

**DELAWARE RIVER AND BAY  
WATER QUALITY ASSESSMENT  
1996-1997 305(b) REPORT**



DELAWARE RIVER BASIN COMMISSION

WEST TRENTON, NEW JERSEY

AUGUST 1998

9/17/1998

## ERRATA

*The Delaware River and Bay Water Quality Assessment, 1996-1997 305(b) Report*, August 1998, contains an error in the assessment of Support of Fish Consumption in lower Zone 5 and in Zone 6. The assessment was based on data obtained from EPA's national database for fish advisories-- *Listing of Fish and Wildlife Advisories*--which is the primary database EPA uses in its National 305(b) report to assess Support of Fish Consumption, according to EPA's *Guidelines for Preparation of ...305(b) Reports...*

The *Listing of Fish and Wildlife Advisories* indicated that the State of Delaware had issued a No Consumption, General Population advisory for striped bass, channel/white catfish and white perch, from the C&D canal to Cape Henlopen, due to high concentrations of PCB's. Actually the State of Delaware issued an advisory to Restrict Consumption. Therefore the Support of Fish Consumption in Delaware Bay should be assessed as providing Partial Support rather than No Support. (Note: The error in the *Listing...* has been brought to the attention of EPA.)

Two maps are attached to replace the maps in this document; the text should be changed as follows:

PAGE	PARAGRAPH	CORRECTION
5	Table 6	For Fish Consumption: Size Not Supporting column should be 38; Size Partially Supporting should be 803.
6	Third	Strike second sentence: "For the individual uses, ...in 1996-97."
7	Last	Second sentence: strike "for example, ...striped bass."
8	First	Strike first two lines and third line through "...estuary/Bay."
13	First	Strike second and third sentences.

**DELAWARE RIVER AND BAY  
WATER QUALITY ASSESSMENT  
1996-1997 305(b) REPORT**



Report prepared by the Delaware River Basin Commission, Carol Collier, Executive Director; Jeffrey P. Featherstone, Deputy Executive Director. Robert C. Kausch was the principal author. GIS maps were prepared by Karen Reavy and Vern Svatos.

AUGUST 1998

# CONTENTS

## **PART 1 SUMMARY / OVERVIEW**

Introduction .....	1
Support Of Uses .....	2
Changes Since The 1996 305b Report .....	6
Cause And Source Of Impairments .....	7
Programs To Correct Impairments .....	7
General Water Quality Trends .....	7
Monitoring / Special Concerns / Initiatives .....	8

## **PART 2 BACKGROUND**

Purpose .....	9
Study Area Description .....	9
Water Uses And Standards .....	9
Water Pollution Control Program .....	9

## **PART 3 SURFACE WATER ASSESSMENT**

Surface Water Monitoring Program .....	11
Assessment Methodology .....	11
Non-Tidal Delaware River (Zone 1) .....	11
Tidal Delaware River, Estuary/Bay (Zones 2-6) .....	11
Wetlands .....	13
Public Health And Aquatic Life Concerns .....	13
Fish Populations .....	13

## **PART 4 GROUNDWATER ASSESSMENT .....**

14

## **PART I SUMMARY / OVERVIEW**

### **INTRODUCTION**

This report briefly summarizes the Delaware River Basin Commission's analysis of the quality of the water comprising the Delaware River and the extent to which the River supported various designated uses during 1996 and 1997. The data has been entered into EPA's Water Body System and transmitted to EPA in an electronic form. The electronically filed data and this document constitute the Commission's report under Section 305(b) of the Water Quality Act, in accordance with EPA's Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates (September 1997). In accordance with the "Guidelines...", the following report is focused on changes in the support of water uses, and changes in the water quality monitoring and pollution control programs that have occurred since the last full "hard copy" report (Delaware River and Bay Water Quality Assessment, 1994-1995 305b Report), issued June 1996.

The assessment primarily involved comparisons of ambient water quality monitoring data with DRBC water quality standards. The degree of support--full, full but threatened, partial, and none--was based on the number of times the standards were violated. Following the "Guidelines...", for conventional water quality parameters such as those used in assessing support for aquatic life (dissolved oxygen, pH, temperature, conductivity, turbidity), the degree of support is determined as follows: when zero to 10% of the tests for a single parameter violate a standard, full support is indicated; exceedance in 10% to 25% of the tests reflects partial support; greater than 25% equals no support; and, full, but threatened, support occurs when there is an increasing trend in the mean for a parameter that provides full support. In many cases professional judgment was utilized when the data was insufficient or indeterminate. For water uses for which DRBC does not have specific water quality standards at present, the assessment considered the actions/judgments of other resource management agencies; for example, the extent to which fish consumption was supported was based on public notices urging the public to either not consume or to limit consumption of contaminated fish. These advisories were issued by agencies of New Jersey, Pennsylvania and Delaware.

## PART I SUMMARY / OVERVIEW

### SUPPORT OF USES

Support was highest in the non-tidal Delaware River where full support was provided for all assessed uses in 150 miles of the 206-mile long reach. The tidal, freshwater reach and the estuary/bay did not provide full support for all assessed uses anywhere. It was determined that one or more uses were impaired (i.e. either partially, or not, supported) along 54 miles of the non-tidal river, in 25 square miles of the tidal, freshwater reach, and in 841 square miles of the estuary/bay.

The degree of support for individual uses varied. Based on the percentage of the total miles/square miles assessed that provided Full Support for a use, throughout the Basin, the order is as follows:

Agricultural	100 %
Secondary Contact	98 %
Swimming	97 %
Drinking Water	95 %
Shellfish	86 %
Aquatic Life	57 %
Fish Consumption	14 %

(See the GIS maps at the end of the report for the approximate location of the zones of support for each individual use.)

Tables 1 and 2 present summary data and individual use data for the 197-mile long non-tidal river, extending from Hancock, NY to Trenton, NJ (Zone 1). Tables 3 and 4 present data for the 54-mile-long (25 square miles) tidal, freshwater reach (Zones 2, 3 and 4) which begins at Trenton and extends to Marcus Hook, PA. Tables 5 and 6 summarize use support in the 79-mile long (841 square miles) estuary/bay (Zones 5 and 6).

## PART I SUMMARY / OVERVIEW

Table 1. Summary of Fully Supporting, Threatened, and Impaired Waters, 1996-1997

Waterbody: **NON-TIDAL DELAWARE RIVER (ZONE 1)<sup>a</sup>**(in miles)

Degree of Use Support	Assessment Category		Total Assessed Size(miles)
	Evaluated	Monitored	
Size Fully Supporting All Assessed Uses		150	150
Size Fully Supporting All Assessed Uses but Threatened for at Least One Use		2	2
Size Impaired for One or More Uses	54		54
<b>TOTAL ASSESSED</b>	54	152	206

<sup>a</sup>. includes 9 miles of West Branch Delaware River

Table 2. Individual Use Support Summary, 1996-1997

Waterbody: **NON-TIDAL DELAWARE RIVER (ZONE 1)<sup>a</sup>** (in miles)

Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Not Attainable
Aquatic Life	206	204	2	0	0	0
Fish Consumption	206	152	0	46	8	0
Shellfishing	*	*	*	*	*	*
Swimming	206	200	6	0	0	0
Secondary Contact	206	206	0	0	0	0
Drinking Water	206	202	4	0	0	0
Agricultural	206	206	0	0	0	0
Cultural/Ceremonial	*	*	*	*	*	*

<sup>a</sup>. includes 9 miles of West Branch Delaware River

Asterisk (\*) = category not applicable

Dash (-) = category applicable, no data available

Zero (0) - category applicable, but size of waters in the category is zero

## PART I SUMMARY / OVERVIEW

Table 3. Summary of Fully Supporting, Threatened, and Impaired Waters, 1996-1997

Waterbody: **DELAWARE RIVER (TIDAL-FRESHWATER) ZONES 2, 3, 4**(in square miles)

Degree of Use Support	Assessment Category		Total Assessed Size
	Evaluated	Monitored	
Size Fully Supporting All Assessed Uses			
Size Fully Supporting All Assessed Uses but Threatened for at Least One Use			
Size Impaired for One or More Uses	25		25
<b>TOTAL ASSESSED</b>	25		25

Table 4. Individual Use Support Summary, 1996-1997

Waterbody: **DELAWARE RIVER (TIDAL-FRESHWATER) ZONES 2, 3, 4** (in square miles)

Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Not Attainable
Aquatic Life	25	0	0	0	25	0
Fish Consumption	25	0	0	0	25	0
Shellfishing	*	*	*	*	*	*
Swimming	10	2	8	0	0	0
Secondary Contact	23	15	8	0	0	0
Drinking Water	14	6	0	0	8	0
Agricultural	14	14	0	0	0	0
Cultural/Ceremonial	*	*	*	*	*	*

Asterisk (\*) = category not applicable

Dash (-) = category applicable, no data available

Zero (0) - category applicable, but size of waters in the category is zero



## PART I SUMMARY / OVERVIEW

Table 5. Summary of Fully Supporting, Threatened, and Impaired Waters, 1996-1997

Waterbody: **DELAWARE ESTUARY/BAY (ZONES 5, 6)** (in square miles)

Degree of Use Support	Assessment Category		Total Assessed Size
	Evaluated	Monitored	
Size Fully Supporting All Assessed Uses			
Size Fully Supporting All Assessed Uses but Threatened for at Least One Use			
Size Impaired for One or More Uses	841		841
TOTAL ASSESSED	841		841

Table 6. Individual Use Support Summary, 1996-1997

Waterbody: **DELAWARE ESTUARY/BAY (ZONES 5, 6)** (in square miles)

Use	Size Assessed	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Size Not Attainable
Aquatic Life	191	36	96	49	10	0
Fish Consumption	841	0	0	0	841	0
Shellfishing	679	582	0	35	62	0
Swimming	191	191	0	0	0	0
Secondary Contact	191	191	0	0	0	0
Drinking Water	*	*	*	*	*	*
Agricultural	*	*	*	*	*	*
Cultural/Ceremonial	*	*	*	*	*	*

Asterisk (\*) = category not applicable

Dash (-) = category applicable, no data available

Zero (0) - category applicable, but size of waters in the category is zero

## **PART I SUMMARY / OVERVIEW**

### **CHANGES SINCE THE 1996 305B REPORT**

In the non-tidal River (Zone 1) the following changes in support of uses occurred since 1994-95: Support of All Assessed Uses—One mile was added to the Fully Supported, but Threatened, category and one mile was removed from the Impaired category; there was no change in the Full Support category. For the individual uses—Aquatic Life dropped 1 mile from Full Support and added 1 to the ‘Threatened’ category; Fish Consumption added 1 mile to Full Support and dropped 1 mile from the Not Supporting category; Swimming added 78 miles to the Size Assessed category which were distributed—72 miles added to Full Support and 6 miles to ‘Threatened’ categories; Secondary Contact added 78 miles to the Size Assessed and the Full Support categories; Drinking Water Use dropped 4 miles from Full Support and added them to the ‘threatened’ category.

In the Tidal-Freshwater reach (Zones 2,3,4) there were no changes in the Support of All Assessed Uses breakdown. For the individual uses, the only change occurred under Aquatic Life Use— 8 sq. miles were shifted from Full Support to Not Supporting due to chronic (total) toxicity, while 5 of those 8 sq. miles could also have been shifted to ‘Threatened’ due to low dissolved oxygen.

In the Estuary/Bay reach (Zones 5 and 6) there were no changes in the Support of All Assessed Uses breakdown. For the individual uses, however, there was a significant change-- 803 square miles that previously provided Partial Support for Fish Consumption were determined to provide No Support in 1996-97. Under Aquatic Life Use there was a shift of 138 square miles from the Full Support category—89 square miles became ‘Threatened’ and 49 square miles became Partially Supporting. Under Shellfishing, Full Support lost 1 square mile to Partial Support.

## PART I SUMMARY / OVERVIEW

### CAUSE AND SOURCE OF IMPAIRMENTS

The following is an update of Table 7 Summary of Impaired Uses of the June 1996 305b report. The changes are highlighted.

Table 7. **SUMMARY OF IMPAIRED USES, 1996-1997**

LOCATION	MILEAGE/AREA AFFECTED	IMPAIRED USE	CAUSE	SOURCE
non-tidal river (Zone 1)	54 mi.	fish consumption	chlordan, PCBs, mercury	point sources and non-point stormwater runoff
tidal, freshwater (Zones 2-4)	25 sq.mi.	aquatic life	volatile organics chronic toxicity	point sources
tidal, freshwater (Zones 2-4)	25 sq.mi.	fish consumption	chlordan, PCBs, mercury(zones2,3)	point sources and non-point stormwater runoff
tidal, freshwater (Zones 2-4)	8 sq.mi.	drinking water	volatile organics	point sources
estuary/bay (Zones 5-6)	59 sq.mi.	aquatic life	Low dissolved oxygen volatile organics chronic toxicity	point sources
estuary/bay (Zones 5-6)	841 sq.mi.	fish consumption	PCBs and chlordan	point sources and non-point stormwater runoff
estuary/bay (Zones 5-6)	97 sq.mi.	shellfish consumption	bacterial infestations	local point sources and non-point stormwater runoff

### PROGRAMS TO CORRECT IMPAIRMENTS

In October 1996, the Commission adopted water quality criteria and implementation procedures for toxic pollutants as part of Phase 1 for a Total Maximum Daily Load (TMDL) for the tidal Delaware River. Phase 1 is focused on pollutants from point source discharges. The pollutants of concern include several volatile organics and whole effluent chronic toxicity. In Phase 2, PCB's, chlorinated pesticides (including DDT and its derivatives), and metals will be addressed.

### GENERAL WATER QUALITY TRENDS

Water uses received less support at several locations in 1996-1997, compared to 1994-1995. Most of the decreases occurred in tidal freshwater (Zones 2, 3 and 4) and in the Estuary/Bay (Zones 5 and 6); for example, the detection of higher levels of PCB's in estuarine fish tissues resulted in warnings that the general population not consume any

## **PART I SUMMARY / OVERVIEW**

striped bass, channel catfish, or white perch. That action meant that Fish Consumption, which in 1994-1995 had received Partial Support in 803 square miles of Zones 5 and 6, is now listed as Not Supported in all 841 square miles of the estuary/Bay. The area which provided full support for Aquatic Life Use in Zones 5 and 6 dropped from 91% to 19% due to lower oxygen levels. Bacteria levels in Zone 2 were higher and warranted a continuation of the 'threatened' category for Swimming and Secondary Contact. Oxygen levels were also lower in Zone 2 which could have resulted in a 'threatened' rating for Aquatic Life Use over a 5-square mile area, if it were not for a re-classification of those 5 square miles, and another 3 square miles (formerly listed as Fully Supported), into Not Supporting due to chronic toxicity. Support for Aquatic Life, Swimming and Drinking Water Uses declined slightly in parts of Zone 1.

## **MONITORING / SPECIAL CONCERNS / INITIATIVES**

The Commission has begun the preliminary steps to develop a biological monitoring program for the 198-mile long non-tidal River (Zone 1). The purpose of a biological monitoring program would be to provide data on various biological communities in order to determine the general condition of the biota and to better understand the interactions between water quality and the biota. Preliminary planning is focusing on the appropriate number of stations and their distribution, the frequency of sampling, sampling methods and staffing. The Commission and the National Park Service have been developing special biological monitoring programs in the upper Delaware River for those reaches that are protected for their scenic and recreational values. Some of the techniques used in the Upper Delaware may be adopted for use throughout Zone 1. The US Geological Survey is developing an Index of Biotic Integrity for fish communities for these reaches as well, which can be useful in establishing background conditions. Actual implementation of a bio-monitoring program, as with any major, new monitoring program, will depend on the availability of adequate funding.

The Commission staff fully supports the Comprehensive Conservation Management Plan of the Delaware Estuary Program to develop expanded monitoring (water quality, biological and other) programs for Delaware Bay. The Commission is aware that the existing water quality monitoring programs do not encompass the entire Bay. To have a truly comprehensive, basin-wide water quality sampling program it will be necessary to increase efforts in Delaware Bay in the future. With the support of the Delaware Estuary Program, the Commission has added a person to the staff who will coordinate all the monitoring programs in the Estuary.

## **PART 2 BACKGROUND**

### **PURPOSE**

No changes have occurred in this Section (see 1994-1995 305b Report, June 1996).

### **STUDY AREA DESCRIPTION**

No changes have occurred in this Section (see 1994-1995 305b Report, June 1996).

### **WATER USES AND STANDARDS**

Water quality criteria have been adopted for toxic pollutants, see Water Pollution Control Program below.

### **WATER POLLUTION CONTROL PROGRAM**

In October 1996, the Commission adopted water quality criteria and implementation procedures for toxic pollutants as part of Phase 1 of a Total Maximum Daily Load (TMDL) for the tidal Delaware River. This effort is part of a two phase approach to establishing TMDLs in which the loadings of selected pollutants from point source discharges will be the focus in Phase 1, and the discharge of pollutants from both point and non-point sources discharges will be addressed in Phase 2.

The pollutants of concern to be addressed in Phase 1 include several volatile organics and whole effluent chronic toxicity. These parameters were identified during field and modeling studies conducted between 1990 and 1995 that indicated that the concentrations of these parameters were primarily controlled by point source discharges to the estuary. Commission staff is currently completing draft wasteload allocations for 1,2 - dichloroethane, tetrachloroethene, trichloroethene, and chronic toxicity that will be reviewed by the Commission's Toxic Advisory Committee prior to public participation in 1998.

The pollutants of concern to be addressed in Phase 2 include polychlorinated biphenyls (PCBs), chlorinated pesticides including DDT and its derivatives, and metals. These pollutants are included in Phase 2 because they are either strongly associated with estuary sediments or have significant non-point sources that require further identification and characterization. A recently completed study by the Commission of large municipal treatment plant discharges and tributaries found the treatment plants and their associated collection systems to be significant sources of PCBs (Studies of the Loadings of Polychlorinated Biphenyls From Tributaries and Point Sources Discharging to the Tidal Delaware River DRBC, June 1998). Enhancement of the Commission's water quality model for toxic pollutants to include a sediment transport model that incorporates the tidal forces in the estuary is a prerequisite to the development of the full TMDL for all pollutants to the estuary.

## **PART 2 BACKGROUND**

Commission staff are supervising development of a new estuary assimilative model, which is contracted to HydroQual, Inc. The model predicts dissolved oxygen, bacteria, and nutrient concentrations. The dry-weather component of the model is completed.

The Commission is being assisted by its Peer Review Team, composed of nationally renowned experts; and subcommittees for the Estuary Model, Combined Sewer Overflow (CSO), and Total Maximum Daily Load (TMDL).

Data gathering for calibration has been an important aspect of model development. In addition to routine water quality monitoring, there have been special studies for other parameters. The impact of aquatic vegetation was investigated by The Academy of Natural Sciences. The impact of *Corbicula* was investigated by the Delaware Department of Natural Resources and Environmental Control. A wet-weather Dye Study was conducted by Ocean Surveys, Inc.

Ongoing efforts are directed to evaluation of seasonal/short term/spatial impacts of CSOs, design of a wet-weather fecal coliform fate sampling program, and incorporation of wet-weather kinetics into the model.

The model will be used to develop TMDLs; the tentative date for completion of preliminary TMDLs is year 2001.

## **PART 3 SURFACE WATER ASSESSMENT**

### **SURFACE WATER MONITORING PROGRAM**

No changes have occurred in this Section (see 1994-1995 305b Report, June 1996).

### **ASSESSMENT METHODOLOGY**

No changes have occurred in this Section (see 1994-1995 305b Report, June 1996).

### **NON-TIDAL DELAWARE RIVER (ZONE 1)**

Only 1 sample at Callicoon (Zone 1A) exceeded the pH criteria therefore 1 mile was removed from the 'Threatened' category for Aquatic Life Use support. One mile was added (total 3 miles) to the Not Supporting category for Fish Consumption due to a 1997 advisory from the Pa.DEF against consumption of American eel (chlordan residue) from the Callicoon area.

In Zone 1D, 2 miles were removed from the Not Supporting category for Fish Consumption when Pa.DEF rescinded its advisory against consumption of white sucker (chlordan residue) in the vicinity of the Delaware Water Gap. With 2 values (15%) exceeding the fecal coliform criteria at Kittatinny Beach, 2 miles were recorded as Fully Supporting, but Threatened for Swimming.

The daily mean pH recorded by the USGS automatic monitor at Trenton (Zone 1E) exceeded the standard (8.5) on 24 days in '96 and 61 days in '97; on 11 days the daily mean exceeded 9.0. Therefore, Aquatic Life Use support was recorded as 'Threatened' for 2 miles near Trenton. Individual fecal coliform sample results exceeded the maximum standard (which is based on geometric means) 25 % of the time at Trenton and, therefore, also warrant listing Swimming as 'Threatened' in a 2 mile reach. One of four samples each year had high bacteria levels at Lumberville, therefore 2 miles were recorded as 'Threatened' for Swimming. Drinking Water Use support was recorded as Threatened in 4 miles near Trenton due to high pH and bacterial levels.

To clarify the impact of regional advisories against consumption of fish high in mercury, it was determined (as per EPA "Guidelines...") that 96 % of Zone 1 would have provided Full Support for all assessed uses if such advisories were excluded from the assessment process; see map Fish Consumption-- Minus Mercury Advisories.

### **TIDAL DELAWARE RIVER, ESTUARY/BAY (ZONES 2-6)**

While not a result of ambient water quality data collected during the study period, it was necessary to transfer 8 sq. miles in Zone 2 from Aquatic Life Use-- Full Support category to the Not Supporting category. This change is the result of a re-examination of toxicity data collected in the past in the light of information derived from recently developed mathematical models. The cause of the impairment is chronic (total) toxicity. As a consequence of this action it is not possible to shift 5 sq. miles from the Aquatic Life Use -Full Support category to the 'Threatened' category due to a drop in oxygen levels-- 26% of the boat-run samples at the Burlington-Bristol Bridge station and 15 % of the samples at Torresdale had dissolved oxygen levels less than the minimum oxygen standard of 5.0 mg/l.(which is based on the average 24-hr. concentration). The lowest concentration recorded was 3.9 mg/l on July 8, 1997 at the Burlington-Bristol site.

### **PART 3 SURFACE WATER ASSESSMENT**

Bacteria levels were higher throughout Zone 2 during the period compared to '94 -'95; 30% of the enterococcus samples, individually, exceeded 33 colonies per 100 ml. (which as a geometric average is the standard)—and values of 600 were recorded on 4 occasions; 44 % of the samples at Fieldsboro exceeded 33 colonies. These values warrant the continued listing of all 8 square miles of Zone 2 as 'Threatened' for support of Swimming and Secondary Contact.

The support of water uses remained unchanged in Zone 3, although 14 % of the bacterial samples, individually, exceeded 33 colonies per 100 ml. Dissolved oxygen levels recorded during all the boat-run sampling events exceeded 3.5 mg/l which is the minimum standard based on a 24 hr. average; however, the automatic monitor at the end of Pier 12 (Ben Franklin Bridge) recorded 16 days during the summer of 1996 when the daily mean was less than 3.5 . Values as low as 2.9 mg/l (two occasions) were recorded as daily means. These levels might have warranted a judgment of 'Threatened' for Aquatic Life Use, similar to 1992-1993, had Aquatic Life Use support not already be listed as Not Supported in the entire Zone 3 due to chronic toxicity. It should be noted that the automatic monitor is about 1,200 ft. from the center of the channel where the boat-run data is collected, however it is less than 100 ft. from the side of the channel where water depths exceed 46 ft. (In August 1997, the USGS conducted a special cross-section analysis of water quality across the entire river starting at this location. Samples were taken from the surface to the bottom at approximately 3-5 ft. depth intervals, from 13 locations over a 2 hour period. The difference between the surface and near bottom dissolved oxygen concentrations was a few tenths of a mg/l approaching the channel and a maximum difference of 1.1 at one site near mid-channel. Surface level concentrations varied very little except for a rise of 0.7 near the channel.) There were no violations of the oxygen standard recorded by the automatic monitor in 1997 (or in 1994 and 1995).

The largest changes to be seen in the Basin in the degree of support for water uses during 1996-1997 occurred in Zones 5 and 6. Aquatic Life Use support in lower Zone 5 shifted from 42 sq. miles of Full Support and 7 sq. miles of 'Threatened' support in 1994-1995, to 49 miles of Partial Support due to lower levels of dissolved oxygen at New Castle (River Mile 66), Pea Patch Island (RM 61), Reedy Island (RM 55) and Liston Point (RM 49). Individual values (grab-samples) of dissolved oxygen from the boat-run collections were below 6.0 mg/l—which is the minimum dissolved oxygen standard based on a 24-hour average concentration—for 27% of the samples from the above stations. The lowest value recorded was 2.9 mg/l at Pea Patch Island. At the USGS continuous monitor at Reedy Island, daily mean levels of dissolved oxygen were below 6.0 mg/l on 15 days in 1996 and 25 days in 1997. The lowest recorded daily mean levels were 5.4 mg/l and 5.1 mg/l respectively. The lowest minimum daily level recorded was 4.5 mg/l. There was no change in the lack of support for Aquatic Life in the upper 10 square miles of Zone 5 due to the chronic (total) toxicity.

There were two changes during 1996-1997 in the degree of support for water uses in Zone 6. The largest change was in the category Fish Consumption as a result of the state of Delaware's issuance of an advisory to the general public to not consume any striped bass, channel catfish or white perch from the Estuary due to contamination of fish flesh by PCB's. That added 803 square miles to the Not Support category. For Aquatic Life Use, ninety-six square miles were moved from the Full Support category to the 'Threatened' category due to lower levels of dissolved oxygen. Twenty-one per cent of the samples at Port Mahon (RM 35) and 13 % at Ship



### **PART 3 SURFACE WATER ASSESSMENT**

John Light (RM 37) were less than the minimum (at any time) 5.0 mg/l standard for the Zone. The lowest value recorded was 4.1 mg/l at Ship John Light. By comparison, in 1994-1995, only 1 sample was below 5.0, and that was 4.9 at Port Mahon. The State of New Jersey in 1996 downgraded a 1 sq. mile area of shellfish beds around the mouth of the Maurice River from "Seasonally Approved" to "Special Restriction" resulting in the addition of 1 sq. mile to the Partial Supporting category.

#### **WETLANDS**

No changes have occurred in this Section (see 1994-1995 305b Report, June 1996).

#### **PUBLIC HEALTH AND AQUATIC LIFE CONCERNS**

An analysis of residues of PCB congeners in Delaware River channel catfish in 1996, yielded a wet weight concentration of 1.4 parts per million (the sum of 74 congeners), far exceeding previous levels. Fish collected in the Tacony-Palmyra area (Zones 2/3) had the highest levels of PCB's, DDT and metal residues of all the areas sampled; channel catfish had nearly double the levels detected in channel catfish taken elsewhere.

#### **FISH POPULATIONS**

Between April 1, 1996 and May 31, 1996, approximately 515,000\* adult American shad were monitored by hydroacoustic techniques passing the Route 202 bridge (RM 149) (Lambertville, NJ-New Hope, PA) on their upstream spawning run. More than 50 % of the run occurred between April 27 and the 29<sup>th</sup>, and some were still passing in small numbers on May 31. The Delaware River had a high discharge throughout the period with 3 peaks of very high flows followed by periods of lower flows at which time the greatest number of shad were recorded passing the monitor (Overview of the 1996 Delaware River American Shad Run, M. Boriek, NJDEP Div. Fish, Game and Wildlife; \*corrected value, personal communication, Boriek 8/19/98). Not included in the assessment of the shad spawning run are the shad which spawned within the tidal river and certain tidal tributaries (namely Crosswicks, Rancocas, Big Timber and Raccoon Creeks).

### **PART 3 SURFACE WATER ASSESSMENT**

Monitoring of the juvenile shad out-migration in late summer and early fall recorded the highest level since monitoring began in 1979. The catch rate was 456 shad per seine haul which was more than double the 17-year average of 207—the previous all time high was 363 juvenile shad in 1990 (Boriek, op cit). In 1997, the catch rate was 278 shad per seine haul.

### **PART 4 GROUNDWATER ASSESSMENT**

No changes have occurred in this Section (see 1994-1995 305b Report, June 1996).