections of the river boaters visited based on where they were interviewed (i.e., the access site they used). The total participation across zones exceeds 100% since boaters could visit multiple sections of the river (Figure 7). One hundred percent of the boaters that were interviewed at the Cedar Hill launch ramp and marina boated exclusively in the Lower Maryland Nanticoke zone.

Boaters who launched their boats from Phillips Landing were more diverse in their boating patterns. Although 98% of them boated in the Delaware Nanticoke-Broad Creek zone, 14% also boated in the Mid-Upper Maryland Nanticoke zone, and 12% visited the Marshyhope Creek. Boaters launching from the Sharptown public ramp were the most diverse in their boating patterns. They divided their boating evenly between the Delaware Nanticoke-Broad Creek area (52%) and the Mid-Upper Maryland Nanticoke zone (52%). These boaters also visited the Marshyhope Creek (39%), and a small number (8%) traveled to the Lower Maryland Nanticoke area (Figure 7).

With minor variations, these patterns suggest that boaters tend to use access sites that are close to their desired boating destinations. Additionally, the Delaware Nanticoke-Broad Creek area is an intensely visited destination for both Delaware and Maryland boaters. These use intensity patterns will be explored more fully in the following discussion on aerial flight observations.

## GIS ANALYSIS USING AERIAL OBSERVATIONS

A Geographic Information System (GIS) is designed for the collection, storage, and analysis of objects and phenomena where geographic location is an important characteristic or critical to the analysis. While handling and analyzing data referenced to a geographic location are key capabilities of a GIS, the power of the system is most apparent when the quantity of data involved is too large to be handled manually. Another advantage of using a GIS is the output of the finished product. Data obtained from different sources (or at different times) can be input into a GIS and appear on the same basemap for display and analysis. A GIS offered the advantage of linking spatial data with attribute data, explaining where and what recreational boating activities were present in the study area.

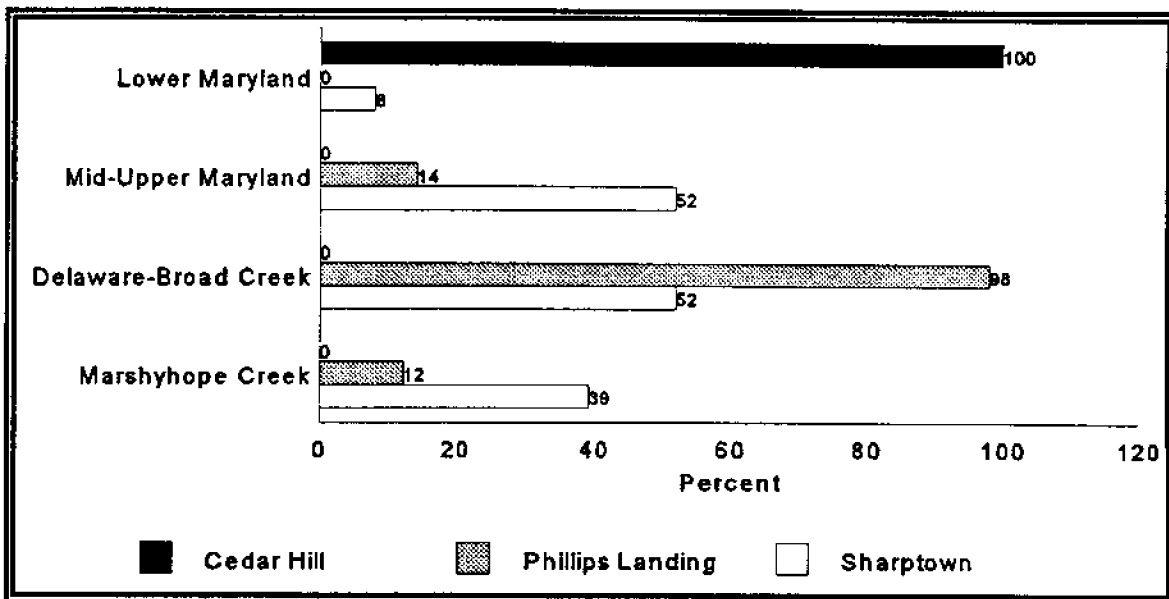


Figure 7. River Sections Used by On-site Boaters, by Boat Access Point (Boaters Could Visit Multiple Sections)

This GIS analysis focuses solely on map data generated from the eight aerial observations conducted during the 1996 boating season. All of the data collected from each flight were aggregated into one GIS map. The intent of aggregating the aerial observation data was to depict recreational boating activity throughout the summer months, on the eight sampling days, and not for just a single day. By aggregating the data, areas of the river that were used most often by certain groups of boaters could be readily identified.

Aerial flight information was used as a data source for the study and each boat recorded by the observers was registered and digitized into the system as a point. Digitized points were not intended to be in scale to the actual size of the boat on the map, rather they represent approximate vessel locations on the river. A color was assigned to each type of boating activity. For example, fishing boats were registered as yellow points, and waterskiers were symbolized by red points. This allowed for both the type and the location of boating activities to be visually apparent on the GIS map.

The total observations for the eight aerial flights completed for this phase of the project were relatively light. They averaged 96 sightings per day, with a range of 47 to 160. On five of the eight flight days, the Delaware Nanticoke-Broad Creek area was the busiest boating area; on the other three days, the MD-Lower area was observed to have the greatest concentration of activity (See Appendix O).

The different recreational use activities examined in this spatial analysis include fishing, cruising, waterskiing, jetskiing, swimming, sightseeing, sailing, crabbing, sailboarding, and canoeing/kayaking. Fishing was the predominant activity observed during the aerial flights, comprising 42% of the total sightings. Fishing was so dominant that it was the top-rated activity on six of the eight days. This was followed by cruising boats (25%) and waterskiing (and tubing behind boats) which represented 13% of all the activity observed. Jetskiing (5%), swimming from boats (4%), sightseeing (3%), sailing (3%), crabbing (2%), canoeing/kayaking (2%) and sailboarding (<1%) represented the remainder of activities that were observed through this phase of the study (Table 3).

As previously characterized, five areas of the Nanticoke River and tributaries were identified to geographically segment the watershed: Maryland-Lower, Maryland-Middle, Maryland-Upper, Marshyhope Creek, and Delaware Nanticoke-Broad Creek. The total activity level recorded in each section for all eight aerial flights is depicted in Table 4. The Delaware portion of the river, which includes the northern-most section of the Nanticoke River and Broad Creek had the highest number of activity sightings (n=245), followed closely by the southern-most section of the river, at the mouth of the Chesapeake Bay, with 244 activity sightings. These two river segments accounted for 64% of the total activity observed over the eight days of aerial flights. The Marshyhope Creek accounted for another 18% of the total activity, the MD-Upper area accounted for 13%, and only 5% of the total boating activity was observed in the MD-Middle area.

#### Boater Activity Locations

The ability to prepare maps depicting boater activity locations, using GIS methods, helps to present a clearer picture of activity patterns and makes it possible to begin assessing intensely used areas and possible conflicts between users. This analysis provides resource managers with another tool to consider in the management of boating activity on the Nanticoke River and its tributaries. It can be used together with the mail and on-site survey results to target areas in need of further attention by managers.

Table 3. Total Recreational Activity Sightings Based on Eight Aerial Flights

Recreational Use	Number Of Activity Sightings	Percentage
Fishing	326	42
Cruising	191	25
Waterskiing	99	13
Jetskiing	38	5
Swimming	34	4
Sailing	26	3
Sightseeing	22	3
Crabbing	16	2
Canoeing/Kayaking	16	2
Sailboarding	1	<1
TOTAL	769	100

Table 4. Total Recreational Activity Sightings Observed on Nanticoke River Segments Based on Eight Aerial Flights

River Segment	Number Of Activity Sightings	Percentage
DE Nanticoke-Broad Creek	245	32
MD-Lower	244	32
Marshyhope Creek	137	18
MD-Upper	101	13
MD-Middle	42	5
TOTAL	769	100

Figure 8 displays all of the activity points where boaters were engaged in an activity (represented by 10 colors) in the most heavily used section of the waterway--Delaware Nanticoke-Broad Creek. The most common activities observed were fishing (37%), cruising (27%), and waterskiing or tubing behind boats (22%). The remaining activities observed accounted for less than 14% of the total activity locations (Table 5).

In addition to being the most heavily used zone within the study area, many areas are quite narrow (Broad Creek in particular). Phillips Landing public boat ramp is located near the convergence of Broad Creek and the Nanticoke River. Ample parking for cars and trailers, and a park-like setting, make this one of the more popular boat launch sites for Delaware-registered boaters. Another public boat launch site is located in Seaford, Delaware, providing additional access to this portion of the river for boaters. A number of shoreline residents also keep their boats at docks or piers along this segment of the river.

This section of the river is used by the widest variety of boaters. Anglers, waterskiers, jetskiers, paddlers, and pleasure boaters all recreate here. A number of fishing tournaments are also held in the region during the summer months, mainly on weekends. Many of those anglers use bass boats, which have a low draft and high-powered outboard motors, usually exceeding 100 horsepower.

The potential for conflicts in this region could increase as additional boaters use this portion of the waterway. Due to the narrower width of some sections of the river and Broad Creek, in particular, the likelihood of boaters encountering one another is greater than in the southern portions of the study area. Results reported from the on-site survey of boaters indicated that fishermen cite jetskiers and waterskiers as sources of conflict. Some respondents mentioned that while they are stationary fishing, boats towing waterskiers maintain a high rate of speed in order to avoid "dunking" the skier while passing their stationary boats. While this may not pose a problem in wider areas of a water body, in the narrower sections of this portion of the river it may cause undesired wakes that disturb and disrupt stationary anglers.

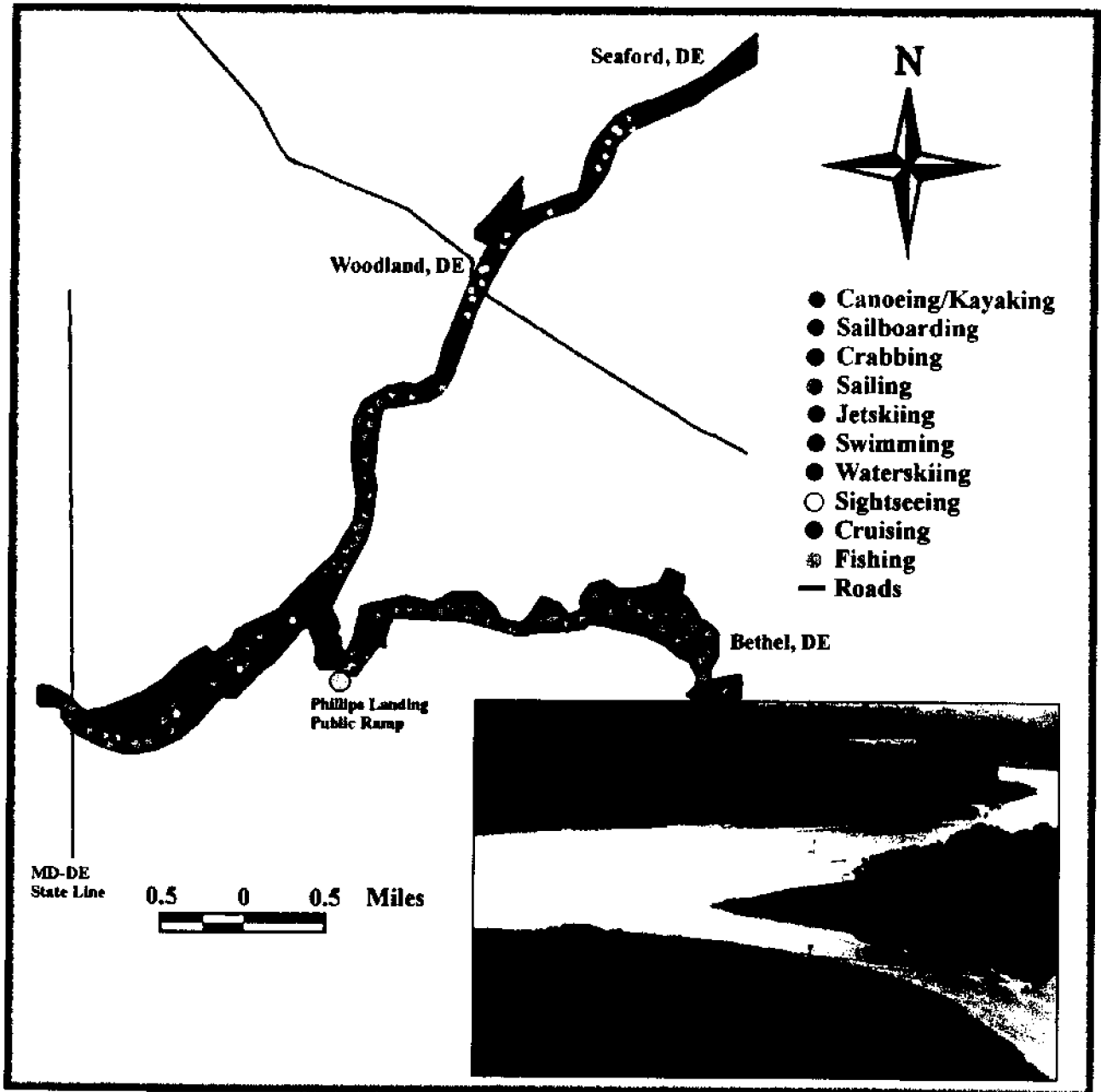


Figure 8. Point-pattern Map of Observed Activity Sites for Delaware Nanticoke-Broad Creek River Segment (Points are not to scale, but represent approximate locations of activity sites.)



Table 5. Recreational Activity Participation by Nanticoke River Segments Based on Eight Aerial Flights

Activities	MD-Lower <sup>1</sup>	MD-Middle <sup>2</sup>	MD-Upper <sup>3</sup>	Marshyhope Creek <sup>4</sup>	DE Nanticoke-Broad Creek <sup>5</sup>
Fishing	54%	29%	29%	45%	37%
Cruising	18	45	26	26	27
Waterskiing	2	0	27	10	22
Jetskiing	1	19	9	2	6
Swimming	5	0	7	7	2
Sailing	10	0	1	0	0
Sightseeing	5	0	1	4	2
Crabbing	5	7	1	0	0
Canoeing & Kayaking	0	0	0	5	4
Sailboarding	0	0	0	0	0
Total	100%	100%	101%*	99%*	100%

\*Does not equal 100% due to rounding

<sup>1</sup>From mouth of Chesapeake Bay, north to Chapter Point

<sup>2</sup>From Chapter Point, north to Vienna, MD

<sup>3</sup>From Vienna, MD, north to DE border

<sup>4</sup>From convergence of creek with Nanticoke River, north to Federalsburg, MD

<sup>5</sup>From DE Border, north to Seaford, DE, and Broad Creek, east to Bethel, DE

The next most-heavily used section of the river is the Maryland-Lower segment (Figure 9). This section is the widest segment of the study area, oftentimes exceeding one and a half miles in width. Over the eight-day sampling period, 244 activity sightings were observed. The most frequent activities observed in this zone included fishing (54%) cruising (18%), and sailing (10%). Equal amounts of crabbing (5%), swimming (5%), and sightseeing (5%) were also observed in this southern-most segment of the river (Table 5).

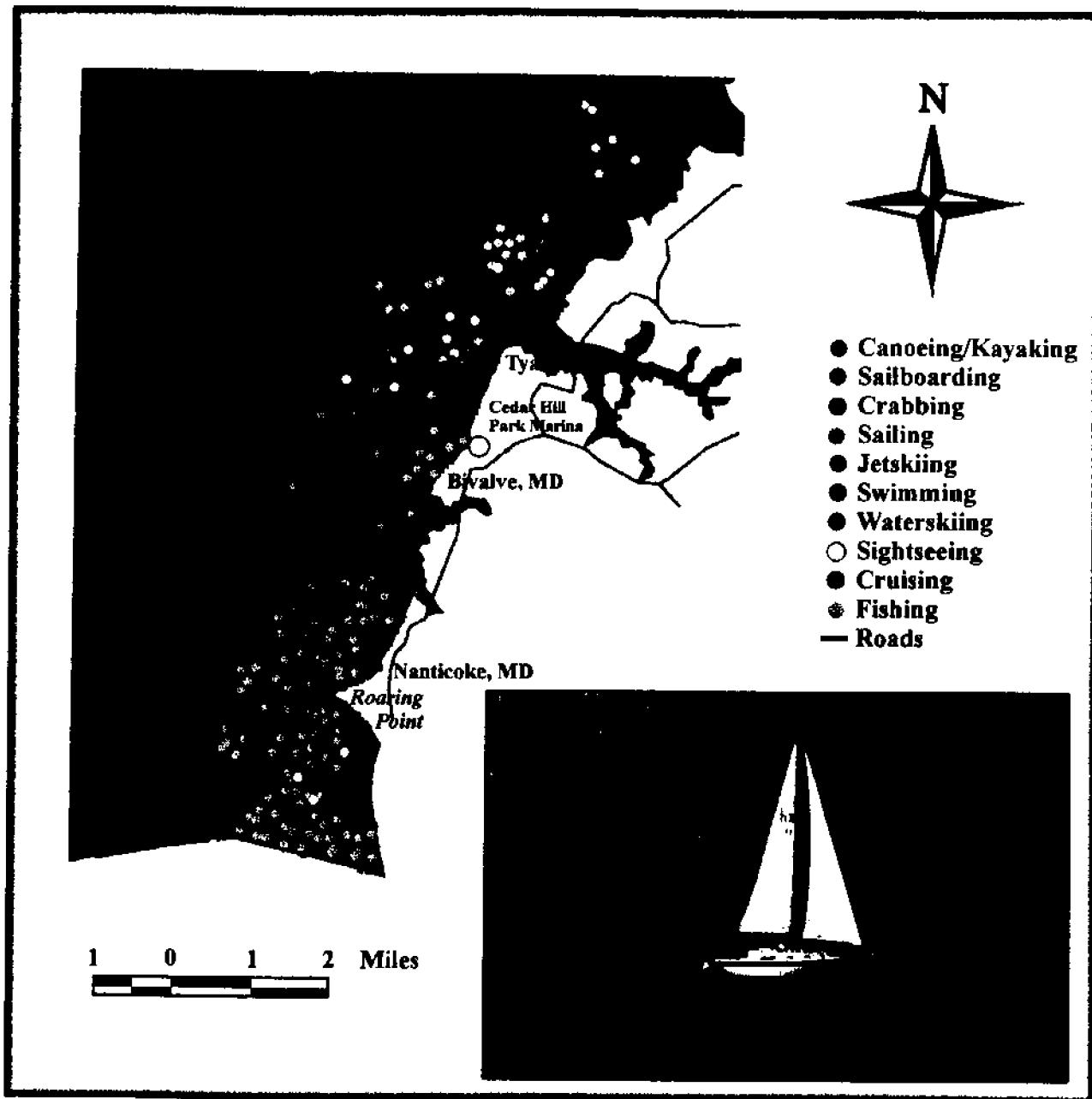


Figure 9. Point-pattern Map of Observed Activity Sites for Maryland-Lower River Segment (Points are not to scale, but represent approximate locations of activity sites.)

The probability of conflict between activities in this zone is low due to the extensive width of this section of the river and the widespread distribution of use. For example, the near absence of waterskiers (2%) and jetskiers (1%) greatly diminishes the probability of encounters with fishermen. Swimming also takes place in this area, specifically near the small, sandy beaches of Roaring Point. The fact that only a few swimmers were observed over the summer, and that they appeared to be swimming in close proximity to shallow waters along the shoreline in the widest section of the river, lessens the potential conflicts between boaters and swimmers.

The Marshyhope Creek was designated as a separate segment of the river due to its length and the unique physical characteristics that it possesses (Figure 10). Far fewer total activity sightings (n=137) were observed on this segment of river than on the two previously discussed. However, there is still a need to be aware of total boating activity since the creek narrows in the upper reaches, approaching the town of Federalsburg, Maryland. The major activities observed on this river segment included fishing (45%), cruising (26%), and waterskiing (10%). Five percent of the observed activity sightings were canoeing/kayaking; this was one of only two sections of the entire waterway where this activity was observed (Table 5).

Even though boating is fairly light in this segment of the waterway, boaters here are more apt to encounter one another due to the creek's narrow width. The nearby Phillips Landing public boat launch facility and the Sharptown public ramp, along with two launch ramps in Federalsburg, offer convenient access to the Marshyhope Creek. For these reasons, the potential for boater conflicts is present in the Marshyhope Creek area. For example, sightseers and paddlers, which include both canoers and kayakers, often are on the water to observe and reflect on the environment surrounding them, traversing the water at slow speeds. Jetskiers and waterskiers tend to view the surrounding environment as an arena for their high-speed activities. The narrower width and winding course of the creek make close encounters more likely and could present safety concerns. Boat wakes may have a greater effect on slow-moving and stationary boats in the creek than in wider portions of the study area.

Figure 11 depicts the Maryland-Upper portion of the waterway. This section of river showed three major activities as being dominant and nearly equal (Table 5). They included fishing (29%), waterskiing (27%), and cruising (26%). Nine percent of the total activity sightings were jetskiing, and 7% were swimming.

This section of the river is a relatively heavily used section of the study area, even though total observations recorded were low. The public boat launch facility at Sharptown, Maryland, was one of the more heavily used access sites during the study period, with the greatest concentration of activity occurring near the boat launch facility itself. Shore-side swimming adjacent to the boat ramps is also popular; however, this is less of a safety concern than it may appear because a designated swimming area has been roped off to keep swimmers away from boat launching and landing. The segment of the river near the public access site ranks as a potential area of concern, due to the multiple uses occurring simultaneously and the presence of jetskiing and waterskiing activities, which comprised more than one-third of the total activity observed.

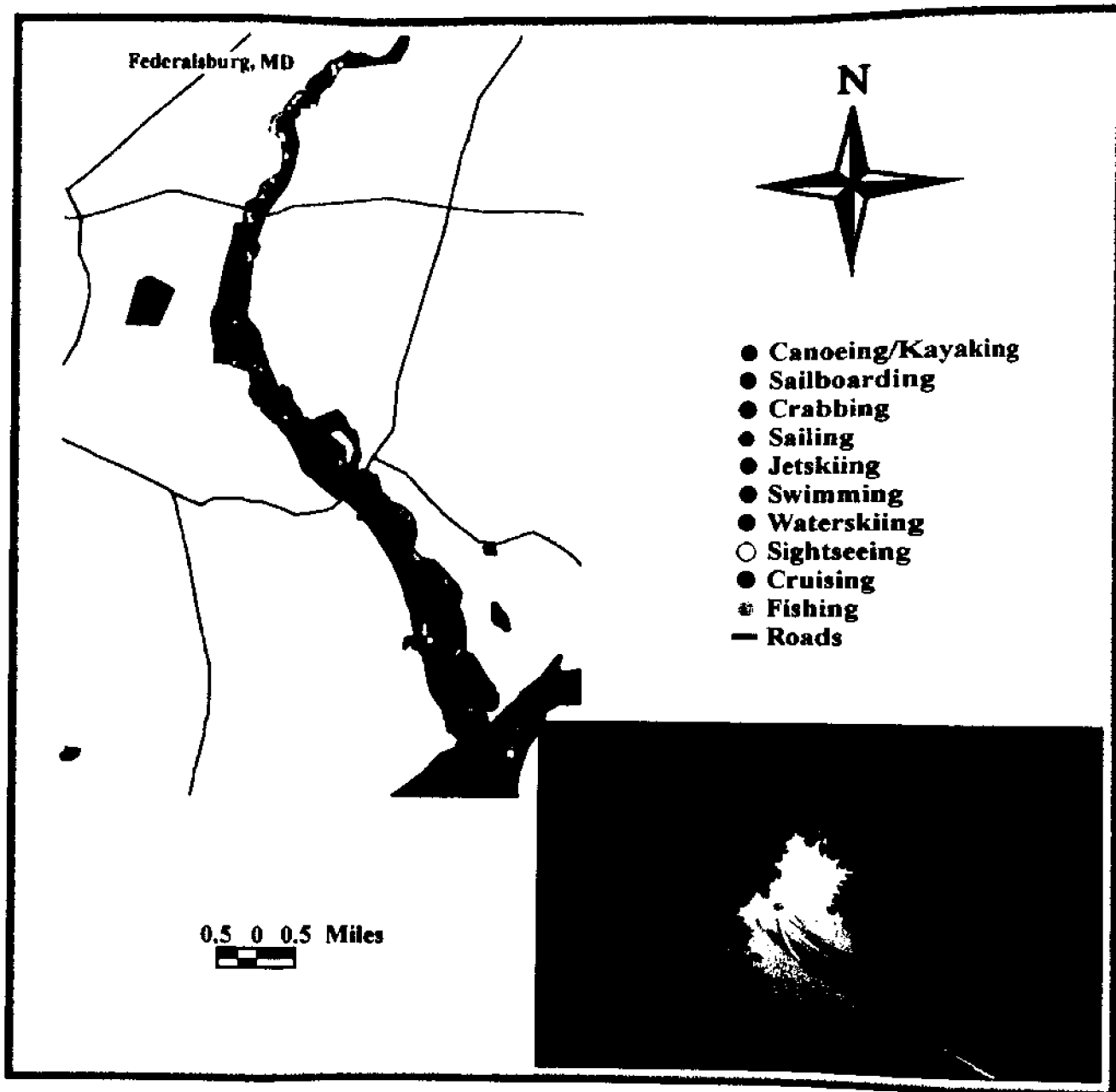


Figure 10. Point-pattern Map of Observed Activity Sites for Marshyhope Creek River Segment (Points are not to scale, but represent approximate locations of activity sites.)

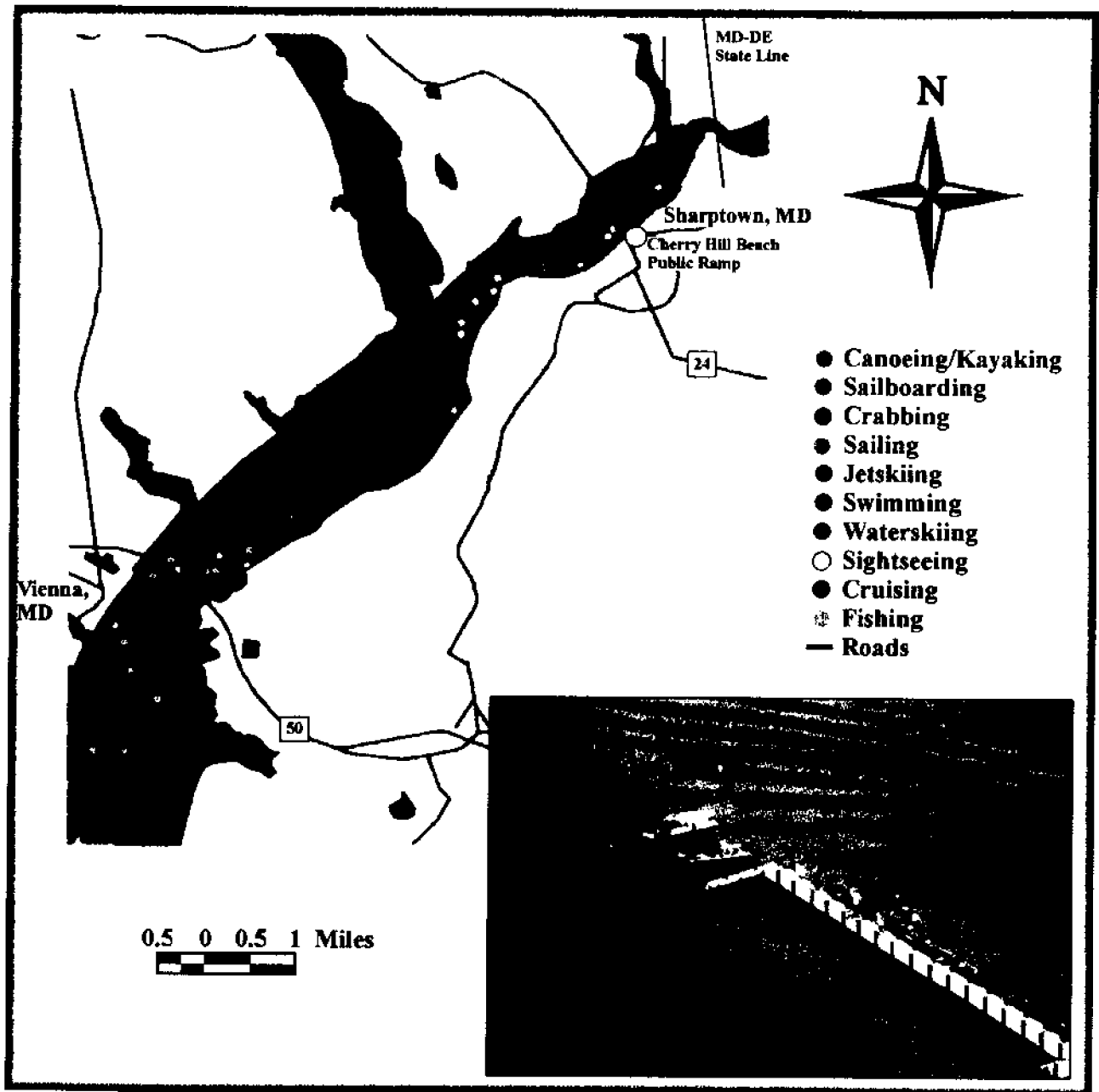


Figure 11. Point-pattern Map of Observed Activity Sites for Maryland-Upper River Segment (Points are not to scale, but represent approximate locations of activity sites.)

The least populated section of river, as determined by aerial observations, was the Maryland-Middle segment (Figure 12). Only 42 total activity sightings were counted on the eight sampling flights. Three activities dominated this section of river--cruising (45%), fishing (29%), and jetskiing (19%). The remaining activities sighted accounted for only 7% of the total activity observed in this section (Table 5).

Recreational boating is limited in this area, which averages about half a mile wide. Most boating is concentrated in the northern section of this river segment, near the Route 50 overpass. There is a small public boat launch facility in Vienna, Maryland, but it was found to be minimally used over the course of the study period. Very few, if any, conflicting uses should occur between boaters in this region, due to the absence of a major boat launching facility and a relatively wide section of river.

### REASONS FOR BOATING ON THE NANTICOKE

Boaters engage in water-related activities for a variety of reasons. They primarily use the Nanticoke River and its tributaries to participate in specific recreational activities with their watercraft. However, there are other attributes that also make the water body an attractive resource to enjoy. To better understand why Nanticoke River boaters use the resource for their boating enjoyment, a list of 11 reasons was presented to both on-site and landowner boaters. Boaters were asked to indicate whether each reason was important to their selection of the Nanticoke for their boating experience (Figure 13). Overall, the reason that received the highest response rate by on-site boaters was its peaceful location (80%). This was followed closely by the scenic quality of the river and its tributaries (75%), adequate water depth (74%), close to their home or where they were staying (73%), and there were adequate channel markers on the river (71%). The lowest rated reason for boating on the Nanticoke River, according to on-site boaters, was good swimming (32%).

When landowner boaters' responses were examined, a number of responses were very different from those selected by on-site boaters. Landowning boaters' top choices for boating on the river included opportunities to observe wildlife (79%), there was not a lot of other boating (76%) and the river's wide channel (69%). The reasons least likely to influence boating on the river included adequate channel markers (16%) and adequate water depth (24%).

The extreme differences presented between boating groups for certain variables (e.g., adequate markers, adequate water depth, peaceful location, and scenic qualities) suggest that not all segments of boaters are alike and that they are looking for a variety of experiences while using the river. This being the case, it becomes even more important for resource managers and decision makers to fully understand what motivates users to insure that management measures are successful in achieving desired goals.

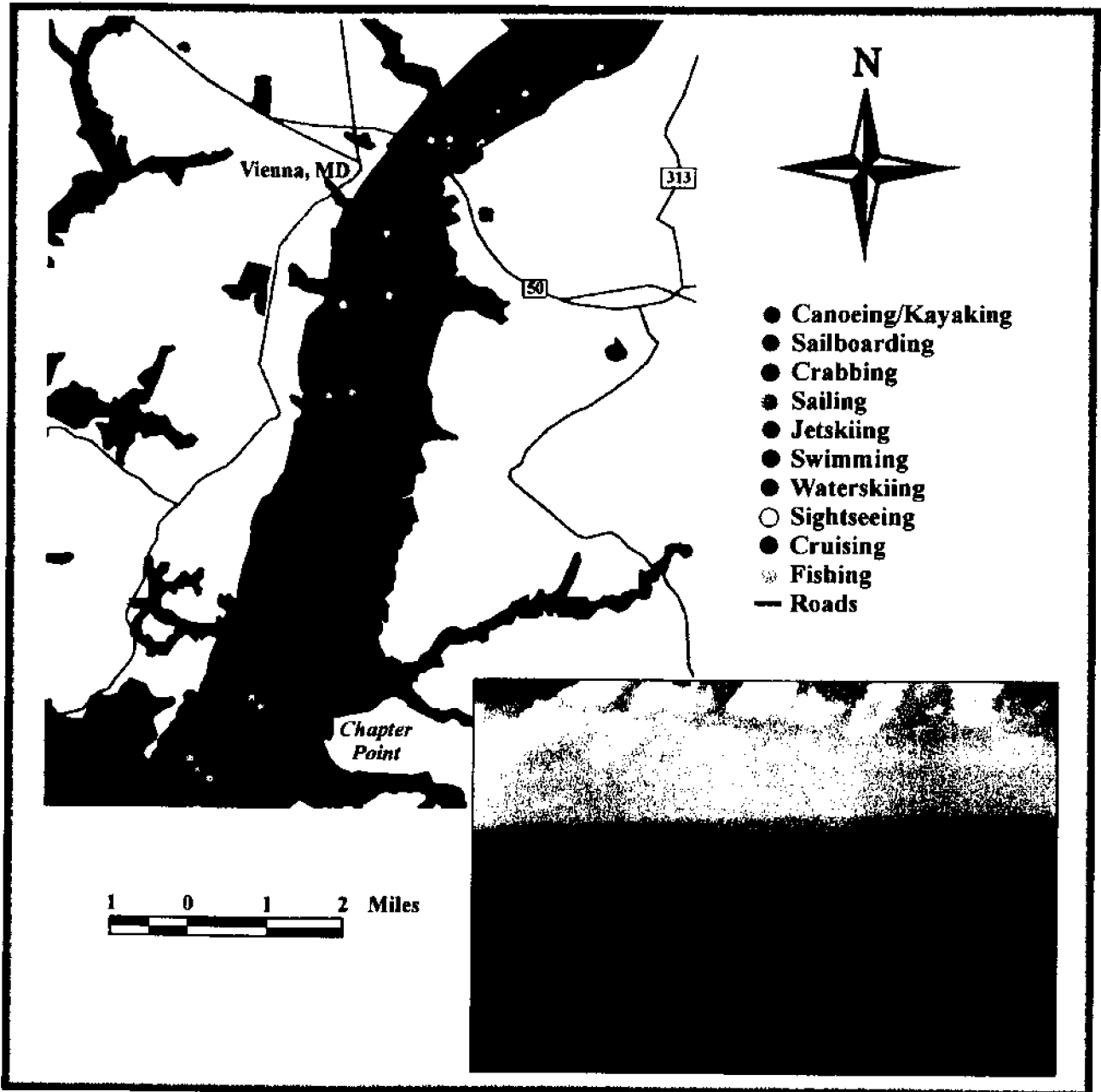


Figure 12. Point-pattern Map of Observed Activity Sites for Maryland-Middle River Segment (Points are not to scale, but represent approximate locations of activity sites.)

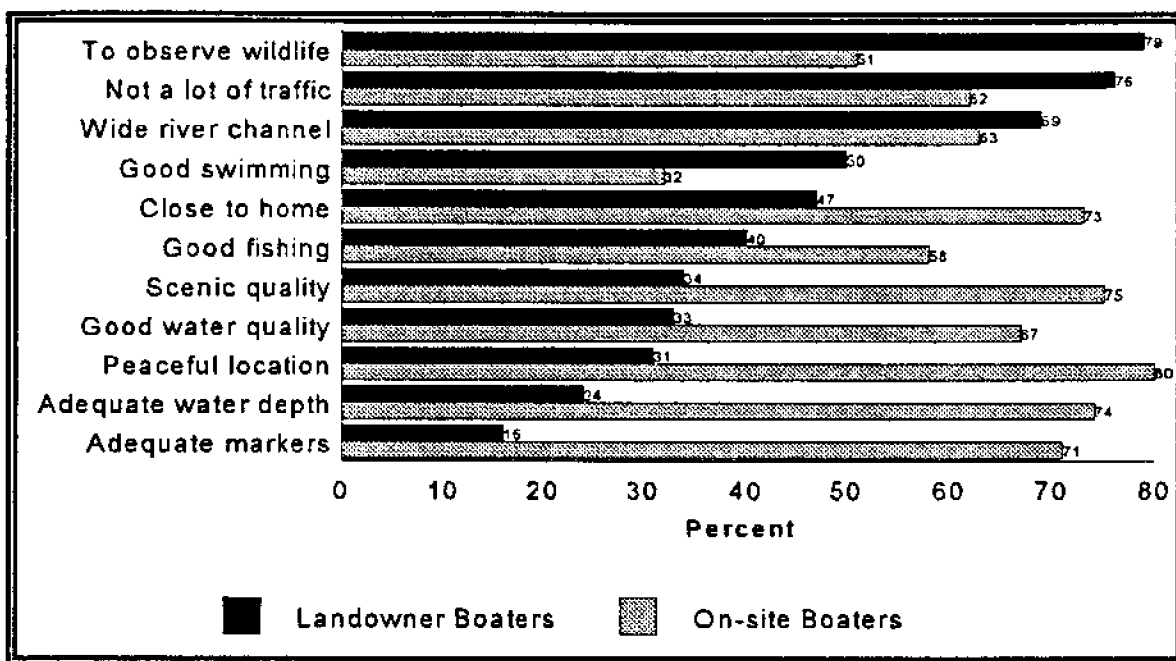


Figure 13. Reasons for Boating on the Nanticoke River and Tributaries by Landowner and On-site Boaters

#### PERCEPTIONS OF RECREATIONAL BOATING QUALITY

On-site boaters were also given the opportunity to rate boating conditions on the river on the day they boated. A series of statements were read by interviewers, and boaters were requested to respond to each of the statements. A five-point scale was used, with 1=strongly disagree and 5=strongly agree. The statements dealt with various concerns, ranging from safety issues to concerns about law enforcement and public access.

Three statements received fairly strong agreement from respondents in the field (Table 6). They included *I thoroughly enjoyed my boat trip today* (4.38 mean response rating and 96% agreed or strongly agreed); *boating conditions on the river and its tributaries were safe* (4.08 mean response rating and 89% agreed or strongly agreed); and *there are adequate law enforcement patrols on the river and its tributaries* (3.41 mean response rating and 58% agreed or strongly agreed).

The statements that boaters tended to disagree with were those that pointed towards negative behavior by boaters on the water or unsafe boating conditions for boaters (Table 6). These included *I nearly had an accident on the river because of crowded conditions* (1.55 mean response rating and 1% agreed or strongly agreed); *commercial boat traffic created conditions*



*that were hazardous* (1.65 mean response rating and 0% agreed or strongly agreed); *the behavior of other boaters interfered with the quality of my boating experience* (1.80 mean response rating and 9% agreed or strongly agreed); and *the noise of other boats reduced my enjoyment on the river and its tributaries* (1.87 mean response rating and 0% agreed or strongly agreed). The low number of boaters who agreed or strongly agreed to these statements further confirms that boating activity on the river overall is considered safe and that there is currently little concern about conflicts among the recreational boaters.

Table 6. On-site Boaters' Ratings of Conditions on the Nanticoke River (Mean Rating Based on Five-point Scale: 1=Strongly Disagree & 5=Strongly Agree; n=93)

Statement	Mean Response Rating	% who Agree/ Strongly Agree
Thoroughly enjoyed boat trip	4.38	96
Boating conditions on river were safe	4.08	89
Adequate law enforcement on river	3.41	58
Amount of public access limits my use of river	2.30	18
Other boats came closer to my boat than I liked	2.16	12
Noise of other boats reduced my enjoyment on river	1.87	0
Behavior of other boaters interfered with the quality of my boating experience	1.80	9
Commercial boat traffic created hazardous conditions	1.65	0
I nearly had an accident on the river because of crowded conditions	1.55	1

To further test whether or not on-site boaters had an enjoyable boating experience, they were asked to rate the quality of their overall boating trip on the day they were interviewed. A 10-point scale was used with a rating of 10 signifying a perfect trip. The mean response rating for all on-site boaters was 8.3, with 83% of respondents rating the day's boating experience a level of 8 or greater.

Oftentimes, crowded boating conditions may lead to boater conflicts and possibly accidents. With this in mind, on-site boaters were asked to rate the crowding levels on the river the day they were interviewed using a 9-point scale, with 1=not at all crowded and 9=extremely crowded (Figure 14). Fifty percent of the responding boaters indicated the lowest level of crowding (1), and no boaters indicated the highest (9). The mean crowding level was 2.4 on the 9-point scale.

A follow-up question asked on-site boaters how they would respond to greater crowding levels on the river in the future. They were given a hypothetical situation, with a randomly selected level of crowding that was higher than the level they reported for their experience, and asked if they would spend fewer days boating on the river if this condition prevailed throughout the boating season. Respondents were divided in their responses, with 45% indicating they would spend fewer days boating if it were more crowded and 55% indicating they would not change their behavior. The response varied by the extent of crowding posed in the question. Only 6% reported they would boat less frequently if crowding increased to the *slightly crowded* level, while 53% would boat less if it were *moderately crowded*, and 59% would boat less if it increased to *extremely crowded* conditions. When asked how many fewer days they would boat if conditions were more crowded, 23% reported they would not boat at all under the more crowded conditions, and 32% reported they would reduce their participation by 50%. Another one-third (33%) would reduce their boating between 10 and 40%, and the remaining 10% would reduce their participation by 80 to 90%.

When asked to rate their perceptions of crowding on the river using the same 9-point scale, landowning boaters rated the river 3.23 on average (Figure 14). Sixty-five percent of the respondents rated the crowding low (between 1 and 3), 22% rated it medium (between 4 and 6), and 13% rated the crowding high (between 7 and 9). It is important to note that residents were asked to describe the level of crowding throughout the boating season compared to on-site boaters who were asked to provide their daily impression of conditions. This may, in part, explain the higher average rating for landowners (3.2) than for on-site boaters (2.4).

Landowners also were asked how they would respond if conditions on the Nanticoke River became more crowded. A majority (51%) reported that they would spend fewer days boating if the river became *extremely crowded*. This is comparable to the 59% of on-site boaters who stated they would boat less under *extremely crowded* conditions. Most of the landowner boaters (69%) indicated they would reduce their boating participation by 50% or less. (It should be noted that, due to the mail survey format for data collection, landowners were not given different levels of crowding in a hypothetical scenario--they were all asked how they would respond to the worst-case scenario of extreme crowding).

#### Landowner Perceptions of Recreational Boating Traffic

When property owners were asked to describe the level of recreational boat traffic along the river, the following pattern emerged. Thirty-eight percent of the respondents reported heavy (9%) or moderate (29%) traffic. Forty-four percent indicated they felt the recreational traffic was light, and 19% had no opinion. Property owners generally felt that recreational traffic was heavier than commercial traffic on the river (see discussion on page 40), although the majority still considered recreational traffic to be light or had no opinion about it.

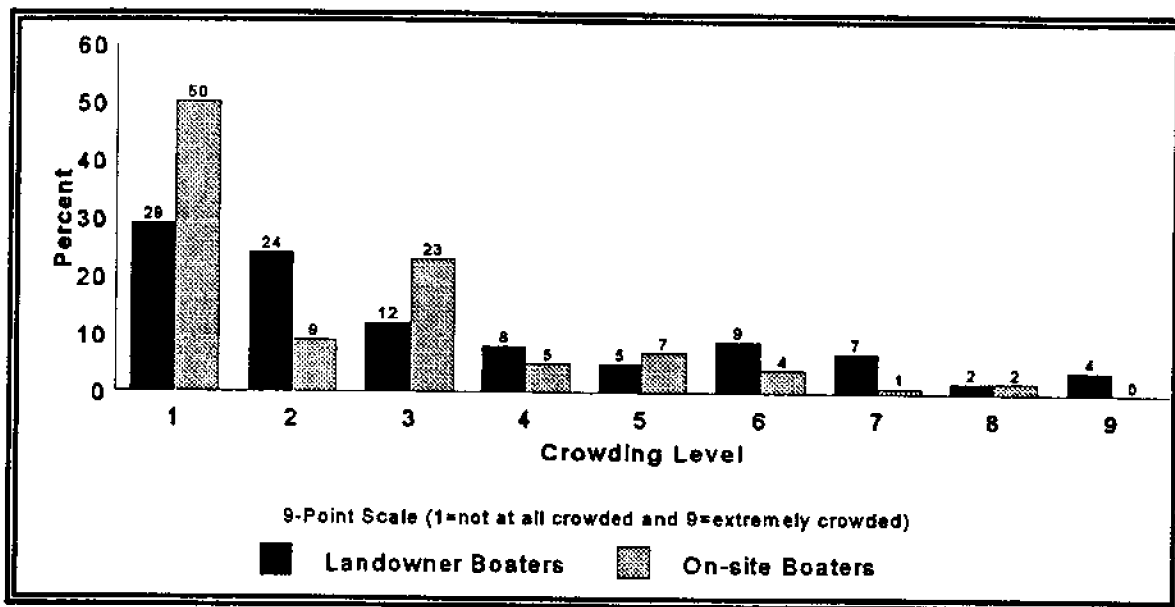


Figure 14. Comparison of River Crowding Conditions by Landowner and On-site Boaters

Property owners were also requested to indicate whether recreational boating contributed to any of a series of negative factors on or near their property (Table 7). Property owners were most likely to respond that boaters always or sometimes caused pollution and litter in the river (38%), shoreline erosion (36%), disturbance to wildlife (32%), and safety hazards on the river (32%). They were least likely to cause damage to docks and piers (18%). Generally, about one-third of the landowners felt recreational boating contributed to each of the problems listed. These percentages were considerably greater than the corresponding values for commercial traffic (see Table 9, page 41), and are not surprising in light of the heavier recreational traffic perceived by the resident landowners

#### Commercial Users' Perceptions of Recreational Boating Traffic

Tug and barge operators were asked a series of questions to gauge their impressions of whether recreational vessels caused navigational problems to them. When asked to rate the level of recreational vessel traffic, 13% rated the recreational vessel traffic heavy, 33% rated it moderate, and 53% rated it light (similar to their rating of the commercial traffic). Forty-three percent of respondents believed that there were concentrated areas of recreational vessel use along the river, primarily in the northern Nanticoke River area between Sharptown, Maryland and Seaford, Delaware.

Table 7. Landowners' Perceptions of the Effects of Recreational Boating Traffic on the Nanticoke River (Percentage claiming "Always" or "Sometimes" Contributes; n=128)

Factor	Landowners' Responding (%)
Pollution/litter in river	38
Shoreline erosion	36
Disturbance to wildlife	32
Safety hazards on river	32
Excessive water turbulence	31
Uncomfortable noise levels	30
Invasion of privacy	27
Damage to docks/piers	18

When asked if recreational vessels posed a hazard to their navigation, 53% responded that boaters did pose navigational problems. The following were identified as causing the most navigational problems: waterskiers (86%), jetskis (86%), powerboats under 20 feet in length (57%), and powerboats over 20 feet in length (29%).

Forty percent of the operators responded that recreational boaters seldom (27%) or never (13%) follow general rules of navigation along the river. Eighty-six percent of tug/barge operators indicated that they perceived recreational boaters seldom (53%) or never (33%) use marine radios to monitor bridge-to-bridge communication between commercial transport vessels along the river. Sixty-seven percent indicated that recreational boaters seldom (40%) or never (27%) respond to common whistle signals by commercial transport vessels along the river.

Commercial shipping firms were asked if there were any factors which would prohibit them from using the river as a shipping route in the future. Only 14% (one response) indicated that increasing recreational boating traffic on the river would prohibit their use of the river as a shipping route. However, should this occur, only a 10% decrease in shipping levels would be realized.

#### COMMERCIAL TRANSPORT ON THE NANTICOKE RIVER

In addition to the recreational boating traffic on the Nanticoke River, there is a significant amount of commercial shipping that occurs. This activity is primarily tug and barge traffic which transports various products (fertilizer, fuel oils, grain and gravel, etc.). Commercial shipping activity can be seen all hours of the day and night, seven days a week.

## Commercial Shipping

Overall, seven responses were received from officials at businesses located along the river who used shipping companies to transport products. The average number of trips per year that each company engages in is 56 (this includes each passage up or down the river as a separate trip). This figure ranges from a low of 26 trips to a high of 130 trips annually.

When firms were asked why they used the river as a shipping route, the primary response was that it was cost effective (86%), followed by it creates fewer environmental impacts than land transport (29%) and it is faster than land transport (29%). Other reasons mentioned were that it was centrally located and that it was the best way to transport large quantities of product in a short period of time. Firms were also asked if there were any factors which would prohibit them from using the river as a shipping route in the future. Of the options presented, increased costs (86%) and increasingly hazardous navigational conditions (57%) received the greatest number of responses.

When asked if they were aware of any navigational difficulties, 43% of the officials indicated that they were aware of certain navigational problems along the river, which included difficulties in navigating through the Sharptown bridge, especially in the fog, and poor response time by railroad bridge attendants.

Forty-three percent of the respondents felt that there were safety concerns along the river. Concerns focused around issues related to shoaling and the need for adequate dredging and recreational boats speeding through commercial loading areas (see Appendix H for additional comments by commercial shippers).

## Tug/Barge Operations

A total of 15 tug/barge operators responded to the survey instrument designed specifically to gain their insight and knowledge of operating commercial vessels along the river. These respondents had an average of 13.8 years experience navigating commercial vessels on the Nanticoke River. This ranged from a low of one year to a high of 40 years navigating the river.

Forty percent of the responding tug/barge operators make between 50 and 100 trips on the river annually (each passage up or down the river counts as one trip). Twenty-seven percent indicated they make between 25 and 50 trips per year, 7% indicated they made between 10 and 25 trips, and 27% reported making less than 10 trips annually along the river. Two-thirds of all respondents reported that their navigation schedule was the same throughout the week, with no preference for weekdays or weekends. See Table 8 for a listing of reported barge traffic on the river between May 1 and September 30, 1996.

When asked to provide their impressions of the amount of commercial traffic along the Nanticoke River (selecting between heavy, moderate, light, or no traffic), 47% of the operators indicated they thought it was moderate, and 53% felt it was light. Tug and barge operators were asked to indicate if there were problem areas along the river. With regards to maneuverability, 77% indicated there were areas along the river that were difficult to maneuver in. These areas included Hawks Nest Shoal to Seaford, Delaware, Woodland Ferry to Seaford, and near the Vienna (Maryland) Bridge in a moving current.

When asked about problems of visibility along the river, 40% indicated that there were visibility problems along the river. These locations included from Sharptown, Maryland, through Woodland, Delaware, and up to Seaford.

Sixty-two percent of the operators noted that there were other safety concerns along the Nanticoke River. Some of these included issues related to shoaling, piers and docks sticking out into the river too far and too close to turns, and boats speeding around curves too fast (See Appendix I for additional comments by tug and barge operators.).

#### Landowner Perceptions of Commercial Traffic

When asked to describe the level of commercial traffic (barges, tugs, etc.) on the river, only 17% of property owners surveyed indicated that they felt it was heavy (1%) or moderate (16%). Fifty-eight percent indicated they felt it was light, while another 25 percent had no opinion on the level of commercial traffic.

Property owners were provided a list of negative factors that may be caused by commercial shipping traffic along the river and near their property. They were asked to indicate whether commercial activity always, sometimes, seldom, or never contributes to the factors identified. They also had the option of indicating no opinion, if they were unsure of the effect of shipping on a certain factor. Shoreline erosion (21%) was the factor that property owners most often felt was always or sometimes caused by commercial shipping activity (Table 9). Water turbulence was the next most highly rated factor; 10% of the owners indicated that it was always or sometimes caused by shipping traffic. Invasion of privacy (2%) and uncomfortable noise levels (3%) were rarely attributed to shipping traffic according to property owners.

Table 8. Reported Barge Traffic on the Nanticoke River\*

May Dates		June Dates		July Dates		August Dates		September Dates	
Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart
1	1	1	1	8	8	1	2	12	12
6	6	4	4	11	12	6	6	15	15
7	7	5	5	11	11	13	14	23	23
11	11	5	6	17	17	15	15	27	27
14	14	10	10	18	18	16	17	30	30
15	15	11	11	22	22	26	26		
20	20	13	14	22	24				
23	23	14	14	25	25				
24	24	14	14	26	26				
25	25	21	21	30	30				
29	29	24	24	30	31				
30	30	24	24						
		26	26						
		28	28						
		28	28						

\*This table presents arrival and departure dates for barge traffic on the Nanticoke River between May and September 1996, as reported by four businesses using the river to transport products. Most of the reported barge traffic traveling on the Nanticoke River arrives and departs on the same day. Of the 50 round trips depicted in this table, 84% were same-day trips.

Table 9. Landowners' Perceptions of the Effects of Commercial Shipping Traffic on the Nanticoke River (Percentage claiming "Always" or "Sometimes" Contributes; n=123)

Factor	Landowners' Responding (%)
Shoreline erosion	21
Excessive water turbulence	10
Disturbance to wildlife	7
Damage to dock/piers	5
Pollution/litter in river	5
Safety hazards on river	5
Uncomfortable noise levels	3
Invasion of privacy	2

#### ENVIRONMENTAL CONCERNS

According to the Chesapeake Bay Foundation (1996), the natural resources of the Nanticoke Watershed support the ecology, economy, and culture for much of the Delmarva Peninsula. The river drains over 718,000 acres of wetlands, forests, and farmland; with these habitats supporting a vast array of natural resources. These valuable assets need to be closely monitored to insure human activities do not cause irreversible negative impacts. Efforts are currently underway in both Delaware and Maryland to help protect and enhance the river's attractive resource base. Delaware officials have designated the river as "ERES" waters, thereby recognizing the river's distinct value as an Exceptional Recreational and Ecological Resource. In Maryland, the Department of Natural Resources, Natural Heritage Program has identified the upper Nanticoke and three of the river's tributaries as Natural Heritage Areas.

Since many recreational boaters indicated the importance of the river's natural resources as a reason for boating on the water body, their views and concerns are relevant to the study. A series of questions solicited boaters' input on issues with environmental overtones. In addition, boaters' activities are examined with regard to some key environmental issues identified in the river and tributaries.

#### Perceived Changes in Environmental Quality

Two on-site survey questions sought to gain the perceptions of river users on how the environmental quality and living resources of the Nanticoke River were faring. When asked to rate the overall environmental quality of the river and its tributaries over the past 10 years, or



since they have been visiting the river, 24% of boaters felt that it was improving, 16% indicated they felt it was deteriorating and 60% felt that it was not changing very much or were not sure (Figure 15). When the boaters were asked to rate the conditions of the living resources (e.g., fish, crabs, clams) in the river, one-quarter felt they were improving, 28% reported they felt they were deteriorating and 47% felt they were not changing very much or were not sure of the condition of the resources.

Similar to the field survey of boaters, these two questions were used to gain perceptions of property owners on how the environmental quality and living resources of the Nanticoke River were faring. When asked to rate the overall environmental quality of the river and its tributaries over the past 10 years, or since they have been visiting/living in the area, 20% felt that it was improving, 12% indicated they felt it was deteriorating, and 68% felt that it was not changing very much or were unsure. When owners were asked to rate the conditions of the living resources in the river, 12% felt they were improving, 40% reported they felt they were deteriorating, and 48% felt they were not changing very much or were not sure of the condition of the resources.

In comparison, landowners were less likely than boaters to say they were not sure to both questions, but more likely to state that conditions were not changing very much (Figure 15). Property owners (40%) were more likely than boaters (28%) to feel that the river's resources were deteriorating, but less likely to feel that overall environmental quality was deteriorating (12% for landowners versus 16% for boaters).

#### Perceptions of Pollution Levels

Since a large percentage of on-site boaters mentioned that the scenic qualities of the river (75%) and good water quality (67%) were important considerations in boating on the Nanticoke, it was also important to obtain boaters' perceptions of the level of pollution on the river (Figure 16). Respondents were given the opportunity to rate the river on a 9-point scale, ranging from 1=not at all polluted to 9=extremely polluted. Overall, the mean pollution rating for the river, as perceived by on-site boaters, was 3.45. One-fourth of the boaters (27%) felt the river was not at all polluted (scale values of 1 or 2), while the majority (52%) considered it slightly polluted (values of 3 or 4). Only 21% gave pollution ratings above 4 on the 9-point scale, and just 3% reported values of 8 or 9, corresponding to an evaluation of extremely polluted.

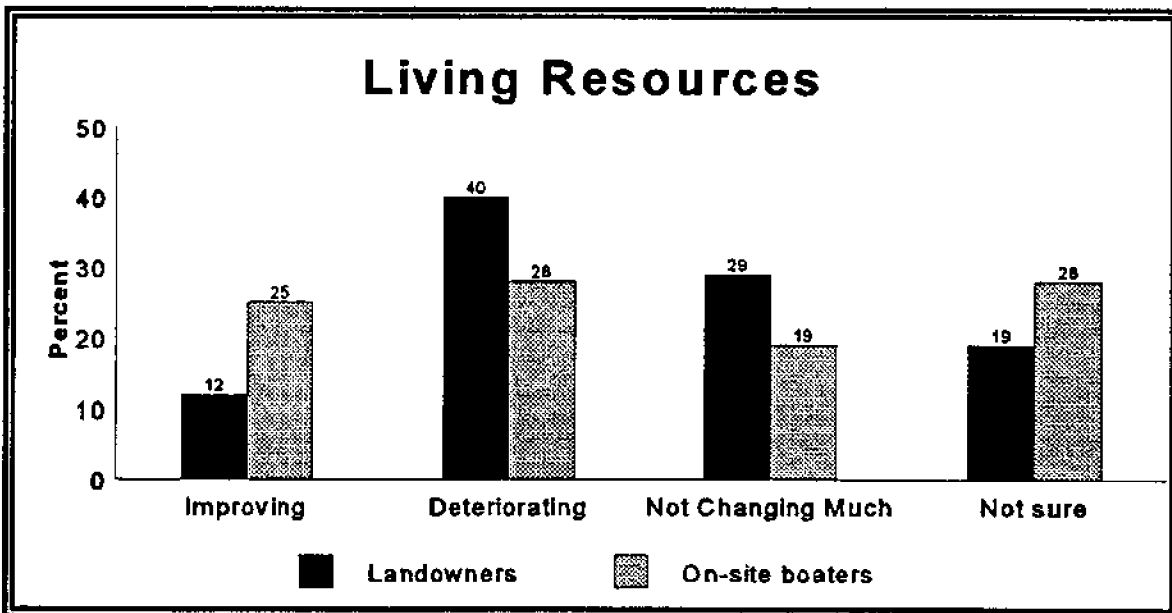
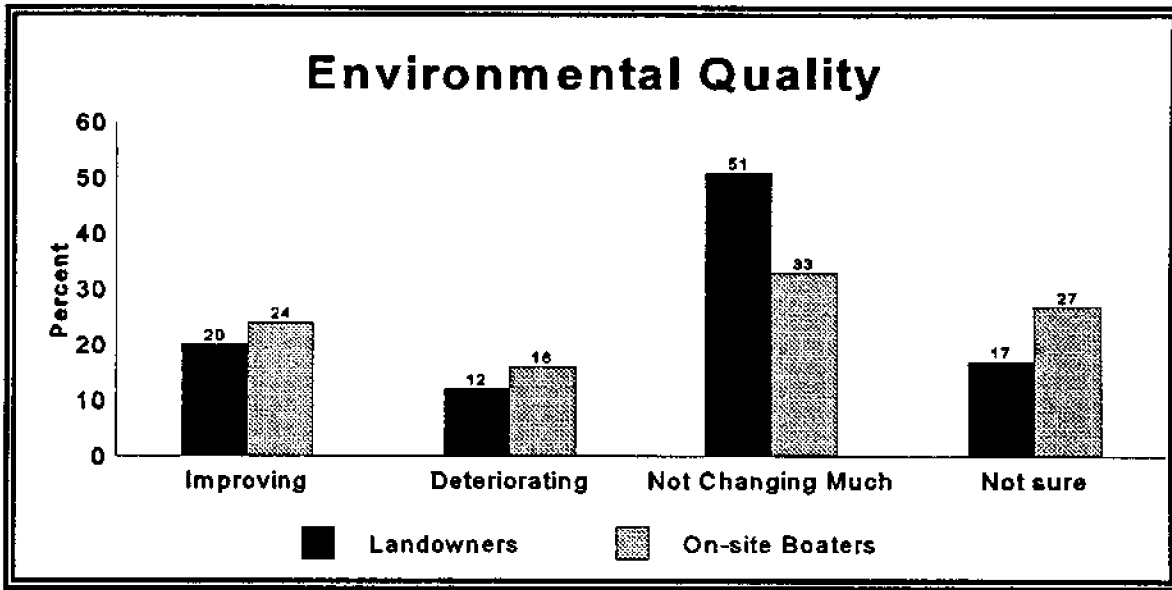


Figure 15. Perceived Changes in the River's Environmental Quality and Living Resources Over the Past 10 Years by Landowners and On-site Boaters

A follow-up question asked on-site boaters how they would respond to increasing levels of pollution on the Nanticoke River. Respondents generally reacted more strongly than they did to the hypothetical increases in crowding reported earlier. Eighty percent said they would spend fewer days boating if the river and its tributaries became more polluted. Most responded this way regardless of the amount of increase in the pollution. Fifty percent would boat less if the pollution increased slightly, while 78% would boat less if the river were moderately polluted, and 88% would boat less frequently if it increased to extremely polluted. The extent of reduced participation was also greater for hypothetical increases in pollution than it was for increased crowding on the river. More than one-third of the on-site boaters (35%) said they would boat no days under the increased pollution scenario, while one-fourth (25%) would reduce their boating participation by 50%. About one-fifth (22%) reported they would boat 10 to 40% fewer days, while an equal number of boaters (22%) would reduce their participation between 60 and 90%.

Landowner boaters were also asked to provide their impressions of the level of pollution on the Nanticoke River and its tributaries, again using a 9-point scale, with 1=not at all polluted and 9=extremely polluted. Their average rating was 3.86. Forty-eight percent rated the pollution level low (between 1 and 3), 45% rated it medium (between 4 and 6), and 7% rated river pollution high (between 7 and 9). As in the case of crowding, landowners perceived the river as more polluted than boaters did.

Landowners also were asked how they would respond if the Nanticoke River became more polluted. Two-thirds (68%) reported that they would spend fewer days boating if the river became extremely polluted. This is somewhat less than the 88% of onsite boaters who stated they would boat less under extremely polluted conditions, perhaps reflecting the landowners' greater attachment to the river. In this case, less than half (46%) of these landowner boaters indicated they would cut their boating participation by 50% or less, with 37% reporting decreasing by 70 to 90%, and the remaining 17% stating they would not boat at all under these conditions. (Again, it should be noted that, due to the mail survey format for data collection, landowners were not given different levels of pollution in the hypothetical scenario--they were all asked how they would respond to the worst-case scenario of extreme pollution).

### Finfish

The Nanticoke River Watershed is an important habitat for many species of fish and wildlife. Freshwater wetlands border nearly all of the major streams, and these wetlands account for 22% of the land surface in the watershed. In addition to many other vital functions, these wetlands create spawning and nursery areas for fish, primarily striped bass and largemouth bass. Both of these species use the upper reaches of the Marshyhope Creek and northern-most section of the river (both Maryland and Delaware portions) as spawning and nursery grounds in the spring of the year (primarily mid-April to mid-May).

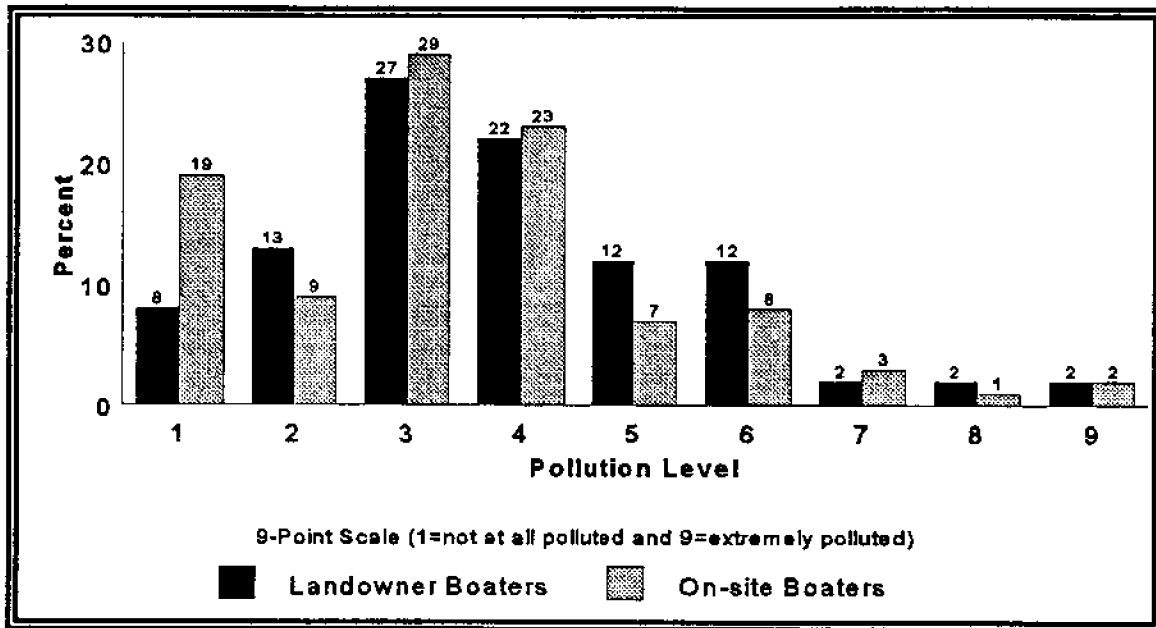


Figure 16. Comparison of River Pollution Conditions by Landowner and On-site Boaters

To insure that spawning stocks of fish prosper, one important consideration is to maintain water quality in these critical areas. A major source of degrading water quality is shoreside development and nutrient runoff (siltation), which results in increased turbidity of the water. Boaters can create similar problems of increased turbidity and waves that may also impact spawning stocks of fish.

Data collected from the on-site field portion of the study shows that a significant number of boaters do use the river and its tributaries during the spawning seasons for the species identified above. Forty-seven percent of boaters indicated they boated during the month of April, and 72% indicated they used the river in May (during primary spawning seasons for both fish).

An overwhelming percentage of field survey respondents (74%) indicate they would support establishing off-limit zones to protect sensitive resources. If it became apparent that boaters were impacting the river's spawning populations of striped bass and largemouth bass, it appears they would support measures to help protect the fish and avoid identified spawning areas.

#### Submerged Aquatic Vegetation

One of the measures of a healthy ecosystem is the proliferation of bottom grasses, known as submerged aquatic vegetation (SAV). To survive, these grasses live with their leaves at or below the surface of the water. Distribution of these grasses is dependent upon salinity levels, water turbulence, soil and sediment conditions, and light penetration. These plants are an

important link in the food chain of estuarine waters; they provide shelter and food for a variety of creatures. Many birds, such as Canada geese and bay ducks, depend on SAV as a food source. Blue herons often feed on the small fish that inhabit the grasses. These hard-working plants help to reduce erosion and pollution. They play a role in stabilizing the shoreline by trapping sediment, thus reducing shore erosion and muddiness. As a result, water near grass beds tends to be cleaner. SAV also acts as a nutrient buffer zone, capturing nitrogen and phosphorus and thereby slowing down the formation of algal blooms (Chesapeake Bay and Susquehanna River Public Access Task Force, 1989).

Historically, there were well-established SAV beds in the lower Nanticoke River. They have disappeared since 1970, based on surveys conducted by the U.S. Environmental Protection Agency and the Virginia Institute of Marine Science. This decline has also reduced the quality of habitat for certain species of birds and ducks. According to a recent study of the Nanticoke River watershed (Maryland Department of Natural Resources, 1994), SAV are re-establishing themselves in certain places in the river. If this re-establishment continues and SAV populations are maintained, a majority of boaters (63%) in the on-site field survey supported restricting boat use in shallow water to prevent degrading these vital resources.

### Shoreline Erosion

Another environmental concern that affects property along the Nanticoke River and its tributaries is erosion. There are numerous causes of shoreline erosion, and the severity can depend on many factors. One of the contributors is turbulence from recreational boat wakes. Boats traveling at certain speeds and close to shorelines can cause shorelines to erode if the shoreline in question is susceptible. The type of shoreline most susceptible to erosion would have a combination of (1) an exposed point of land in a narrow creek or cove, (2) fastland consisting of easily-eroded material such as sand or gravel, (3) a steep nearshore gradient on the shoreline profile, and (4) a location adjacent to a high rate of boating with boats passing relatively close to the shoreline (Maryland Department of Natural Resources, 1981). In addition, the Maryland DNR study also found that boats towing a water-skier created higher boat wakes than those without a skier in tow. This is an important consideration from the standpoint of the Nanticoke River, since a significant amount of waterskiing takes place on the river and some of it occurs in very narrow waterways.

To help gauge the impact of erosion and water turbulence on resident property owners, they were asked to indicate whether recreational boating and commercial shipping activity contributed to this concern. Overall, only 10% of the property owners indicated that commercial shipping always or sometimes contributed to excessive water turbulence, whereas 31% indicated that they felt recreational boating always or sometimes contributed. Twenty-one percent of the owners indicated that commercial shipping always or sometimes contributes to shoreline erosion, and more than one-third (36%) felt that recreational vessels always or sometimes contributed.

From these results, it does appear that property owners have some concerns about recreational vessel traffic and its contribution to shoreline erosion. Some residents would be more impacted by erosion than others, especially those who live in areas where there is a high frequency of boats traveling within a few hundred feet from the shore and pulling a waterskier or tuber. This activity occurs primarily in the northern three reaches: Maryland-Upper, Marshyhope Creek, and Delaware Nanticoke-Broad Creek. The Marshyhope and Broad Creeks are the narrowest sections of the waterway and would be subject to the most severe erosion.

### CONFLICTS BETWEEN RIVER USERS

The following discussion reports on conflict and observed boating accidents from the groups sampled in this study. Conflicts between Nanticoke River users have been examined, to a limited degree, in the past. The Delaware DNREC, Division of Fish and Wildlife (1992) asked recreational users whether they had observed any conflicts between groups in the upper Nanticoke and Broad Creek areas. The specific types of conflicts reported were as follows: boats causing wakes in no-wake zones at Phillips Landing, waterskiing too close to boats, bass tournament boats going too fast and causing congestion at ramps, and a general disregard for other recreational boats by discourteous boaters.

Conflicts between river users were not observed during on-water reconnaissance trips, nor during the aerial flight phase of the study. Both of these activities, however, were typically conducted at relatively high speeds and potential conflict situations may not have been obvious. In order to gain a better understanding of whether conflicts were occurring on the river, all of the groups who were surveyed were asked to provide their impressions. Additional comments on conflicts are reported in Appendices A, E, and I.

When on-site boaters were asked if they felt there were any conflicts between users of the river, 26% indicated they felt there were conflicts. However, only 3% of responding boaters reported that they had observed any boating accidents within the last year which were due to conflicts between users (Figure 17).

All landowners were asked if they felt there were any conflicts between users of the Nanticoke River or its tributaries. Twenty-two percent reported that they felt there were conflicts. Like the on-site sample of boaters, only 3% of property owners had observed any boating accidents within the last year due to conflicting uses on the river.

Twenty-seven percent of tug/barge operators responded that they encountered conflicts with recreational vessels (e.g., close calls, near accidents, or other navigation problems) within the past year. However, only 14% indicated that they had observed a boating accident within the last year which was a result of conflicts between users.

When shipping firms were asked if they were aware of any conflicts (e.g., close calls, near-accident situations, or other navigational problems) their vessels had with other commercial ships or with recreational vessels along the river, all responses were negative for both questions.

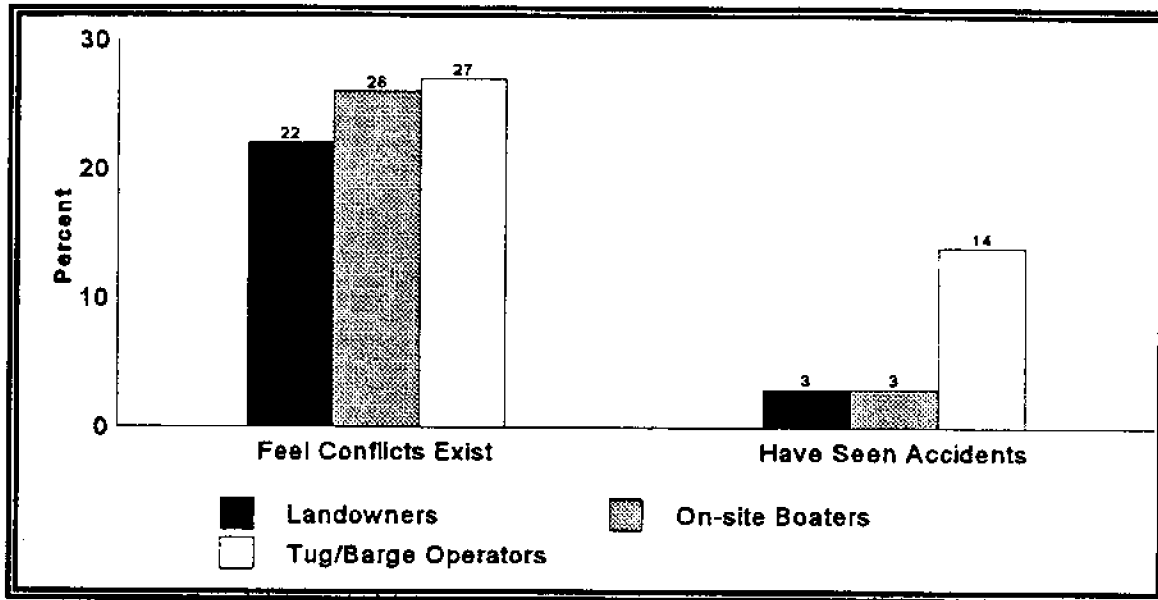


Figure 17. Indicators of Conflict between Users

### MANAGEMENT OF THE NANTICOKE

Since Nanticoke River landowners, as well as boaters using access sites to the river, have a familiarity and appreciation of the watershed and its unique resources, their input into the selection of management options is vital. A series of management options were presented both to boaters interviewed in the field, as a final component of the dockside interview, and to landowners through the mail survey. It is important to note that these management suggestions are not currently being considered and were only included to solicit ideas and comments on a range of important issues. Both on-site boaters and landowners had the choice to favor or oppose the options, or to respond *not sure* if an option was unclear to them or they had no opinion.

Table 10 depicts responses to these series of options from three distinct groups. First, responses from boaters in the on-site field survey are presented. Next, responses from landowners who also boat on the river are revealed. Finally, landowners who do not boat on the river are presented as a distinct group with their unique view of the options.

With no surprise, the management option that gained nearly complete support from on-site boaters was prohibiting all discharges of pollutants into the water, 96% of all respondents favored this option. Eighty-four percent of landowning boaters favored this option, and 74% of non-boaters supported it, making it the most favored option by both groups of landowners. Other management options received considerable support from on-site boaters and dealt with protecting the river's resources. They included establishing off-limit zones to protect sensitive resources (74%), restrictions on building and development (66%), and restricting boat use in shallow waters to prevent scouring and resource degradation (63%).

These same options had considerably less appeal to landowners. Forty-eight percent of non-boaters favored off-limit zones, and only 38% of landowning boaters favored this option. Restrictions on building and development were fairly close for both segments of landowners (52% for boaters and 44% for non-boaters) but still less than the support noted by the on-site group of boaters. Non-boaters (54%) were closer to on-site boaters in their support for restricting boating in shallow waters than they were to landowning boaters (37%).

The option of increasing the number of boat ramps received far greater support from on-site boaters (59%) than from either landowning boaters (27%) or the non-boating group (19%). It is interesting to note that 56% of landowning boaters opposed this option. Increasing boater pumpouts and dump stations along the river received support from more than one-half of all responding on-site boaters (53%) and landowning boaters (54%) but dropped off for non-boaters (41%).

Zoning the river to provide for specific uses in designated places received limited support from on-site boaters (39%) and considerably less support from landowners (22% of boaters and 27% of non-boaters). A majority of both boating groups opposed this option (57% of on-site boaters and 67% of landowning boaters).

The option of placing stricter limits on harvesting fish, crabs, and clams, etc. consistently received the lowest level of support from each responding group (34% of on-site boaters, 31% of landowning boaters, and 39% of non-boaters). Again, it is noteworthy that a majority of both boating groups (51% for each group) opposed this option.

Both boating groups (82% of on-site boaters and 72% of landowning boaters) overwhelmingly opposed limiting the number of boats using the river. A majority of non-boaters (51%) also opposed this measure. There was very little support for this option from any of the responding groups. There was also major opposition to limiting the size and power of boats using the river from both boating groups (77% of on-site boaters and 69% of landowning boaters). Non-boaters (40%) favored this measure considerably more than the boating groups. Overall, non-boaters were more inclined to state that they were *unsure* about more of the management options than the boating groups. This is understandable, since many of the options were more applicable to boaters than non-boaters.



Finally commercial shipping firms and tug/barge operators were also asked if they had any suggestions for changes they would like to see. Forty-three percent of the responding shipping firm representatives made suggestions such as enforcing no-wake zones near commercial loading areas and regulations that would give a high priority to commercial shippers' use of the river. Seventy-one percent of the tug/barge operators also suggested specific changes they would like to see along the Nanticoke River. These suggestions included such things as additional dredging at certain locations; better buoy markers, especially lighted markers and buoys that can withstand ice conditions on the river; and warning signs to alert small-boat owners of the commercial shipping traffic that navigates the river.

Table 10. On-site Boaters and Landowner Boaters and Non-boaters Favoring and Opposing Various Management Options for the Nanticoke River (Remaining Percentages "Unsure")

Management Options	Field Survey		Mail Survey			
	On-site Boaters (n=93)		Landowner Boaters (n=82)		Landowner Non-Boaters (n=45)	
	Favor	Oppose	Favor	Oppose	Favor	Oppose
Prohibit discharge of all pollutants into water	96	3	84	8	74	0
Establish "off-limit" zones to protect sensitive resources	74	18	38	42	48	20
Restrictions on building and development	66	24	52	38	44	26
Restrict boat use in shallow waters to prevent scouring and resource degradation	63	19	37	44	54	9
Increase the number of boat ramps	59	26	27	56	19	35
Increase the number of boater pumpout/dump stations	53	17	54	19	41	13
Zone the river to provide for specific uses at specific places	39	57	22	67	27	33
Stricter limits on size/number of fish, crabs, clams, etc. that can be harvested	34	51	31	51	39	34
Limit size and power of boats using waters	15	77	17	69	40	34
Limit the number of boats using the river	13	82	8	72	16	51

## CONCLUSIONS AND MANAGEMENT IMPLICATIONS

This report summarizes a series of data collection efforts aimed at gaining an initial understanding of current uses of the Nanticoke River, and their associated impacts on each other. The results provide a baseline to monitor future changes in river users, boating use patterns, and boaters' and riparian landowners' attitudes and perceptions about activities on the river.

For the most part, it appears that existing river conditions are generally favorable. Satisfactory boating experiences were reported routinely by boaters interviewed in the field, with 96% indicating that they thoroughly enjoyed their boating trip. Environmental quality appears high, both in absolute terms and from the perspective of various river user groups. The majority of all user groups perceived little conflict among river users. Recreational boating quality was high, with little impact from crowding or environmental pollution. This is not to say, however, that there are no concerns about the future of the Nanticoke River, nor that all users consider current conditions ideal.

Recreational boating appears to be growing in popularity, which has led to expansion or improvements at existing boating facilities as well as a proposal for a new marina. Survey results confirm resource managers' perceptions of growth in two ways. First, significant numbers of "new" boaters, or those using the river for the first time in 1996, were found in both the on-site boater survey (15% of boaters sampled) and the landowner survey (10% of landowners who reported boating participation). Secondly, frequency of participation, as measured by annual days spent on the river, was projected by boaters to be higher for 1996 than for the previous year. While the intentions of boaters to spend more time on the river may or may not be realized, they are indicative of a quality boating environment with the potential to continue attracting more boaters.

Fishing and cruising are the dominant boating activities, according to both the on-site boater survey and aerial flight data. Waterskiing is the next most popular activity and may present some safety concerns, especially in narrower sections of the river. Jetskiing remains a minor component of boating on the Nanticoke and has not expanded in popularity to the same extent as in many other areas. However, while personal watercraft account for only about 5% of all boats observed on the river in 1996, they account for a disproportionate share of complaints and comments from other river users. Numerous comments, from landowners especially, indicated a desire to restrict or ban jetskis on the river or to require mandatory education and training for operators. With personal watercraft (including jetskis) continuing to be the fastest growing segment of the recreational boating market, resource officials should continue to monitor the use of these vessels on the river in the future.

Boating patterns on the river show that convenience and ease of access are important considerations to Nanticoke River boaters. On-site boaters generally selected public ramps that were close to their home or accommodations. Most boaters also limited their boating to the river section where they launched their boats. Boaters launching from the Sharptown public ramp were the most diverse in their boating patterns, dividing their boating evenly between the Delaware Nanticoke-Broad Creek area and middle and the upper Maryland Nanticoke segments.

The highest levels of boating activity were observed in the upper and lower sections of the watershed. Boating density levels in the lower section, however, are not considered to be a cause for concern. The wide expansive features of this section of river allow for multiple uses to occur with very little potential for conflicts or safety problems among users. The upper section in Delaware, including Broad Creek, exhibits the highest boating density due to the narrower width of the river in this area. In addition, this section is used by the widest variety of boaters. Broad Creek and the area around Phillips Landing launch ramp were seen as areas in need of closer monitoring by marine enforcement personnel. Observations provided by survey respondents indicated that the narrow, winding nature of the creek presents problems, especially from high-speed boaters and jetskiers. Suggestions were made to impose speed limits along this section of waterway from the mouth to town of Bethel, Delaware. Concerns were also raised about people swimming in Broad Creek immediately adjacent to the launching facility. All of these factors suggest that this upper portion of the river may be the most prone to user conflicts in the future.

Landowners who boat on the river differed in several ways from boaters sampled at major access points along the river. First, their patterns of participation differed, reflecting the convenience of direct access from their property. While the majority of boaters sampled on-site boated primarily on weekends, landowner boaters were more likely to split their boating time between weekends and weekdays. Secondly, landowner and on-site boaters show some striking differences in their reasons for boating on the Nanticoke. Observing wildlife, low boating traffic, wide river channel, and good swimming were more important to landowners who boated, while adequate water depth, good fishing and being close to home were more important to boaters sampled in the field.

Some quality of experience indicators also varied between the two groups of boaters, with landowner boaters generally expressing more critical or negative views. For example, landowners considered river conditions to be more crowded than on-site boaters, and they also perceived slightly higher levels of pollution than on-site boaters. Reactions to potential management strategies varied markedly between non-boating landowners and boaters overall. Not surprisingly, boaters generally showed more support for options that enhanced boating opportunities and landowners generally were more opposed to restrictions on development or certain boating practices. Within the landowner sample, reactions to some management options varied strongly depending on whether or not the riparian owners were boaters. For example, non-boating landowners were much more likely to favor limiting the size and power of boats allowed on the river and restricting boat use in shallow waters.

Based on field observations, aerial flight data, and survey responses, overall boating use on the river during 1996 was considered light. Aerial data revealed low use levels even during peak weekend boating periods. The greatest number of boats observed on any single day was 160, with the average for the eight sampling flights being 96 boats per day. The majority of both landowners and on-site boaters also regarded crowding levels as relatively low on the Nanticoke River. About one-half of both groups reported that they would spend fewer days boating if the river became more crowded. Most of these boaters, however, would not reduce their boating unless conditions became at least moderately or extremely crowded; only 6% said they would change their boating due to slight increases in crowding on the river.

Similarly, most river users considered the river to be relatively unpolluted. Survey respondents generally reacted more strongly to hypothetical increases in pollution than they did to hypothetical increases in crowding. Eighty percent of on-site boaters said they would boat less often if the river became more polluted, and most of these said they would reduce their participation regardless of the amount of increase in the pollution. Two-thirds of the landowners surveyed said they would spend fewer days boating if the river became extremely polluted.

Riparian landowners generally felt that recreational traffic on the river was heavier than the commercial traffic, although the majority considered recreational traffic to be light or had no opinion about it. About one-third of the landowners felt the recreational traffic contributes to various problems, including pollution in the river, shoreline erosion, disturbance of wildlife, safety hazards, water turbulence, noise and invasion of privacy. About one-half of the commercial tug and barge operators surveyed felt that recreational vessels pose some navigation problems. Overwhelmingly, these operators mentioned the area from Sharptown, Maryland to Seaford, Delaware as being the most congested with recreational boat traffic.

Significant amounts of commercial boating traffic occur on the Nanticoke River. However, nearly all landowners surveyed considered commercial shipping traffic to be light and not a disruptive force in their lives. Shoreline erosion was the only factor that property owners felt caused some element of concern, but only 21% reported that commercial traffic always or sometimes contributes to shoreline erosion.

The environmental impacts caused by recreational boating can be numerous and severe depending on many factors. On the Nanticoke River, these impacts centered around finfish, submerged aquatic vegetation (SAV), and shoreline erosion. In each case, concerns are limited to certain geographic areas and may imply the need for site-specific management actions. The majority of boaters surveyed supported management actions that would address threats to these environmental resources. To more fully assess the environmental impacts caused by boat use on the river, resource officials should consider initiating environmental monitoring in conjunction with future boating quality studies. One environmental indicator easily sampled could be water turbidity. This can be measured during the boating season at specific sites and compared with boating use intensities on the same sampling days. Through an integrated monitoring approach, a reliable method of associating boating activity with environmental disturbances could be achieved.

Conflicts between river users were addressed in several ways, and results generally suggest that conflict levels are currently relatively low. Only about one-fourth of boaters, landowners, and tug/barge operators reported that there were any conflicts between the users of the Nanticoke River. Much lower percentages reported actually observing any incidents resulting from conflicting uses. Conflicts that were reported centered around jetski issues, boating courtesy, speed, and noise of boats.

Safe boating practices are key elements to a satisfactory boating experience. Although many general comments focused on the need for boaters to improve their boat handling skills, very few boaters reported specific unsafe practices by other river users. Only 12% of on-site boaters noted that other boats came too close to them while they were boating and there were no reports of commercial vessels creating hazardous or unsafe conditions. Landowning boaters reported substantially more boating experience on the river than on-site boaters and were also more inclined to have taken a boating safety education course. Although all boaters can benefit from additional boating education, it would be more effective to initially direct any safe boating messages to users at the major access sites than to landowners who also boat.

Finally, river users generally do not perceive the need for more intensive management of the river. The majority of all groups, including non-boating landowners, opposed limiting the number of boats using the river. User groups' reactions to management alternatives tended to reflect the vested interests of the various groups. For example, boaters more likely favored development of boating facilities, while landowner boaters generally were opposed to the development of more boat ramps. Landowners also were more likely to oppose restrictions on their boating activity. Many comments received from all user groups expressed the sentiment that no additional regulations are needed. Apparently, river users value their freedom to use the river as they wish and generally consider current conditions acceptable and not in need of additional management efforts.

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**APPENDICES A - I**

**ADDITIONAL SURVEY INSTRUMENT COMMENTS**

**LANDOWNERS  
ON-SITE BOATERS  
COMMERCIAL SHIPPERS  
TUG/BARGE OPERATORS**

APPENDIX A

LANDOWNER RESPONSES TO CONFLICTS BETWEEN USERS  
OF THE NANTICOKE RIVER AND TRIBUTARIES

<b>Jetski Issues</b>
Jetskis noisy, unsafe, and too much speed
Jetskiers lack of respect
Pleasure boaters vs. Jetskiers
Jetskiers untrained and inconsiderate
Jetskis dangerous
Jetskis and fishermen
Jetskiers lack of respect for other boaters, residents, and fishermen
I object to jetskis
Jetski noise
Too many jetskis
Fishermen and nature lovers want quiet, while jetskis make noise
Jetskiers lack of respect

<b>Boating Courtesy and Education</b>
Lack of bass boat courtesy and lack of courtesy and "rules of road" from other boaters
Inconsiderate bass fishermen
Lack of respect for other boaters
Not following rules of river and not being careful when going by ferry
Little boating knowledge



<b>Speed and Noise of Boats</b>
High speed of bass boats
Noise level of some boats
Boats need to slow down near Woodland, DE

<b>Commercial Fishing Issues</b>
Sportsmen don't want commercial fishermen on the river
Commercial vs. recreational boaters
Conflicts between recreational and commercial crabbers

<b>Waterski Issues</b>
Too many waterskiers
Skiers effect on tributaries?

<b>Other Issues</b>
Excessive use of "OUR" waters by out-of-towners and out-of-staters
Wildlife disturbances on tributaries
Recreational users think they own the river
Property owners think they own the river
Crowds from Delaware

APPENDIX B

LANDOWNER RESPONSES TO OBSERVING BOATING ACCIDENTS ON  
NANTICOKE RIVER AND TRIBUTARIES DUE TO CONFLICTING USES

<b>Miscellaneous Comments</b>
The "big ditch" is not big enough for big boats
Jetskier cut off boat causing it to veer into the shallow waters
Near accidents because of jetskis

APPENDIX C

LANDOWNER RESPONSES SUGGESTING CHANGES FOR  
NANTICOKE RIVER AND TRIBUTARIES

<b>Environmental Concerns/Clean-up/Pollution</b>
Improve water quality (2)
Prevent overflow of municipal and private sewage
Enforce discharge limits by city of Seaford and plants
Control sewage
Education programs regarding how individuals can control pollution to river
Remove trees; don't let people throw leaves in the river
Clean trash out of river
Tighter pollution and effluent control
Catch basins needed
Clean trash up
Do not allow female crabs to be caught or kept
Limit the capture/sale of "sook" crabs
Help the crabs

<b>Dredging/Erosion Control</b>
Allow more bulkheading to protect shore from erosion
Control erosion
Dredge Broad Creek and tributaries
Speed up erosion control permit process
Jackson Harbor construction increasing shoreline erosion
Decrease beach erosion
Gordon Creek needs dredging
Systematic dredging in Seaford and up

<b>Dredging/Erosion Control (cont.)</b>
Grants and loans for shoreline protection
Speed up erosion control permit process
Require soil conservation ditch
Divert road and field drainage
No bulkheads or seawalls
Increase navigability to Middleford and Concord

<b>Recreational Boating (General)</b>
Less boat traffic
License required and test for boaters
Heavy fines for loud and fast bass boats
Bass boats out of control
Limits to ease congestion
Safety course
Waterskiing and tubing in designated areas, not on tributaries
Control inboard power boats
Waive license fee for river residents
Charge for use of ramps if not a Wicomico County resident
Stricter limits and enforcement (boating)
Limit boat traffic not by numbers, but by area
Recognize courteous boaters and DNREC for keeping Phillips Landing so nice

<b>Speeding/Speed Limits on River</b>
Speed limits (2)
40 mph speed limit on river; 30 mph on tributaries
Slow traffic down in Woodland, DE
Slower speeds where shoreline needs protecting
More speed limit zones
Size and speed limits on tributaries with strict enforcement
Speed limit on Broad Creek, limit boat motor size
Strict enforcement of speed limits
Speed zones to decrease erosion
No wake zones
No wake around homes and docks

<b>Jetski Issues</b>
No jetskis (3)
Prohibit jetski use
Jetski training course
Jetski age limit of 18+
Ban jetskis
Restrict jetskis
Control jetskis

<b>Enforcement/Marine Patrols</b>
Same boating laws for Maryland and Delaware
Increase marine police weekends and evenings
Maryland enforcement is much better than Delaware
Increase marine patrols
Increase marine police
Less police harassment
Enforce current laws
No use of binoculars by marine police (intrusive)

<b>Facility Improvements</b>
Need pumpout facility (3)
More parking at ramps
More ramps
Increase boating amenities
Increase boat ramps
Safety and mechanical equipment maintenance facilities needed

<b>Development Issues</b>
Control development
Only allow large parcel family development
Upgrade Seaford with walks, docks, and restaurants
Restrict development
Housing setbacks

<b>Other Issues</b>
Limit government intervention
Don't let "tennis shoe wearing old ladies" run environmental organizations, let locals have say
No restrictions
Stop playing God
Raise duck limits for sportsman
Leave us alone; no more regulations
Allow people to feed ducks
More studies needed

APPENDIX D

ADDITIONAL LANDOWNER COMMENTS

<b>Environmental Concerns</b>
Wildlife habitats have improved, increase in endangered species sightings
Noticed environmental quality increase since I was a child
Nitrates a problem
I want to donate land to a good cause
Is it possible to replenish SAV?
Mosquitoes and other insects out of control
Last 45 years river has become much more dirty, don't know why
Noise and water pollution, environmental concerns first before monetary gains
Rivers north of the Nanticoke are cleaner due to pumpouts, I assume boaters on other rivers have more education and respect
No-wake zones could protect the environment
I have seen mattresses in river
River users should properly dispose of their grabage, DE residents are dumping on unattended land
There should be a way to enjoy the river without impacting vegetation

<b>Recreational Boating (General)</b>
Boat traffic less than in 1972; less commercial traffic than pre-1978
Boating not a problem in our area of the river
I don't want boat size limits
Abusive use, not volume is the problem; poor training and lack of consideration by boaters
No problems at all on the James Branch; only canoes and kayaks there
Don't change upper river and Broad Creek, they are doing well
Boaters are discourteous, particularly at peak times (i.e. holidays); alcohol involved



**Recreational Boating (General) (cont.)**

Loud boats; jetskis bad; river too narrow and winding for 50-70 mph speed

Boater education should be a priority, boaters on the Nanticoke are better than other boaters however

A boat, in the wrong hands, is just as dangerous as a car, motorcycle, or airplane

No wake zones could solve lots of problems

**Regulations/Restrictions**

Fed up with regulations; people from all over move in and want to control things

Regulations must be flexible and affordable

Enough building restrictions in place, regulations must be balanced

No special regulations needed, I don't want over-regulation

I do not like being told what to do with property while paying outrageous taxes

No additional restrictions

River property owners cannot/should not limit others' use of river

**Other Issues**

I think it is very nice on the river

Property given to me by dying father. I want to preserve hunting and fishing for children and grandchildren like my father did for me

The river is peaceful and I hope it never changes

APPENDIX E

ON-SITE BOATER RESPONSES TO CONFLICTS BETWEEN USERS OF THE  
NANTICOKE RIVER AND TRIBUTARIES

<b>Jetski Issues</b>
Jetskis (8)
No enforcement of PWCs
Jetskiers vs. waterskiers
Jetskis should have a course

<b>Safe Boating Issues</b>
Unsafe boating, too fast
Unsafe boating
Upper Nanticoke has problems
Fishing vs. pleasure boaters, not safe, lack of courtesy
No enforcement of no-wake zones

<b>Waterski Issues</b>
Speed boaters vs. skiers (2)
Skiers vs. fishermen
Bass fishing vs. waterskiers
Ski course left out, but not available for use by all

<b>Environmental Concerns</b>
Oil and sewage (Vienna, MD, and Seaford, DE)
Boat wake erosion
Pollution
People keeping illegal fish

<b>Other Issues</b>
Bass boats vs. pleasure boaters
Boaters running over crab lines
Bass tournaments
Weekend traffic

APPENDIX F

ON-SITE BOATER RESPONSES TO OBSERVING BOATING ACCIDENTS  
ON NANTICOKE RIVER AND TRIBUTARIES DUE TO CONFLICTING USES

<b>Miscellaneous Comments</b>
Friend crashed into channel marker that was hard to see (near Cedar Hill Marina)
People falling off of jetskis
Some guy ran up on sandbar
Boat ran aground

APPENDIX G

ON-SITE BOATER RESPONSES SUGGESTING CHANGES FOR  
NANTICOKE RIVER AND TRIBUTARIES

<b>Jetski Issues</b>
Restrict jetskis (2)
Zone jetskis
No jetskis because they destroy SAV
Jetskis hard to see
Prohibit jetskis
Need specific areas for jetskis
Less jetskis

<b>Phillips Landing Launch Ramp Issues</b>
Increase enforcement especially at Phillips Landing
Kids swim too close to boat traffic at Phillips Landing
More park ranger monitoring at Phillips Landing
Add another boat ramp at Phillips Landing
Telephone needed at Phillips Landing
Increase parking at Phillips Landing
Permanent restrooms needed at Phillips Landing

<b>Facility Improvement</b>
Improve marina amenities
Increase access to fuel pumps
Pumpout stations needed
Increase fuel access
Increase public fishing areas for non-boaters

<b>Facility Improvement (cont.)</b>
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Increase boat ramps
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Increase bathing and swimming areas
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<b>Safe Boating Issues</b>
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More markers (lighted)
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Mandatory safety course for boaters
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Boaters need to be tested
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Protect safety
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Need slow zones at boat ramps
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People drinking and boating
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<b>River Clean-Up and Pollution Issues</b>
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Clean trees out of river from Bethel to Laurel
--

Keep river clean
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Too polluted
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Need pollution and resource (fish) monitoring
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Clean trees from Marshyhope Creek
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Increase environmental quality studies
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<b>Enforcement/Marine Patrols</b>
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Increase enforcement
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Need more marine police
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Increase patrols
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Increase patrolling in Delaware, laws need to be enforced
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Too much patrolling
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<b>Waterski Issues</b>
Skiers hard to see around curves
Waterskiers are drinking
Need specific areas for waterskiers
People should not leave the ski course out

<b>Development Issues</b>
Restrict development
Stop development
Limit development
Decrease urban pollution

<b>Create Certain Activity Areas</b>
Zone watersports (e.g., skiing)
Designate activity areas
Establish canoe/kayak only areas
More control of boating activity

<b>No Changes</b>
No changes, its a beautiful river
All is great, its a beautiful river
No changes, its a great river

<b>Other Issues</b>
Remove hydraulic dredges
Restrict use of river by out-of-state users
Dredge Sharptown Ramp
No fee for out-of-staters
Better and more fishing and crabbing



APPENDIX H

COMMERCIAL SHIPPERS' SURVEY  
ADDITIONAL COMMENTS TO OPEN-ENDED QUESTIONS

<b>Question 2. Why do you use the Nanticoke River as a shipping route?</b>
Large quantities of liquid fertilizer needed in short period of time--best way to bring in these quantities
Centrally-located for our operational needs
<b>Question 3. Are you aware of any navigational difficulties encountered by your vessel(s) when they use the Nanticoke River as a shipping route?</b>
Oil barge unable to navigate at low tide
Poor response by railroad bridge
Sharptown bridge is difficult to get through, especially during fog
<b>Question 4. What factors, if any, would prohibit you from using the Nanticoke River as a shipping route in the future?</b>
Shoaling
Increasing environmental restrictions or taxing its use
<b>Question 8. Do you feel there are any other safety concerns along the river?</b>
Development
Commercial traffic must have priority
Mouth of river suffers from too much shoaling, we need 16 feet of entrance
Recreational boats speed through commercial loading areas
<b>Question 9. Are there any specific changes you would like to see occur along the Nanticoke River?</b>
A facility for pleasure boat maintenance and repairs
Would want a high premium on commercial use
No-wake enforcement along commercial loading areas

APPENDIX I

TUG/BARGE OPERATORS' SURVEY  
 ADDITIONAL COMMENTS TO OPEN-ENDED QUESTIONS

<b>Question 6. In your opinion, are there any areas of particularly limited VISIBILITY along the river? If yes, please describe the location (e.g., near channel markers, land points, towns, or any particular concerns):</b>
Riverton # 36, 38, 39, 41, 45, 46, 52, 53, 54, 56 - to Woodland Ferry to Seaford (2)
Markers #45-46 and #57-58
Sharptown on up
Buoys #45-46 and #57-58

<b>Question 7. In your opinion, are there any areas of particularly limited MANEUVERABILITY along the river? If yes, please describe the location (e.g., near channel markers, land points, towns, or any particular concerns):</b>
Hawks Nest Shoal to Seaford (4)
From Sharptown to Seaford needs dredging; shallow places (2)
Woodland Ferry to Seaford
The river is narrow and has lots of turns, we operate slow with a 6-foot draft.
Hawks Nest Shoal; dredge channel from #62 buoy on up.
Vienna Bridge outbound with fair current
Buoy #45 and above

<b>Question 8. In your opinion, are there any areas of particularly concentrated recreational vessel use along the river? If yes, please describe the location (e.g., near channel markers, land points, towns, or any particular concerns):</b>
Sharptown Bridge to Seaford (3)
Sharptown to Seaford--heavy traffic (2)
Most seems to originate from boat ramp in Seaford

**Question 14a. Within the Nanticoke River corridor, where have most of your conflicts with RECREATIONAL craft occurred? (Please be as specific as possible: near channel markers, land points, or towns.)**

From Sharptown Bridge, heavy around 46-50; all the way to Seaford Boat ramp (2)

Sharptown Bridge to Seaford

Most of our travel is at night and recreational craft is not a factor

**Question 14b. When have most of your conflicts with RECREATIONAL craft occurred? (Please list time of day, day of week, month of year, and (if applicable) any holiday period.)**

Weekends, holidays and daytime (2)

Saturdays and Sundays during June, July, August

**Question 16. In addition to the responses you have already provided, do you feel that there are any other safety concerns along the Nanticoke River?**

Channel has very shallow draft from #9a to #11 buoy (3)

Piers protruding out in river too far and too close to turns (2)

Widen and deepen channels

Bass boat and speed boat coming around corner at 50+ mph at #45, 46, 57, 58

Route 50 bridge in Vienna needs to be perpendicular to channel

**Question 17. Have you observed any boating accidents within the last year which you believe were a result of conflicting user interests?**

Ski ramp, Hawks Nest reach #50 buoy (2)

**Question 18. Are there any specific changes you would like to see occur along the Nanticoke River?**

Dredge deeper so we can navigate freely. Too many piers especially on turns and too close to channels (2)

Deeper channel to minus 11 feet, mean low water in shoal areas

Take out shoals in channel as needed

<b>Question 18. (Cont.)</b>
Take out shoal spots in channel
Better light markers
Dredging
The draw system at Vienna Bridge
Sign at Sharptown boat ramp "Warning: large vessels travel through this area"; better marked channel from Vienna Bridge to #1 Nanticoke, around lump #16, #18 to #20 and #31; better buoys and ice buoy in winter on lower Nanticoke; dredging off #38 and #48 to #53
I would like to see the number of docks reduced in the upper Nanticoke
My number of trips in the last 5 years have been much less than prior to that time; there is much more recreational traffic than previously

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**APPENDIX J**  
**SURVEY INSTRUMENT WITH SUMMARY RESPONSES**  
**FOR ON-SITE SURVEY**

**NANTICOKE RIVER BOATING STUDY—1996  
FIELD SURVEY**

Number _____	Location _____	Date _____	Start Time _____
Interviewer _____	Boat Registration Number _____		

**INTRODUCE YOURSELF. SAY:**

I am with the University of Delaware, College of Marine Studies. We are doing a study of boating on the Nanticoke River. Will you answer a few questions about your experience here today?

**IF RESPONDENT AGREES, CONTINUE:**

Thank you. Now I must choose a person in your party who is willing to answer the questions. Who in this party (18 years or older) actually operated the boat today?

**IF RESPONDENT REFUSES, SAY:**

My questions only take 10-15 minutes. You were selected as part of a representative sample, so your answers are very important. Your answers are confidential and will only be reported as group statistics.

<p><b>IF RESPONDENT REFUSES AGAIN, SAY:</b> Thank you, enjoy your visit to the area. <b>RECORD THE FOLLOWING INFORMATION:</b></p>
---

Boat Length (app.): \_\_\_\_\_ feet

Boat Type: \_\_\_\_\_ (e.g., jetski, pontoon boat, canoe, power boat, etc.)

No. in Party: \_\_\_\_\_; No. Males: \_\_\_\_\_; No. Females: \_\_\_\_\_

Estimate number under age 16 \_\_\_\_\_

**SELECT RESPONDENT**

**BEFORE ASKING QUESTIONS, SAY:**

So that the answers will be reliable, I need to read the questions exactly as they are written.

1. Where is your permanent home address:

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

2. Did you drive from that location to boat on the Nanticoke River and its tributaries today?

88% Yes      12% No

If yes, what was that distance (one-way in miles)? mean = 25 miles

If no, what distance (one-way) did you travel to boat here today? mean = 22 miles

3. How many people were in your boating group today? (include all people using boat)? (DON'T ASK IF YOU CAN OBSERVE.)

Total mean = 2.8 (mean = 1.9 males; mean = .9 females) (mean = .4 no. under 16 years of age)

4. Which of the following best describes the composition of your group?

1. Family <u>41%</u>	4. Business Associates <u>1%</u>
2. Friends <u>18%</u>	5. Alone <u>13%</u>
3. Family/Friends <u>27%</u>	6. Other _____

5. How many years have you been a boater? mean = 18.6 years

6. How many years have you boated on the Nanticoke River and its tributaries?  
mean = 12 years

7. How would you rate yourself as a boater?

9% Novice    39% Intermediate    41% Advanced    12% Expert

**OBSERVE—OR ASK THESE QUESTIONS:**

8. What kind of boat did you use on the Nanticoke River today (e.g., power, sail, jetski, etc)?

Power = 95%      Sail = 3%      jetski = 2%

9. How many feet long is this boat? Mean = 18.4 feet

10. What is the total horsepower of your engine(s)? Mean = 113 hp.

11. How many days did you boat on the Nanticoke River and its tributaries last year (1995)?

x = 19.8 days

12. We are now interested in the number of days you plan to go boating on the Nanticoke and its tribs this year? Would you say you plan to go:

- |   |                                     |   |                                    |
|---|-------------------------------------|---|------------------------------------|
| 1 | Less than 5 days - <u>11%</u>       | 5 | Between 30 and 50 days - <u>9%</u> |
| 2 | Between 5 and 10 days - <u>26%</u>  | 6 | Greater than 50 days - <u>8%</u>   |
| 3 | Between 10 and 20 days - <u>26%</u> |   |                                    |
| 4 | Between 20 and 30 days - <u>21%</u> |   |                                    |

13. Considering all the boating you do, what months of the year do you specifically boat on the Nanticoke River and its tributaries? (Check all that apply:) Jan 7% Feb 7% Mar 21% Apr 47% May 72% Jun 87% Jul 96% Aug 96% Sep 84% Oct 57% Nov 25% Dec 11%

14. Do you do most of your boating on (check one):  
21% weekdays 53% weekends - holidays/special events  
26% weekends & weekdays equally

15. Have you ever taken a boater safety education course? Yes 37% No 63%  
 If yes, when was the year of your last course? -

16. Do you usually carry a marine VHF radio, cell phone, or CB (or other means of communications) onboard your vessel? Yes 48% No 52%

If yes, which do you use? VHF - 48% Cell Phone - 43% CB - 10%

**NOW I WOULD LIKE TO ASK YOU ABOUT  
TODAY'S BOATING EXPERIENCES:**

17. What time did you start boating today? \_\_\_\_\_ a.m. or p.m.

18. Here is a list of boating activities you might take part in. Please tell me which of these activities your boating group participated in today.

Sail (Sa)	3%	Sightseeing (Si)	16%
Cruise—Sail/Power (Cr)	34%	Fishing (Fi)	51%
Waterskiing (Ws)	16%	Crabbing (Cr)	1%
Sailboarding (Sb)	0%	Swimming (Sw)	6%
Canoe/Kayak (C/K)	1%	Jetski (Js)	2%
Other (Ot)	11%		



19. IF RESPONDENT'S GROUP ENGAGED IN MORE THAN ONE ACTIVITY, what activity do you consider to be your group's primary activity today?

Fishing - 49%      Cruising - 25%      Waterskiing - 15%

20. IF RESPONDENT'S GROUP ENGAGED IN MORE THAN TWO ACTIVITIES, what activity do you consider to be your group's secondary activity today?

Sightseeing - 43%      Cruising - 30%

**REFER RESPONDENT TO MAP OF NANTICOKE RIVER AND TRIBUTARIES.**

21. On the map, please draw the route that you followed in your boat today.
22. Using the initials from your activity list (Question 18), please show on your map where you participated in each activity.
23. Which areas of the river or its tributaries did you MOST ENJOY? (Record these on the map with an "E.")
24. Why did you most enjoy these areas?
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
25. Which areas of the river or its tributaries did you LEAST ENJOY today? (Record these on map with an "L.")
26. Why did you least enjoy these areas?
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
27. Were there any parts of the river you deliberately AVOIDED today? (Record these on the map with an "A.")
28. Why did you avoid these areas?
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

29. I AM NOW GOING TO READ SOME STATEMENTS ABOUT BOATING ON THE NANTICOKE RIVER. BASED ON YOUR EXPERIENCE HERE TODAY, PLEASE RATE YOUR LEVEL OF AGREEMENT OR DISAGREEMENT WITH EACH STATEMENT I READ. (SD = Strongly Disagree; D = Disagree; U = Undecided; A = Agree; SA = Strongly Agree)

	SD	D	U	A	SA
Boating conditions on the river and its tributaries were safe.	1%	8%	2%	61%	28%
I thoroughly enjoyed my boat trip today.	0	4%	0	50%	46%
Other boats came closer to my boat than I liked.	14%	70%	4%	10%	2%
The noise of other boats reduced my enjoyment on the river and its tributaries.	16%	81%	3%	0	0
There are adequate law enforcement patrols on the river and its tributaries.	4%	20%	17%	46%	12%
I nearly had an accident on the river and its tributaries today because of crowded conditions.	47%	52%	0	1%	0
The behavior of other boaters interfered with the quality of my boating experience.	42%	50%	0	4%	4%
• Describe behavior of boaters if A or SA.					
The amount of public access limits my use of the Nanticoke River and its tributaries.	13%	65%	4%	16%	2%
Commercial boat traffic created conditions that were hazardous.	36%	63%	1%	0	0

30. Using the crowding scale (refer to card), how would you describe the boating conditions on the river today?

1-50%	2-9%	3-23%	4-5%	5-7%	6-4%	7-1%	8-2%	9-0%
Not at all Crowded		Slightly Crowded			Moderately Crowded			Extremely Crowded

31. Suppose conditions on the Nanticoke river and its tributaries were crowded throughout your boating season. Would you spend fewer days boating on the river and its tribs?

1. NO - 55%
2. YES - 45%

If NO, proceed to question #32.

31a. (If YES) Approximately how many fewer days? Please refer to the possible range of answers on the card I have given you and tell me the letter that corresponds to your choice.

- |              |                  |
|--------------|------------------|
| A. 10% - 3%  | F. 60% - 0%      |
| B. 20% - 3%  | G. 70% - 0%      |
| C. 30% - 13% | H. 80% - 7%      |
| D. 40% - 7%  | I. 90% - 3%      |
| E. 50% - 32% | J. No Days - 23% |

32. In your opinion, how polluted is the Nanticoke River?

1-19%	2-9%	3-29%	4-23%	5-7%	6-8%	7-3%	8-1%	9-2%
Not at all Polluted		Slightly Polluted		Moderately Polluted			Extremely Polluted	

33. Suppose conditions on the Nanticoke River and its tributaries were polluted throughout your boating season. Would you spend fewer days boating on the river and its tribs?

1. NO - 20%
2. YES - 80%

If NO, proceed to question #34.

33a (If YES) Approximately how many fewer days? Please refer to the possible range of answers on the card I have given you and tell me the letter that corresponds to your choice.

- |              |                  |
|--------------|------------------|
| F. 10% - 0%  | F. 60% - 4%      |
| G. 20% - 6%  | G. 70% - 2%      |
| H. 30% - 6%  | H. 80% - 12%     |
| I. 40% - 8%  | I. 90% - 4%      |
| J. 50% - 25% | J. No Days - 35% |

34. Why did you choose to engage in boating activities on the Nanticoke River and its tributaries today? As I read you the following list, please tell me all that apply.

Good water quality	67%	Adequate channel markers	71%
Scenic quality of river and its tributaries	75%	Not a lot of other boating traffic	62%
Good fishing	58%	Close to home/other accommodations	73%
Wide river channel	63%	Peaceful location	80%
Good swimming	32%	Other:	9%
To observe wildlife	51%		
Adequate water depth	74%		

(ASK NO. 35 ONLY IF RAMP USAGE INVOLVED.)

35. Why did you choose to launch from this particular boating ramp/marina today? As I read you the following list, please tell me all that apply.

Well-maintained launch site	60%	Adequate parking	54%
Close to home/other accommodations	66%	Ease of ramp use	56%
Close to desired destination on the river or its tributaries	52%	Minimal ramp traffic	53%
Safe place to park car/trailer	58%	Other:	32%

36. On a scale of 1 to 10 (10 being perfect), how would you rate the quality of your boating experience today? Mean = 8.3 rating

37. Do you feel there are any conflicts between users of the Nanticoke River and its tributaries?

26% Yes 74% No. If yes, please explain: \_\_\_\_\_

38. Have you observed any boating accidents within the last year which you believe were a direct result of conflicting uses on the river and its tributaries?  
3% Yes 97% No If yes, please explain. \_\_\_\_\_
- 
39. Over the past 10 years or since you have been visiting the area, do you think the environmental quality of the Nanticoke River and its tributaries has been:  
24% improving 33% not changing very much  
16% deteriorating 27% not sure
40. Over the past 10 years or since you have been visiting the area, do you think the river and its tributaries' resources (fish, crabs, clams, etc.) have been:  
25% improving 19% not changing very much  
28% deteriorating 28% not sure
41. Would you favor or oppose each of the following management options for the Nanticoke River and its tributaries?

	Favor	Oppose	Not Sure
Increase the number of boat ramps	59%	26%	15%
Limit the number of boats using the Nanticoke River and its tributaries	13%	82%	5%
Limit the size and power of boats using these waters	15%	77%	8%
Zoning the river and its tributaries to provide for specific uses at specific places	39%	57%	4%
Stricter limits on the size and/or number of fish, crabs, clams, and waterfowl that can be taken	34%	51%	15%
Restrictions on building and development	66%	24%	10%
Increase the number of boater pumpout and/or dump stations	53%	17%	30%
Establish "Off Limits" zones to protect sensitive resources	74%	18%	8%
Prohibiting all discharges of pollutants into the water	96%	3%	1%
Restrict boat use in shallow waters to prevent bottom scouring and resource degradation	63%	19%	18%

42. Are there any specific changes that you would like to see occur along the Nanticoke River and its tributaries? Please explain:

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If you would like a copy of the survey results, please give me your name and address:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

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**APPENDIX K**  
**SURVEY INSTRUMENT WITH SUMMARY RESPONSES**  
**FOR LANDOWNER MAIL SURVEY**





UNIVERSITY OF  
DELAWARE

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SEA GRANT COLLEGE PROGRAM  
MARINE ADVISORY SERVICE  
700 PILOTTOWN ROAD  
LEWES, DE 19958-1298

Summer 1996

Dear Nanticoke River Resident/Visitor:

We are conducting a survey of boating on the Nanticoke River. At the present time, little information concerning boating and its associated impacts on the Nanticoke River is available. Management decisions should consider you, the river user—your experiences, insights, and opinions. The success of this study depends on your response, which will provide us with useful impressions and observations of activities on the river, as well as enlightening us to your concerns.

Please place your completed questionnaire in the enclosed postage-paid envelope and return it to us as quickly as possible. Strict confidentiality is guaranteed; questionnaires are coded with identification numbers for mailing purposes only. When your questionnaire is returned to us, we will use the number to check your name off our mailing list so that you do not receive any further mailings. Your name will never be placed on the questionnaire or appear in relation to your responses.

If you would like a copy of a summary report when this study is completed, please write your name and address on a separate sheet of paper and enclose it in the return envelope along with your questionnaire, or send it separately if you wish.

Information from people like yourself is needed to maintain the high quality of the Nanticoke River watershed. For this reason, we greatly appreciate your interest and assistance in this study.

Sincerely,

James M. Falk  
Project Leader

Enclosures

Dear Nanticoke River Resident/Visitor:

About a week ago, you should have received a questionnaire requesting information about your views on matters related to boating on the Nanticoke River. At the time this postcard was mailed, we had not yet received your response. Your answers are very important and will be used to represent the responses of other property owners with views similar to yours.

We would greatly appreciate it if you would take a few minutes to complete the questionnaire and return it to us in the postage-paid envelope we provided. If you have misplaced the questionnaire, or did not receive it, we will send you another one if we do not hear from you.

Thank you for your help and cooperation.

Sincerely,

James M. Falk  
Project Leader

**Note:** If you have already completed and returned the questionnaire, please disregard this reminder. Thank you for your prompt response.



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**SEA GRANT COLLEGE PROGRAM  
MARINE ADVISORY SERVICE  
700 PILOTTOWN ROAD  
LEWES, DE 19958-1298**

Summer 1996

Dear Nanticoke River Resident/Visitor:

About three weeks ago, we sent you a questionnaire seeking your opinions about boating on the Nanticoke River. If you have already completed your questionnaire, we thank you for your prompt response. If you have not completed the survey, would you please take the time to do so today? It should only take about 15 minutes.

At the present time, little information is available about boating and its associated impacts on the Nanticoke River and its tributaries. Management decisions need to consider you, the river user. Whether you are a full-time resident or a seasonal visitor to your property along the river, your views are important.

We are writing to you again because if our results are to be as reliable and useful as possible, it is important that each questionnaire be completed and returned. Remember, all responses will be summarized and handled in strict confidentiality.

A copy of the questionnaire and reply envelope are enclosed in case you did not receive, or have misplaced, the original materials we sent to you. Once the survey has been completed, drop the envelope in any mailbox; you need not add any postage.

Your cooperation is greatly appreciated.

Sincerely,

James M. Falk  
Project Leader

Enclosures

# Nanticoke River Boating Study—1996

## PART I. Your Nanticoke River Property

1. How long have you owned your property along the Nanticoke River or its tributaries? mean=26.7 years
2. Is there a house or other dwelling on your property near the Nanticoke River?

69% Yes      31% No

If "No," go to Question 5.

3. If yes, about how far is your house or other dwelling from the river's edge? mean=323 feet
4. Is your house or dwelling on the Nanticoke River your primary residence or do you usually live somewhere else?

74% Permanent Resident

26% Usually live somewhere else

GO TO QUESTION 5.

Where is your primary residence?

State: DE - 50% MD - 44% PA - 3%

City or Town: \_\_\_\_\_

Zip Code: \_\_\_\_\_

How many miles is it from your primary residence to your riverfront property (one way)?

Mean = 90 miles

5. Do you boat on the Nanticoke River and its tributaries?

59% Yes

41% No

If "Yes,"  
please continue.

If "No," please go to Part III  
and complete the rest of the survey.

## PART II. Your Boating Experience

6. How many boats do you keep on the Nanticoke River or its tributaries? mean = 1.6 boats
7. Please answer the following questions with regard to the boat that you use *most often* on the Nanticoke River.
  - a. What is the length of your boat? mean = 19.9 feet
  - b. What is the total horsepower of your engine(s)? mean = 122 hp.
  - c. Which of the following best describes your boat?

12% cabin cruiser	46% runabout	5% pontoon boat	8% rowboat	- sailboard
- jet ski	7% kayak/canoe	1% sailboat	5% bass boat	16% Other: _____
8. How many years have you been a boater? mean = 30.5 years

9. How would you rate yourself as a boater? 4% novice 33% intermediate 43% advanced 21% expert
10. How many days did you boat on the Nanticoke River last year (1995)? mean= 34.8 days
11. We are now interested in the number of days you will boat on the Nanticoke River and its tributaries this year (1996)? Would you say your overall boating activity will be (please check only one):
- |                                  |                                   |                                   |
|----------------------------------|-----------------------------------|-----------------------------------|
| <u>14%</u> Less than 5 days      | <u>19%</u> Between 10 and 20 days | <u>23%</u> Between 30 and 50 days |
| <u>16%</u> Between 5 and 10 days | <u>17%</u> Between 20 and 30 days | <u>12%</u> Greater than 50 days   |
12. Do you do most of your boating on (check one):
- 21% weekdays 31% weekends 1% holidays/special events 46% weekends & weekdays equally
13. Have you ever taken a boater safety education course? 47% Yes 53% No  
If yes, what year did you take your last course? \_\_\_\_\_
14. Do you usually carry a marine VHF radio, cell phone, or CB (or other means of communications) onboard your vessel?
- 52% Yes 48% No If yes, which do you use? VHF Radio - 54% Cell Phone - 37% CB - 10%
15. Using the following crowding scale, how would you describe the overall boating conditions on the Nanticoke River and its tributaries throughout your boating season? Please circle a number that corresponds to your answer.
- |                    |              |                  |             |             |                    |             |             |                   |
|--------------------|--------------|------------------|-------------|-------------|--------------------|-------------|-------------|-------------------|
| <u>1-29%</u>       | <u>2-24%</u> | <u>3-12%</u>     | <u>4-8%</u> | <u>5-5%</u> | <u>6-9%</u>        | <u>7-7%</u> | <u>8-2%</u> | <u>9-4%</u>       |
| Not at all Crowded |              | Slightly Crowded |             |             | Moderately Crowded |             |             | Extremely Crowded |
16. Suppose conditions on the Nanticoke River and its tributaries were EXTREMELY CROWDED throughout your boating season. Would you spend fewer days boating on the river and its tributaries?
- 51% Yes 49% No If No, proceed to question 17.
- 16a. If Yes, approximately how many fewer days? Please refer to the possible range of answers below and check the answer that corresponds to your choice.
- |                      |                     |                      |                      |  |
|----------------------|---------------------|----------------------|----------------------|--|
| <u>9%</u> 10% fewer  | <u>9%</u> 30% fewer | <u>31%</u> 50% fewer | <u>4%</u> 70% fewer  | <u>4%</u> 90% fewer days   |
| <u>20%</u> 20% fewer | <u>-</u> 40% fewer  | <u>2%</u> 60% fewer  | <u>11%</u> 80% fewer | <u>9%</u> I would spend no days at all boating on the river and its tributaries. |
17. In your opinion, how polluted is the Nanticoke River? Please circle a number that corresponds to your answer.
- |                     |              |                   |              |              |                     |             |             |                    |
|---------------------|--------------|-------------------|--------------|--------------|---------------------|-------------|-------------|--------------------|
| <u>1-8%</u>         | <u>2-13%</u> | <u>3-27%</u>      | <u>4-22%</u> | <u>5-12%</u> | <u>6-12%</u>        | <u>7-2%</u> | <u>8-2%</u> | <u>9-2%</u>        |
| Not at all Polluted |              | Slightly Polluted |              |              | Moderately Polluted |             |             | Extremely Polluted |
18. Suppose conditions on the Nanticoke River and its tributaries were EXTREMELY POLLUTED throughout your boating season. Would you spend fewer days boating on the river and its tributaries?
- 68% Yes 32% No If No, proceed to question 19.
- 18a. If Yes, approximately how many fewer days? Please refer to the possible range of answers below and check the answer that corresponds to your choice.
- |                     |                      |                      |                      |   |
|---------------------|----------------------|----------------------|----------------------|---|
| <u>3%</u> 10% fewer | <u>10%</u> 30% fewer | <u>22%</u> 50% fewer | <u>3%</u> 70% fewer  | <u>15%</u> 90% fewer  |
| <u>7%</u> 20% fewer | <u>3%</u> 40% fewer  | <u>-</u> 60% fewer   | <u>19%</u> 80% fewer | <u>17%</u> I would spend no days at all boating on the river and its tributaries. |
19. Why do you choose to engage in boating activities on the Nanticoke River and its tributaries? Please check all that apply on the following list.
- 33% Good water quality 69% Wide river channel 47% Close to home/other accommodations 24% Adequate water depth
- 16% Adequate channel markers 50% Good swimming 34% Scenic quality of river and its tributaries 31% Peaceful location
- 40% Good fishing 79% To observe wildlife 76% Not a lot of other boating traffic 20% Other: \_\_\_\_\_

## PART III. Overall Impressions of Boating on the Nanticoke River

20. How would you describe the level of commercial vessel traffic (tugs, barges, etc.) along the river? (Check one.)  
1% heavy traffic 16% moderate traffic 58% light traffic 25% no opinion
21. How would you describe the level of recreational boating traffic along the river? (Check one.)  
2% heavy traffic 22% moderate traffic 44% light traffic 19% no opinion
22. Concerning your property along the Nanticoke River or its tributaries, how often does COMMERCIAL SHIPPING contribute to the following factors identified below? Place an "X" in the column space that corresponds to your answer.

FACTOR	Always Contributes	Sometimes Contributes	Seldom Contributes	Never Contributes	No Opinion
Invasion of my privacy . . . . .	0%	2%	11%	68%	20%
Safety hazards on river . . . . .	1%	4%	17%	56%	22%
Uncomfortable noise level . . . . .	0%	3%	14%	63%	20%
Pollution/litter in river . . . . .	1%	4%	24%	45%	26%
Disturbance of wildlife . . . . .	2%	5%	23%	48%	22%
Damage of docks/piers . . . . .	3%	3%	19%	53%	23%
Excessive water turbulence . . . . .	3%	7%	20%	50%	21%
Shoreline erosion . . . . .	6%	15%	21%	36%	23%

23. Concerning your property along the Nanticoke River or its tributaries, how often does RECREATIONAL BOATING contribute to the following factors identified below? Place an "X" in the column space that corresponds to your answer.

FACTOR	Always Contributes	Sometimes Contributes	Seldom Contributes	Never Contributes	No Opinion
Invasion of my privacy . . . . .	6%	21%	27%	30%	16%
Safety hazards on river . . . . .	9%	23%	23%	29%	17%
Uncomfortable noise level . . . . .	7%	23%	20%	36%	15%
Pollution/litter in river . . . . .	10%	29%	25%	23%	14%
Disturbance of wildlife . . . . .	9%	24%	24%	28%	15%
Damage of docks/piers . . . . .	6%	12%	22%	39%	21%
Excessive water turbulence . . . . .	9%	21%	20%	32%	17%
Shoreline erosion . . . . .	15%	22%	22%	27%	15%

## PART IV. Your Concerns

24. Do you feel there are any conflicts between users of the Nanticoke River or its tributaries?  
22% Yes 78% No If yes, please explain: \_\_\_\_\_
25. Have you observed any boating accidents within the last year which you believe were a direct result of conflicting uses on the river?  
3% Yes 97% No If yes, please explain: \_\_\_\_\_

26. Over the past 10 years or since you have been visiting or living in the area, do you think the environmental quality of the Nanticoke River has been:  
20% Improving 12% Deteriorating 51% Not Changing Very Much 17% Not Sure
27. Over the past 10 years or since you have been visiting or living in the area, do you think the river's living resources (fish, crabs, clams, etc.) have been:  
12% Improving 40% Deteriorating 29% Not Changing Very Much 19% Not Sure
28. Would you favor or oppose each of the following management options for the Nanticoke River and its tributaries? Place an x in the column that corresponds to your answer.

	FAVOR	OPPOSE	NOT SURE
Increase the number of boat ramps . . . . .	25%	48%	27%
Limit the number of boats using the Nanticoke River and its tributaries . . . . .	11%	65%	24%
Limit the size and power of boats using these waters . . . . .	25%	56%	19%
Zone the river and its tributaries to provide for specific uses at specific places . . . . .	23%	56%	21%
Stricter limits on the size and/or number of fish, crabs, clams, and waterfowl that can be taken	34%	45%	21%
Restrictions on building and development . . . . .	50%	33%	17%
Increase the number of boater pumpout and/or dump stations . . . . .	50%	16%	33%
Establish "Off Limits" zones to protect sensitive resources . . . . .	42%	33%	25%
Prohibit all discharges of pollutants into the water . . . . .	81%	5%	14%
Restrict boat use in shallow waters to prevent bottom scouring and resource degradation . . .	43%	31%	26%

29. Are there any specific changes that you would like to see occur along the Nanticoke River? Please explain.

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FEEL FREE TO PROVIDE ANY ADDITIONAL COMMENTS:

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*Thank you for participating in our survey.  
 Please return the completed survey in the stamped,  
 self-addressed envelope provided.*

**APPENDIX L**  
**SURVEY INSTRUMENT WITH SUMMARY RESPONSES**  
**FOR TUG/BARGE OPERATOR MAIL SURVEY**





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Hugh R. Sharp Campus  
Lewes, Delaware 19958-1298

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E-Mail: JAMES.FALK@MVS.UDEL.EDU

SEA GRANT COLLEGE PROGRAM  
MARINE ADVISORY SERVICE  
700 PILOTTOWN ROAD  
LEWES, DE 19958-1298

Summer 1996

FIELD(Company)  
FIELD(Individual)  
FIELD(Address 1)  
FIELD(Address 2)  
FIELD(City), FIELD(State) FIELD(Zip)

Dear FIELD(Salutation)

We are conducting an extensive study of boating activity on the Nanticoke River. At the present time, little information concerning boating and its associated impacts on the Nanticoke River is available. Management decisions need to consider your uses of the river along with many others. The insights, experiences, and opinions of your tug operators/pilots are vital to conducting a comprehensive study. The success of this project depends on their response, which will provide us with useful impressions and observations of activities on the river, as well as enlightening us to their concerns.

Please distribute the enclosed surveys to your tug operators/pilots who navigate on the river and encourage them to complete and return the surveys to you as quickly as possible. We would request that you return the completed surveys as soon as you receive them in the postage-paid envelopes which we have provided. Surveys are coded with identification numbers for distribution purposes only. Strict confidentiality is guaranteed. Responses will be tabulated collectively, and your tug operators/pilots will not be identified in any way with their answers.

We will provide you with a copy of this study's findings upon completion. Information from your river user group is needed to insure the Nanticoke River remains a safe, high-quality watershed for all users. For this reason, we greatly appreciate your interest and assistance in this study.

Sincerely,

James M. Falk  
Project Leader

Enclosures

**NANTICOKE RIVER BOATING STUDY—1996  
TUG OPERATOR/PILOT SURVEY**

1. How many years have you navigated **COMMERCIAL** vessels on the Nanticoke River? mean = 13.8 years
2. In general, how would you describe the level of **COMMERCIAL** shipping traffic along the Nanticoke River? (Check one.)  
- heavy 47% moderate 53% light - no traffic
3. In general, how would you describe the level of **RECREATIONAL** vessel traffic along the Nanticoke River? (Check one.)  
13% heavy 33% moderate 53% light - no traffic
4. When do you most frequently navigate **COMMERCIAL** vessels along the Nanticoke River? (Check one.)  
7% weekends 27% weekdays 67% same frequency throughout the week
5. How many trips per year do you typically make navigating vessels on the Nanticoke River?  
 (Count each passage up or down the river as separate trips.)  
27% less than 10 7% 10 to 25 27% 25 to 50 40% 50 to 100 - greater than 100
6. In your opinion, are there any areas of particularly limited **VISIBILITY** along the river? 40% Yes 60% No  
 If yes, please describe the location (e.g.; near channel markers, land points, towns, or any particular concerns):  


---
7. In your opinion, are there any areas of particularly limited **MANEUVERABILITY** along the river? 79% Yes 21% No  
 If yes, please describe the location (e.g.; near channel markers, land points, towns, or any particular concerns):  


---
8. In your opinion, are there any areas of particularly concentrated **RECREATIONAL** vessel use along the river? 43% Yes 57% No  
 If yes, please describe the location (e.g.; near channel markers, land points, towns, or any particular concerns):  


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9. What is your perception of the use of marine radios by recreational vessels in monitoring bridge-to-bridge communications between commercial transport vessels along the river? (Check one.)  
- they always monitor 7% they sometimes monitor 53% they seldom monitor 33% they never monitor 7% unsure
10. What is your perception of recreational boaters' response to common whistle signals by commercial transport vessels along the river? (Check one.)  
- always respond 33% sometimes respond 40% seldom respond 27% never respond
11. In your opinion, do you find that recreational boaters (check one) - always 60% sometimes 27% seldom 13% never follow the rules of navigation on the Nanticoke River.

—CONTINUE ON BACK PAGE—

12. In general, do recreational vessels pose a safety hazard to your navigation along the Nanticoke River? 53% Yes 47% No

13. If yes, what type(s) of recreational vessel(s) MOST FREQUENTLY pose(s) a safety hazard to your navigation along the Nanticoke River? (Check all that apply.)

57% powerboat under 20' 29% powerboat over 20' - sailboat under power 14% canoe/kayak - sailboat under sail  
86% personal watercraft (jetski) 86% waterskiier - fishing vessel - no particular difference between vessels

14. Have you had any conflicts with RECREATIONAL vessels (i.e., close calls, near accidents, or other navigation problems, etc.) within the past year? 27% Yes 73% No If no, please skip to QUESTION 15.

a. Within the Nanticoke River corridor, where have most of your conflicts with RECREATIONAL craft occurred? (Please be as specific as possible; e.g., near channel markers, land points, or towns.)

b. When have most of your conflicts with RECREATIONAL craft occurred? (Please list time of day, day of week, month of year, and (if applicable) any holiday period.)

c. How many times per month on average do you experience conflicts with RECREATIONAL craft?  
- 1-2 33% 3-4 - 5-6 - 7-8 67% 9-10 - Greater than 10

15. Have you had any conflicts with other COMMERCIAL transport vessels (i.e., close calls, near accidents, or other navigational problems, etc.) within the past year? 0% Yes 100% No If no, skip to QUESTION 16.

a. Within the Nanticoke River corridor, where have most of your conflicts with commercial transport vessels occurred? (Please be as specific as possible; e.g., near channel markers, land points, or towns.)

b. When have most of your conflicts with other COMMERCIAL transport vessels occurred? (Please list time of day, day of week, month of year, and (if applicable) any holiday periods?)

c. How many times per month on average do you experience conflicts with other COMMERCIAL transport vessels?  
- 1-2 - 3-4 - 5-6 - 7-8 - 9-10 - greater than 10

16. In addition to the responses you have already provided, do you feel that there are any other safety concerns along the Nanticoke River?

62% Yes 38% No If yes, please specify:

17. Have you observed any boating accidents within the last year which you believe were a result of conflicting user interests?

14% Yes 86% No If yes, please describe:

18. Are there any specific changes you would like to see occur along the Nanticoke River? 71% Yes 29% No  
If yes, please describe:

(Attach additional sheet if necessary.)

*Thank you for participating in our survey.*

**APPENDIX M**  
**SURVEY INSTRUMENT WITH SUMMARY RESPONSES**  
**FOR COMMERCIAL SHIPPER MAIL SURVEY**



UNIVERSITY OF  
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SEA GRANT COLLEGE PROGRAM  
MARINE ADVISORY SERVICE  
700 PILOTTOWN ROAD  
LEWES, DE 19958-1298

Summer 1996

FIELD(Company Name)  
FIELD(Individual Name)  
FIELD(Address 1)  
FIELD(City), FIELD(State) FIELD(Zip)

Dear FIELD(Salutation)

We are conducting an extensive study of boating activity on the Nanticoke River. At the present time, little information concerning boating and its associated impacts on the Nanticoke River is available. Management decisions need to consider your uses of the river along with many others. Your insights, experiences, and opinions are vital to conducting a comprehensive study. The success of this project depends on your response, which will provide us with useful impressions of activities on the river, as well as enlightening us to your concerns.

Please place your completed questionnaire in the postage-paid envelope and return it to us as quickly as possible. Questionnaires are coded with identification numbers for distribution purposes only. Strict confidentiality is guaranteed. Responses will be tabulated collectively, and you will not be identified in any way with your answers.

We will provide you with a copy of this study's findings upon completion. Information from people like yourself is needed to insure the Nanticoke River remains a safe, high-quality watershed for all users. For this reason, we greatly appreciate your interest and assistance in this study.

Sincerely,

James M. Falk  
Project Leader

## NANTICOKE RIVER BOATING STUDY—1996 COMMERCIAL SHIPPING SURVEY

1. Considering your firm's need to use the Nanticoke River and its tributaries as a shipping route, how many trips does your firm typically commission on an annual basis along the river? (Count each passage up or down the river as a separate trip.) Mean = 56 trips
  
2. Why do you use the Nanticoke River as a shipping route? (Please check all that apply.)  
86% cost effective      29% less environmental impacts than land transport      29% faster than land transport  
29% other (specify): \_\_\_\_\_
  
3. Are you aware of any navigational difficulties encountered by your vessel(s) when they use the Nanticoke River as a shipping route?  
43% Yes 57% No    If yes, please explain: \_\_\_\_\_  
 \_\_\_\_\_
  
4. What factors, if any, would prohibit you from using the Nanticoke River as a shipping route in the future? (Please check all that apply.)  
86% increasing costs      14% increasing recreational boating traffic on the river  
57% increasingly hazardous navigational conditions      29% other (specify): \_\_\_\_\_  
0% increasing commercial shipping traffic on the river      \_\_\_\_\_
  
5. Are you aware of any conflicts (i.e., close calls, near-accident situations, or other navigational problems, etc.) your vessel(s) have had with RECREATIONAL vessels while traveling along the Nanticoke River? 0% Yes 100% No If yes, please describe the situation:  
 \_\_\_\_\_  
 \_\_\_\_\_
  
6. Are you aware of any conflicts (i.e., close calls, near-accident situations, or other navigational problems, etc.) your vessel(s) have had with other COMMERCIAL shipping vessels while traveling along the Nanticoke River? 0% Yes 100% No  
 If yes, please describe the situation: \_\_\_\_\_  
 \_\_\_\_\_
  
7. In your opinion, if RECREATIONAL uses of the Nanticoke River increase, can you foresee a decrease in your use of the river as a shipping route? 17% Yes 83% No If yes, approximately how much of a decrease?  
   10% decrease       25% decrease       50% decrease       75% decrease  
   I would not use the river as a shipping route at all       Other (specify): \_\_\_\_\_
  
8. Do you feel that there are any other safety concerns along the river? 43% Yes 57% No  
 If yes, please describe: \_\_\_\_\_  
 \_\_\_\_\_
  
9. Are there any specific changes you would like to see occur along the Nanticoke River? 43% Yes 57% No  
 If yes, please describe: \_\_\_\_\_  
 \_\_\_\_\_

(Attach additional sheet if necessary.)

*Thank you for participating in our survey.*

**APPENDIX N**  
**SURVEY INSTRUMENT WITH SUMMARY RESPONSES**  
**FOR COMMERCIAL WATERMEN MAIL SURVEY**

# Nanticoke River Watershed Boating Study Commercial Watermen

Dear Maryland Watermen:

The Nanticoke River Watershed Alliance, Maryland DNR, Delaware DNREC and the University of Delaware Sea Grant Program have joined forces to examine issues related to recreational boating on the Nanticoke River and its tributaries. The assessment is intended to identify the various recreational and commercial uses of the river, evaluate the level of boating activity, and finally to determine if any conflicting uses are occurring between the river users.

To insure that all relevant user groups have an opportunity to express their concerns, this brief survey instrument has been developed for your review and consideration. If you engage in any commercial fishing activity in the River or its tributaries, we would request that you take a few moments to answer the questions and mail the questionnaire back to the address at the end of the survey.

You will not be identified in any way with your answers. All responses will be handled in strict confidentiality. It will be impossible to identify any specific response with a particular individual.

Thank you for your help and assistance. Results of the study will be published in a future issue of the Waterman's Gazette.

(Frequency based on only 3 responses, results may not accurately represent all watermen.)

1. How many years have you been a commercial waterman on the Nanticoke River or its tributaries? \_\_\_\_\_ Years Mean = 26
2. Please check which months of the year you engage in commercial fishing activity on the Nanticoke River or its tributaries: (%)
 

<u>33</u> Jan	<u>33</u> Feb	<u>67</u> Mar	<u>67</u> Apr	<u>33</u> May	<u>33</u> Jun
<u>67</u> Jul	<u>67</u> Aug	<u>67</u> Sep	<u>33</u> Oct	<u>33</u> Nov	<u>33</u> Dec
3. What time of day do you typically engage in commercial fishing activity on the River or its tributaries? Please check all that apply.
 

<u>33%</u> Between Midnight and 6 a.m.	___ Between 12 noon & 6 p.m.
<u>100%</u> Between 6 a.m. and 12 noon	___ Between 6 p.m. & midnight
4. What type of gear do you fish with? Please check all that apply. (%)
 

<u>33</u> Fixed gear (nets/stakes, etc)	___ Trot line
<u>67</u> Floating gear (gillnets)	<u>67</u> Pots/traps
<u>33</u> Other (specify) _____	

5. On the scale below please rate the overall level of recreational boating traffic that you encounter on the Nanticoke River or its tributaries during your primary fishing season. Please circle the number that corresponds to your answer. (%) Mean = 3.3

1-33	2-33	3	4	5	6	7-33	8	9
Not At All Crowded		Slightly Crowded		Moderately Crowded		Extremely Crowded		

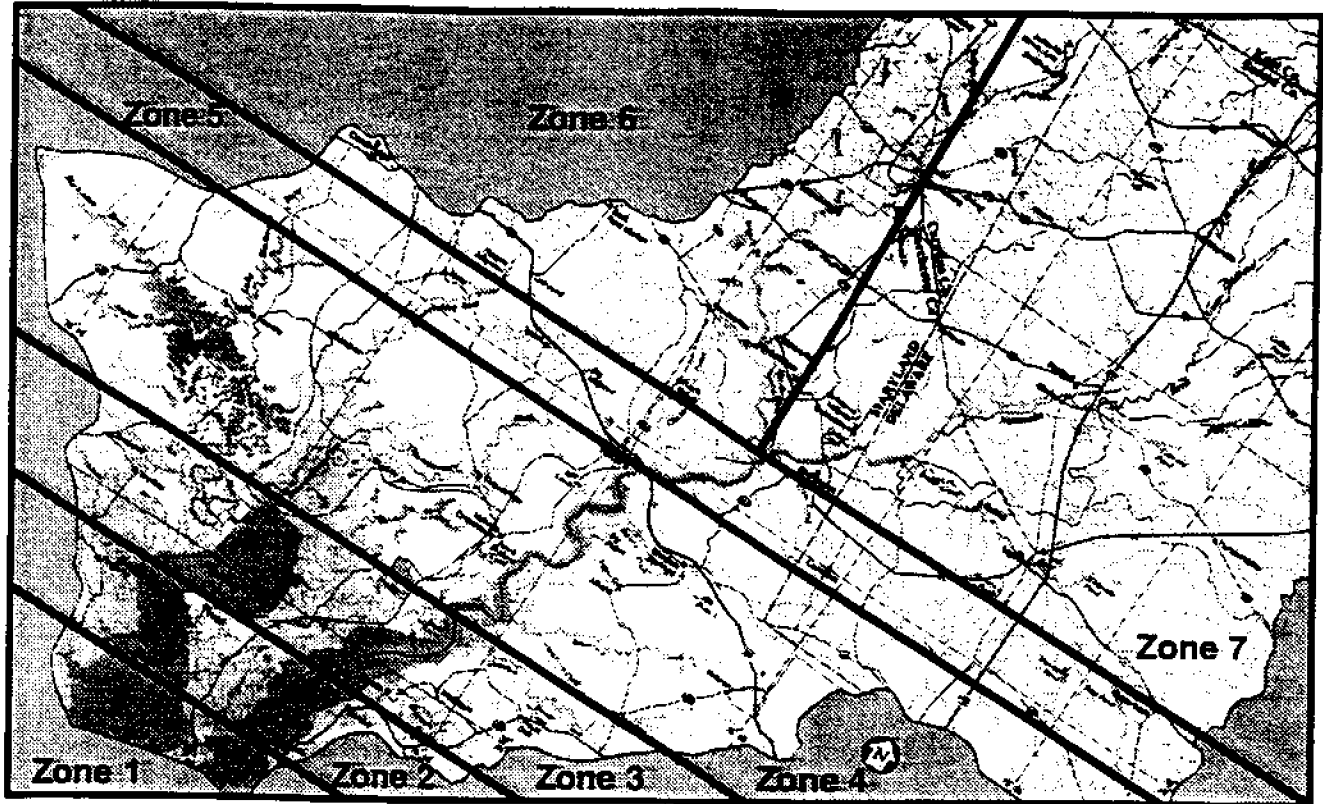
6. Does the level of recreational boating traffic interfere with your fishing activity on the River or its tributaries? 33% Yes 67% No

IF NO, SKIP TO QUESTION 7. If yes, please check all that apply:

- 100% Recreational watercraft runs over nets/gear
- \_\_\_ Recreational watercraft interferes with actual harvesting
- \_\_\_ Recreational watercraft runs over marker buoys
- \_\_\_ Other (specify) \_\_\_\_\_

Feel free to make additional comments about types of watercraft or specific situations: \_\_\_\_\_





7. Does commercial shipping traffic interfere with your fishing activity on the River or its tributaries?  Yes  No

IF NO, SKIP TO QUESTION 8. If yes, please check all that apply:

- Commercial traffic runs over nets/gear
- Commercial traffic interferes with actual harvesting
- Commercial traffic runs over marker buoys
- Other (specify) \_\_\_\_\_

Feel free to make additional comments about types of vessels or specific situations: \_\_\_\_\_

8. Please indicate the area(s) of the river or its tributaries where you typically fish. Please refer to map and check all the zones that apply.

Zone 1  Zone 2  Zone 3  Zone 4  
 Zone 5  Zone 6  Zone 7

9. Over the past 10 years, or since you have been a commercial water man, do you think the environmental quality of the Nanticoke River or its tributaries has been: *Please check only one.*

Improving  Not Changing Very Much  
 Deteriorating  Not Sure

9a. Please describe any particular concerns you have related to the river's environmental quality. \_\_\_\_\_

10. Over the past 10 years, or since you have been a commercial water man, do you think the Nanticoke River or its tributaries living resources (fish, crabs, clams, etc.) have been. *Please check only one.*

Improving  Not Changing Very Much  
 Deteriorating  Not Sure

10a. Please describe any particular concerns you have related to the river's living resources (be species specific if you desire).

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Feel free to add any other comments regarding your use and activities of the Nanticoke River or its tributaries.

\_\_\_\_\_  
 \_\_\_\_\_

**THAT CONCLUDES THE SURVEY.**  
**THANK YOU FOR YOUR TIME AND ASSISTANCE.**  
 Please mail completed questionnaire by April 15, 1997 to:  
 University of Delaware Sea Grant  
 Marine Advisory Service  
 700 Pilottown Road  
 Lewes, DE 19958

**APPENDIX O**  
**AERIAL FLIGHT ACTIVITY TOTALS**  
**(Tables O-1 through O-9)**

Table O-1. Aerial Flight Observations for Five Subdivisions of the Nanticoke River and Tributaries

Saturday, July 6, 1996	Fish	Cruise	Waterski	Jetski	Swim	Sightsee	Sail	Crab	Sailboard	Canoe & Kayak	Total
MD-Lower <sup>1</sup>	4	4	2	0	3	0	1	1	1	0	16
MD-Middle <sup>2</sup>	0	2	0	2	0	0	0	0	0	0	4
MD-Upper <sup>3</sup>	2	9	2	0	0	0	0	0	0	0	13
Marshyhope Creek <sup>4</sup>	2	3	1	0	0	0	0	0	0	0	6
DE Nanticoke- Broad Creek <sup>5</sup>	4	9	2	4	0	0	0	0	0	0	19
<b>Total</b>	<b>12</b>	<b>27</b>	<b>7</b>	<b>6</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>58</b>
<b>Percentage*</b>	<b>21%</b>	<b>4%</b>	<b>12%</b>	<b>10%</b>	<b>5%</b>	<b>0%</b>	<b>2%</b>	<b>2%</b>	<b>2%</b>	<b>0%</b>	<b>101%</b>

\*Does not equal 100% due to rounding.

<sup>1</sup>From mouth of Chesapeake Bay, north to Chapter Point

<sup>2</sup>From Chapter Point, north to Vienna, MD

<sup>3</sup>From Vienna, MD, north to DE border

<sup>4</sup>Convergence of creek with Nanticoke River, north to Federalsburg, MD

<sup>5</sup>From DE border, north to Seaford, DE, and Broad Creek, east to Bethel, DE

Table O-2. Aerial Flight Observations for Five Subdivisions of the Nanticoke River and Tributaries

Sunday, Aug. 4, 1996	Fish	Cruise	Waterski	Jetski	Swim	Sightsee	Sail	Crab	Sailboard	Canoe & Kayak	Total
MD-Lower <sup>1</sup>	11	2	1	0	7	0	1	2	0	0	24
MD-Middle <sup>2</sup>	2	3	0	0	0	0	0	1	0	0	6
MD-Upper <sup>2</sup>	3	6	2	3	4	0	0	0	0	0	18
Marshyhope Creek <sup>4</sup>	5	5	0	0	1	0	0	0	0	1	12
DE Nanticoke-Broad Creek <sup>5</sup>	3	16	11	2	0	0	0	0	0	0	32
<b>Total</b>	<b>24</b>	<b>32</b>	<b>14</b>	<b>5</b>	<b>12</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>92</b>
Percentage*	26%	35%	15%	5%	13%	0%	1%	3%	0%	1%	99%

\*Does not equal 100% due to rounding

<sup>1</sup>From mouth of Chesapeake Bay, north to Chapter Point

<sup>2</sup>From Chapter Point, north to Vienna, MD

<sup>3</sup>From Vienna, MD, north to DE border

<sup>4</sup>Convergence of creek with Nanticoke River, north to Federalsburg, MD

<sup>5</sup>From DE border, north to Seaford, DE, and Broad Creek, east to Bethel, DE

Table O-3. Aerial Flight Observations for Five Subdivisions of the Nanticoke River and Tributaries

Saturday, Aug. 17, 1996	Fish	Cruise	Waterski	Jetski	Swim	Sightsee	Sail	Crab	Sailboard	Canoe & Kayak	Total
MD-Lower <sup>1</sup>	20	9	1	2	1	5	3	2	0	0	43
MD-Middle <sup>2</sup>	1	1	0	0	0	0	0	0	0	0	2
MD-Upper <sup>2</sup>	8	2	1	1	3	0	0	0	0	0	15
Marshyhope Creek <sup>4</sup>	10	5	0	2	3	4	0	0	0	0	24
DE Nanticoke-Broad Creek <sup>3</sup>	15	9	8	2	4	2	0	0	0	2	42
<b>Total</b>	<b>54</b>	<b>26</b>	<b>10</b>	<b>7</b>	<b>11</b>	<b>11</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>126</b>
<b>Percentage*</b>	<b>43%</b>	<b>21%</b>	<b>8%</b>	<b>6%</b>	<b>9%</b>	<b>9%</b>	<b>2%</b>	<b>2%</b>	<b>0%</b>	<b>2%</b>	<b>102%</b>

\* Does not equal 100% due to rounding

<sup>1</sup>From mouth of Chesapeake Bay, north to Chapter Point

<sup>2</sup>From Chapter Point, north to Vienna, MD

<sup>3</sup>From Vienna, MD, north to DE border

<sup>4</sup>Convergence of creek with Nanticoke River, north to Federalsburg, MD

<sup>5</sup>From DE border, north to Seaford, DE, and Broad Creek, east to Bethel, DE

Table O-4. Aerial Flight Observations for Five Subdivisions of the Nanticoke River and Tributaries

Sunday, Aug. 25, 1996	Fish	Cruise	Waterski	Jetski	Swim	Sightsee	Sail	Crab	Sailboard	Canoe & Kayak	Total
MD-Lower <sup>1</sup>	18	12	0	0	0	3	10	2	0	0	45
MD-Middle <sup>2</sup>	2	7	0	3	0	0	0	0	0	0	12
MD-Upper <sup>3</sup>	4	3	16	0	0	1	1	0	0	0	25
Marshyhope Creek <sup>4</sup>	11	9	8	1	0	0	0	0	0	2	31
DE Nanticoke-Broad Creek <sup>5</sup>	24	5	15	0	2	1	0	0	0	0	47
Total	59	36	39	4	2	5	11	2	0	2	160
Percentage	37%	23%	24%	3%	1%	3%	7%	1%	0%	1%	100%

<sup>1</sup>From mouth of Chesapeake Bay, north to Chapter Point

<sup>2</sup>From Chapter Point, north to Vienna, MD

<sup>3</sup>From Vienna, MD, north to DE border

<sup>4</sup>Convergence of creek with Nanticoke River, north to Federalsburg, MD

<sup>5</sup>From DE border, north to Seaford, DE, and Broad Creek, east to Bethel, DE

Table O-5. Aerial Flight Observations for Five Subdivisions of the Nanticoke River and Tributaries

Saturday, Aug. 31, 1996	Fish	Cruise	Waterski	Jetski	Swim	Sightsee	Sail	Crab	Sailboard	Canoe & Kayak	Total
MD-Lower <sup>1</sup>	28	5	0	0	0	3	3	0	0	0	39
MD-Middle <sup>2</sup>	4	2	0	0	0	0	0	0	0	0	6
MD-Upper <sup>3</sup>	7	3	4	2	0	0	0	0	0	0	16
Marshyhope Creek <sup>4</sup>	12	10	2	0	0	1	0	0	0	3	28
DE Nanticoke-Broad Creek <sup>5</sup>	19	10	11	0	0	2	0	0	0	2	44
<b>Total</b>	<b>70</b>	<b>30</b>	<b>17</b>	<b>2</b>	<b>0</b>	<b>6</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>5</b>	<b>133</b>
<b>Percentage*</b>	<b>53%</b>	<b>23%</b>	<b>13%</b>	<b>2%</b>	<b>0%</b>	<b>5%</b>	<b>2%</b>	<b>0%</b>	<b>0%</b>	<b>4%</b>	<b>102%</b>

\*Does not equal 100% due to rounding

<sup>1</sup>From mouth of Chesapeake Bay, north to Chapter Point

<sup>2</sup>From Chapter Point, north to Vienna, MD

<sup>3</sup>From Vienna, MD, north to DE border

<sup>4</sup>Convergence of creek with Nanticoke River, north to Federalsburg, MD

<sup>5</sup>From DE border, north to Seaford, DE, and Broad Creek, east to Bethel, DE.

Table O-6. Aerial Flight Observations for Five Subdivisions of the Nanticoke River and Tributaries

Sunday, Sept. 8, 1996	Fish	Cruise	Waterski	Jetski	Swim	Sightsee	Sail	Crab	Sailboard	Canoe & Kayak	Total
MD-Lower <sup>1</sup>	4	1	0	0	0	0	6	3	0	0	14
MD-Middle <sup>2</sup>	0	0	0	3	0	0	0	2	0	0	5
MD-Upper <sup>3</sup>	1	0	2	3	0	0	0	1	0	0	7
Marshyhope Creek <sup>4</sup>	6	0	2	0	2	0	0	0	0	0	10
DE Nanticoke-Broad Creek <sup>5</sup>	7	7	4	6	4	0	0	0	0	5	33
<b>Total</b>	<b>18</b>	<b>8</b>	<b>8</b>	<b>12</b>	<b>6</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>0</b>	<b>5</b>	<b>69</b>
<b>Percentage*</b>	<b>26%</b>	<b>12%</b>	<b>12%</b>	<b>17%</b>	<b>9%</b>	<b>0%</b>	<b>9%</b>	<b>9%</b>	<b>0%</b>	<b>7%</b>	<b>101%</b>

\*Does not equal 100% due to rounding

<sup>1</sup>From mouth of Chesapeake Bay, north to Chapter Point

<sup>2</sup>From Chapter Point, north to Vienna, MD

<sup>3</sup>From Vienna, MD, north to DE border

<sup>4</sup>Convergence of creek with Nanticoke River, north to Federalsburg, MD

<sup>5</sup>From DE border, north to Seaford, DE, and Broad Creek, east to Bethel, DE



Table O-7. Aerial Flight Observations for Five Subdivisions of the Nanticoke River and Tributaries

Sunday, Sept. 15, 1996	Fish	Cruise	Waterski	Jetski	Swim	Sightsee	Sail	Crab	Sailboard	Canoe & Kayak	Total
MD-Lower <sup>1</sup>	13	3	0	1	0	0	1	0	0	0	18
MD-Middle <sup>2</sup>	1	1	0	0	0	0	0	0	0	0	2
MD-Upper <sup>3</sup>	3	2	0	0	0	0	0	0	0	0	5
Marshyhope Creek <sup>4</sup>	9	1	1	0	0	0	0	0	0	0	11
DE Nanticoke-Broad Creek <sup>5</sup>	5	4	2	0	0	0	0	0	0	0	11
Total	31	11	3	1	0	0	1	0	0	0	47
Percentage*	66%	23%	6%	2%	0%	0%	2%	0%	0%	0%	99%

\*Does not equal 100% due to rounding

<sup>1</sup>From mouth of Chesapeake Bay, north to Chapter Point

<sup>2</sup>From Chapter Point, north to Vienna, MD

<sup>3</sup>From Vienna, MD, north to DE border

<sup>4</sup>Convergence of creek with Nanticoke River, north to Federalsburg, MD

<sup>5</sup>From DE border, north to Seaford, DE, and Broad Creek, east to Bethel, DE

Table O-8. Aerial Flight Observations for Five Subdivisions of the Nanticoke River and Tributaries

Saturday, Sept. 21, 1996	Fish	Cruise	Waterski	Jetski	Swim	Sightsee	Sail	Crab	Sailboard	Canoe & Kayak	Total
MD-Lower <sup>1</sup>	34	9	0	0	0	0	0	2	0	0	45
MD-Middle <sup>2</sup>	2	3	0	0	0	0	0	0	0	0	5
MD-Upper <sup>3</sup>	1	1	0	0	0	0	0	0	0	0	2
Marshyhope Creek <sup>4</sup>	7	3	0	0	0	0	0	0	0	1	11
DE Nanticoke-Broad Creek <sup>5</sup>	14	5	1	1	0	0	0	0	0	0	21
Total	58	21	1	1	0	0	0	2	0	1	84
Percentage*	69%	25%	1%	1%	0%	0%	0%	2%	0%	1%	99%

\*Does not equal 100% due to rounding

<sup>1</sup>From mouth of Chesapeake Bay, north to Chapter Point

<sup>2</sup>From Chapter Point, north to Vienna, MD

<sup>3</sup>From Vienna, MD, north to DE border

<sup>4</sup>Convergence of creek with Nanticoke River, north to Federalsburg, MD

<sup>5</sup>From DE border, north to Seaford, DE, and Broad Creek, east to Bethel, DE

Table O-9. Aggregate Aerial Flight Observations for Five Subdivisions of the Nanticoke River and Tributaries

8 days-1996	Fish	Cruise	Waterski	Jetski	Swim	Sail	Sightsee	Crab	Canoe & Kayak	Sailboard	Total
MD-Lower <sup>1</sup>	132	45	4	3	11	25	11	12	0	1	244
MD-Middle <sup>2</sup>	12	19	0	8	0	0	0	3	0	0	42
MD-Upper <sup>3</sup>	29	26	27	9	7	1	1	1	0	0	101
Marshyhope Creek <sup>4</sup>	62	36	14	3	10	0	5	0	7	0	137
DE Nanticoke- Broad Creek <sup>5</sup>	91	65	54	15	6	0	5	0	9	0	245
Total	326	191	99	38	34	26	22	16	16	1	769
Percentage	42%	25%	13%	5%	4%	3%	3%	2%	2%	<1%	100%

<sup>1</sup>From mouth of Chesapeake Bay, north to Chapter Point

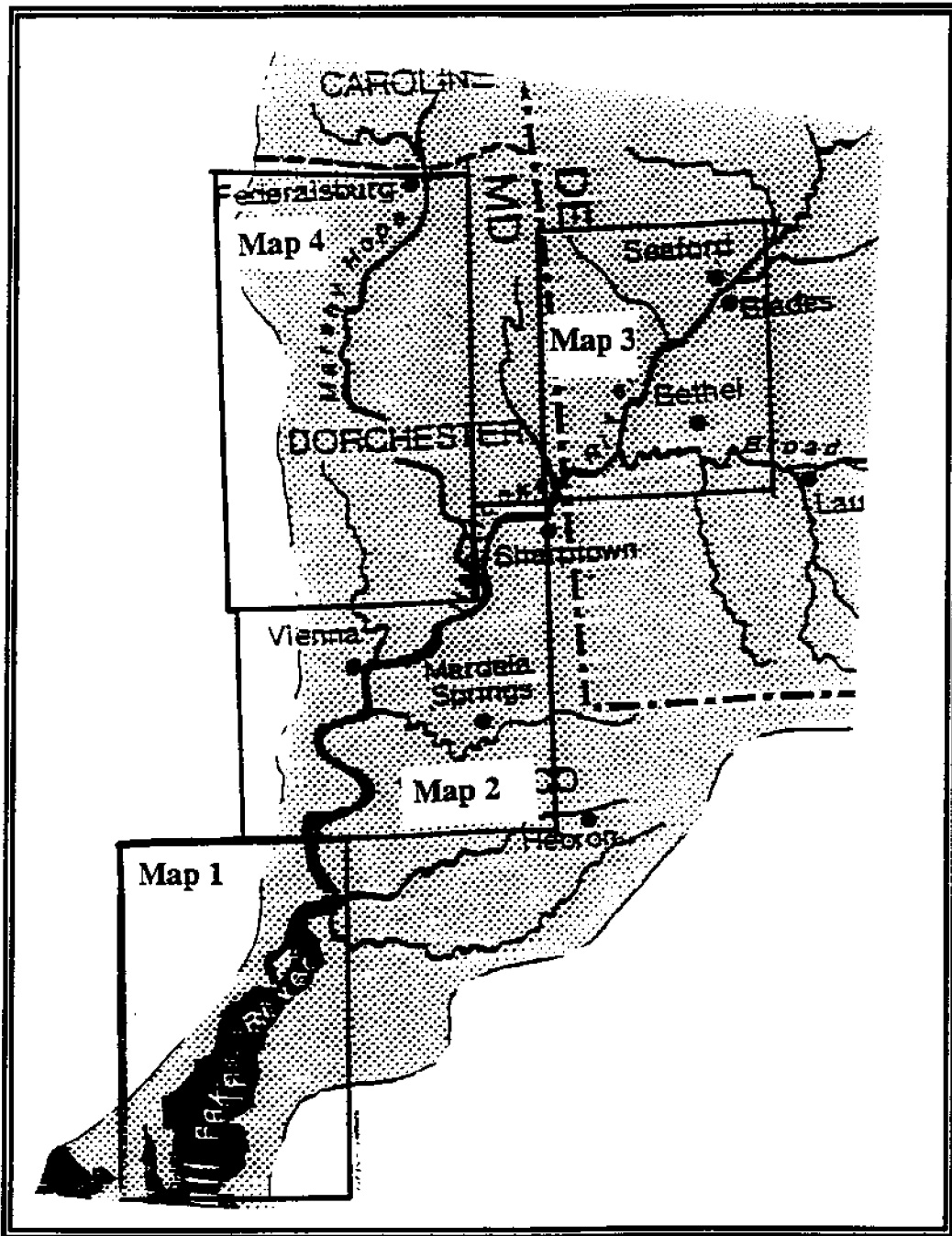
<sup>2</sup>From Chapter Point, north to Vienna, MD

<sup>3</sup>From Vienna, MD, north to DE border

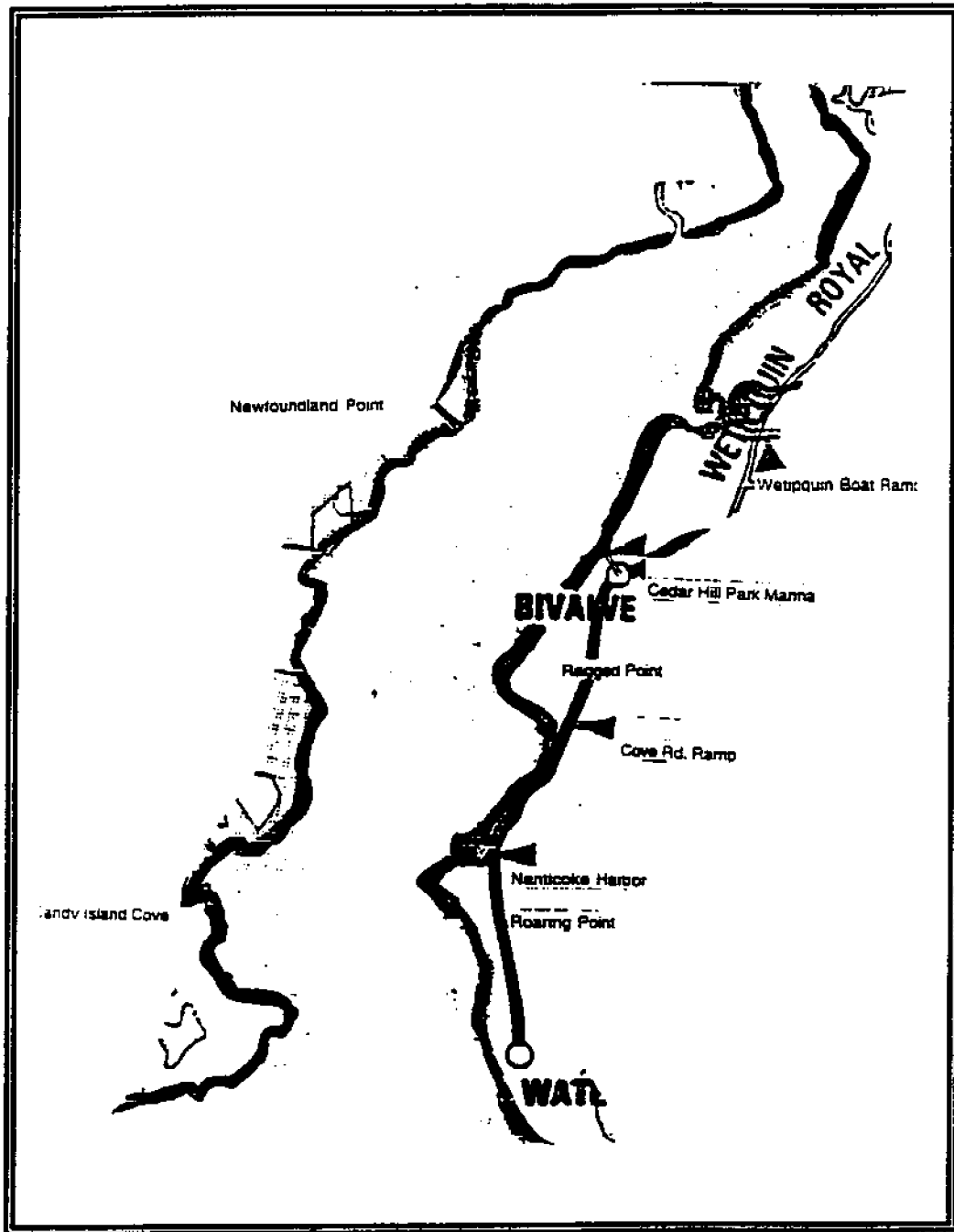
<sup>4</sup>From convergence of creek with Nanticoke River, north to Federalsburg, MD

<sup>5</sup>From DE border, north to Seaford, DE, and Broad Creek, east to Bethel, DE

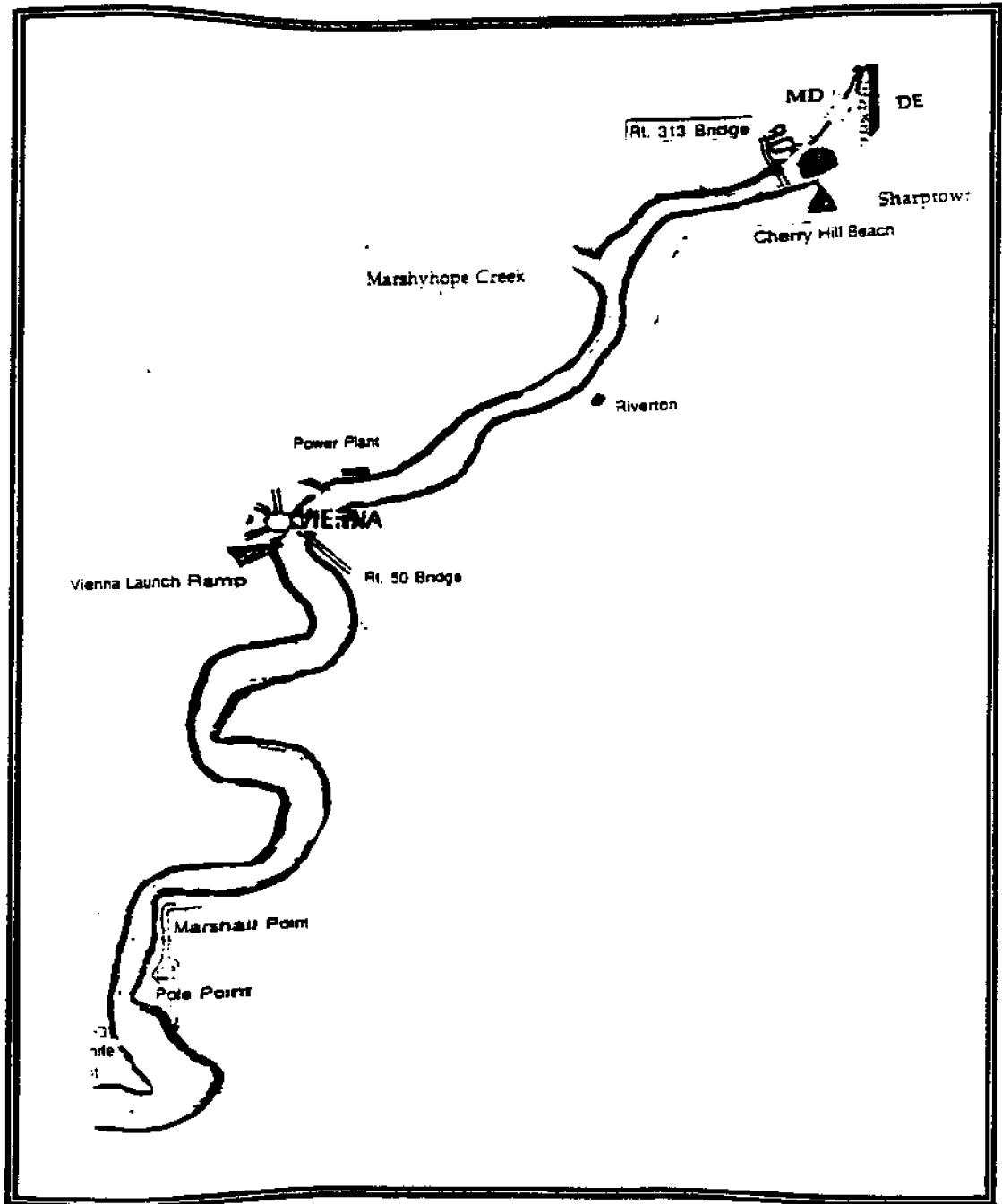
**APPENDIX P**  
**ON-SITE FIELD SURVEY MAPS**  
**(P-1 through P-5)**



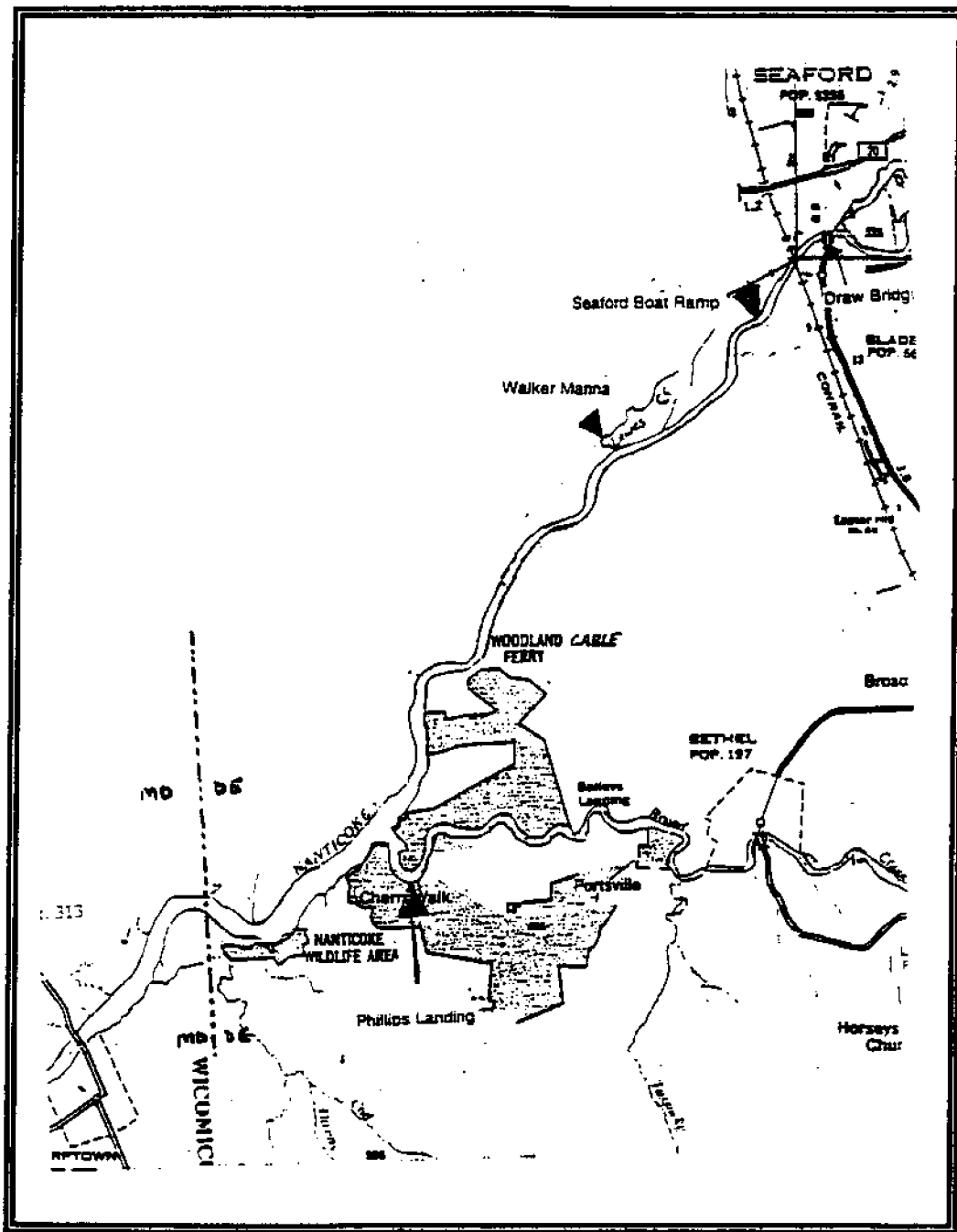
Map P-1. On-site Boaters' Map Depicting four Use Zones



Map P-2. On-site Boaters' Map Zone 1--Lower Maryland Nanticoke

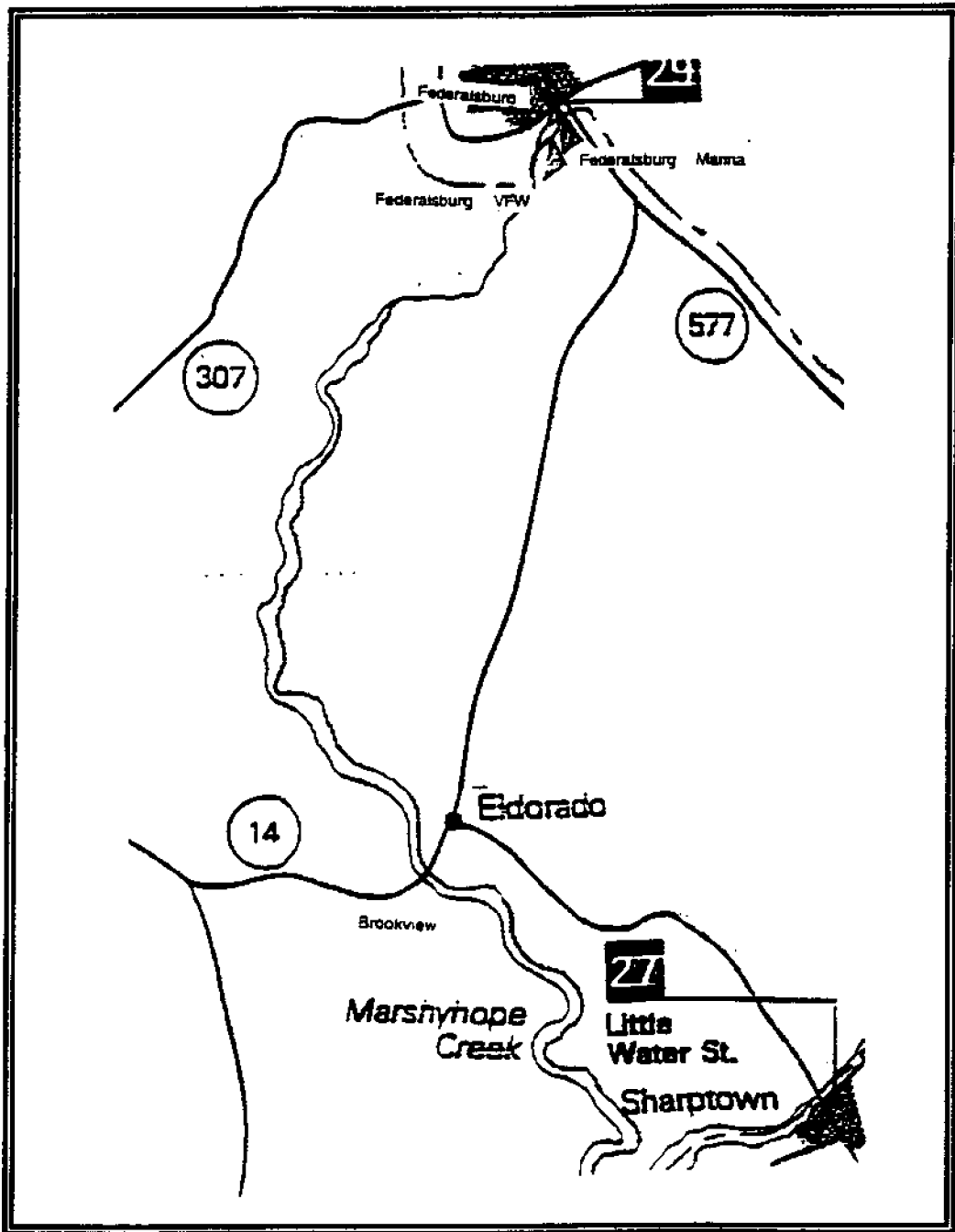


Map P-3. On-site Boaters' Map Zone 2--Mid-Upper Maryland Nanticoke



Map P-4. On-site Boaters' Map Zone 3— Delaware Nanticoke-Broad Creek





Map P-5. On-site Boaters' Map Zone 4--Marshynhope Creek

## APPENDIX Q

### SUMMARY OF REPORTED BASS CLUB TOURNAMENTS IN NANTICOKE RIVER/BROAD CREEK REGION\*

# of Events	# of Anglers	# of Hours	# of Legal Bass/Hr.	Pounds of Legal Bass/Hr.
35	648	5,321	0.22	0.34
10 <sup>1</sup>	102	794	0.26	0.40
45	750	6,115	0.22	

\* Includes Marshyhope Creek

<sup>1</sup> Tournaments using the "Golden Rule" (weights calculated from lengths).

Source: Catherine C. Martin, Fisheries Scientist, Delaware DNREC, Division of Fish and Wildlife. Delaware's Freshwater Fisheries Management Program: Freshwater Fishing Statistical Survey, March 1, 1996 - February 28, 1997, Project F-41-R-8, Dover, DE.