

SUMMARY OF THE OPERATION OF THE
CONOWINGO DAM FISH COLLECTION FACILITY
DURING THE SPRING OF 1978

by

Gary L. McGhan
RMC Ecological Division
Muddy Run Ecological Laboratory
P. O. Box 10
Drumore, Pennsylvania 17518

AM JRC
Secy _____
H.P. _____
H/F RCS
R/W _____
A.O. _____
File: _____

Prepared For
Philadelphia Electric Company

U.S. FISH & WILDLIFE SERVICE
RECEIVED

NOV 16 1978

HARRISBURG OFFICE

RADIATION MANAGEMENT CORPORATION
3508 Market Street
Philadelphia, Pennsylvania 19104

FISH FACILITY OPERATION REPORT 7

SEPTEMBER 1978

TABLE OF CONTENTS

	Page
INTRODUCTION	1
METHODS	2
Schedule of Operation	2
Disposition of Catch	3
Creel Census	4
RESULTS	5
American Shad Catch	7
Fish Transportation	9
Creel Census	9
ACKNOWLEDGMENTS	11
LITERATURE CITED	12

LIST OF TABLES

Table		Page
1	Susquehanna River flows and water temperatures at Conowingo Dam from 1 April-30 June 1978	14
2	Schedule of velocities and volumes for the Conowingo Dam Fish Collection Facility, 15 April-16 June 1978	15
3	List of scientific and common names of fishes collected in the Conowingo Dam Fish Collection Facility, 1978	16
4	Numbers of fishes taken in the Conowingo Dam Fish Collection Facility, 15 April-16 June 1978	17
5	Number of fishes taken in the Conowingo Dam Fish Collection Facility, 1972-1978	19
6	Numbers of eight selected species taken in the Conowingo Dam Fish Collection Facility at high and low attraction flows, 17 April-16 June 1978	21
7	Comparison of catch per 100 hour data from 1972-1978 with special reference to the 1978 alternate day schedule	23
8	Application of alternate day sampling design to 1977 data, and results of expansion of 1978 data	24
9	Sex ratio and spawning condition of American shad, <u>Alosa sapidissima</u> , collected in the Conowingo Dam Fish Collection Facility, 1972-1978	25
10	Number of American shad taken in the Conowingo Dam Fish Collection Facility under various conditions of generation of the Conowingo Hydroelectric Station, 1972-1978	26
11	Time of day American shad were taken in the Conowingo Dam Fish Collection Facility, 27 April-16 June 1978	27
12	Comparison of the numbers of American shad taken in the Conowingo Dam Fish Collection Facility with water temperature 1972-1978	28

Table		Page
13	Age composition of adult American shad taken in the Conowingo Dam Fish Collection Facility and by anglers, 1972-1978	29
14	Daily numbers and release locations of blueback herring, <u>Alosa aestivalis</u> , American shad, striped bass, <u>Morone saxatilis</u> , and striped bass x white bass hybrids transported above Conowingo Dam, 2 May - 16 June 1978	30
15	Hourly catch of American shad and number of anglers fishing from shore just downstream from the Conowingo Dam Fish Collection Facility, 1978 .	31
16	Status of generation of Conowingo Hydroelectric Station in relation to west shore angler catch of American shad	33
17	Comparison of the percentage of American shad taken by shore anglers just downstream of the Conowingo Dam Fish Collection Facility with water temperature, 1973-1978	34
18	Daily angler effort and number of American shad caught along the west shore of the Conowingo Dam tailrace, 1978	35
19	The distribution of boats in the Conowingo Dam tailrace under various conditions of generation of Conowingo Hydroelectric Station, 1973-1978	36
20	Fishing pressure, mean catch per effort and catch composition of anglers interviewed along the west shore of the Conowingo tailrace, 17 April-1 June 1978	37

INTRODUCTION

Construction of the Conowingo Dam Fish Collection Facility began in 1971 and it first operated during the Spring of 1972 as part of a five year study to determine the feasibility of restoring runs of American shad to historical spawning grounds in the Susquehanna River. The five year program ended in 1976, but upon recommendation by the Susquehanna River Anadromous Fish Restoration Committee, Philadelphia Electric Company agreed to continue funding the studies on a year to year basis. This committee was established in 1970 and has two sub-committees that oversee the anadromous fish programs of the Susquehanna River. The Evaluation Sub-Committee is responsible for review of and annual appraisal of all programs, while the Operations Sub-Committee is responsible for determining the methods and physical parameters under which the programs are operated. The Restoration Committee is comprised of representatives from the states of Maryland, Pennsylvania and New York, National Marine Fisheries Service, U.S. Fish and Wildlife Service and the utilities operating the four dams on the lower Susquehanna River.

Results of the operation of the Fish Facility were reported by Robbins (1972), Foote and Robbins (1973), Buchanan and Robbins (1974), Buchanan (1975), Kotkas and McGhan (1976) and McGhan (1977). Guidelines for 1978 operation were detailed in the Operations Sub-Committee Report of 29 March 1978.

METHODS

Schedule of Operation

The seventh year of operation of the fish collection facility began on 15 April. General maintenance limited operation from 0800 to 1100 EST on 15 April and from 0800 to 1200 EST on 17 April. Normal operation (sunrise to 1200 EST) began on 19 April and continued on an alternate day basis through 16 June. This schedule allowed for close monitoring of the changing populations of fishes below Conowingo Dam. When sufficient numbers of alosids (alewife, blueback herring and American shad) were collected, operation continued on a daily basis for the purpose of transportation. The minimum criteria for continuing operation was that a total of 5 or more American shad and/or 500 or more alewife or blueback herring be collected per day.

Operation of the facility was interrupted on 15 May as high river flows forced the removal of the crowder and weir gate motors. River flows peaked at 223,600 cfs (Table 1) on 16 May and completely flooded the facility. Normal operations resumed on 24 May. Few mechanical problems were encountered. A malfunction in the crowder mechanism forced a shutdown of the facility at 0615 on 23 April and for 1 hour on 29 April and 24 May. Binding of the hopper mechanism during horizontal travel stopped work about 1 hour on 3 June.

The fish cycle as described in the Operation and Maintenance Manual (1972) was used in 1978. This process necessitates the crowder doors being closed about 10 minutes between fishing periods. Fishing time is defined as that period in which the crowder doors are open. This will range from 1 to 60 minutes depending upon the relative abundance of fishes. Sets of thirty minutes were most commonly used.

A maximum velocity of 6.0 fps was maintained throughout the season as recommended by the Operation Sub-Committee. In addition, high and low flow conditions was scheduled daily, each on a half day basis. These velocity and flow conditions are controlled by changes in the weir gate settings and station service unit gate settings as outlined in Table 2. Velocity and flow may vary slightly since output of one of the service units is controlled by plant electrical demand. An intermediate crowder gate position (12 in. opening) was used throughout the season.

The occurrence of anadromous fish in the tailrace below Conowingo Dam may require the generation of one or more units to prevent fish mortality due to oxygen deficiencies. An agreement between the State of Maryland and the Susquehanna Electric Company (SECO) states that continuous operation of one small generator (5,000 cfs) may be required when the State deems necessary during anadromous fish runs. The State did not request such action in 1978. However, one generator was continuously operated during a ten-day period (31 May-9 June) as a precaution, and was occasionally operated during shut-downs when requested by the RMC biologist maintaining the fish surveillance program (McCreight 1978). When this occurred, Unit No. 2 was operated to provide water from Conowingo Pond and enhance the attraction of fish along the west bank of the tailrace near the facility. Station engineers were also requested to place Unit No. 1 last on line, to reduce turbulence near the entrance of the fish facility.

Disposition of Catch

The total catch from each fishing period was released into a 6' x 12' x 4' sorting tank. The catch was first examined for diadromous fishes (alewife,

blueback herring, hickory shad, American shad, striped bass or American eel). If present they were transferred to a 1,000 gallon circular fiberglass transport tank and trucked to upriver locations. Release locations included the Broad Creek boat launch on Conowingo Pond and the Pennsylvania Fish Commission boat access at Long Level, Pa. on Safe Harbor Pond. The Long Level site was utilized to provide a faster turn-around time for trucking than would be possible if the Marysville site was used. The Long Level release point gave fish access to about 12 mi of free-flowing Susquehanna River. When insufficient numbers of American shad were present to transport above the dam, they were sexed, tagged with a fly anchor tag (FD-67), and transferred to a 460 gallon fiberglass transport tank for release at Shures Landing (3/4 mi downstream from Conowingo Dam).

All catches were counted or subsampled except when large numbers of fish were available for transport. An estimate of the numbers of fishes in the lift was made by expanding the subsample count. Where mortalities due to an oxygen deficiency were likely, large catches were estimated visually and immediately released to the river.

Length, weight, sex and scale samples were taken from blueback herring, white perch and gizzard shad. American shad which died prior to release were also processed as above. Common names of fishes are used throughout the text and tables. A list of common and scientific names of fishes collected in the Conowingo Dam Fish Collection Facility in 1978 is given in Table 3.

Creel Census

A creel census was conducted below Conowingo Dam to determine fishing effort and total catch of American shad by fishermen along the west shore of

the Conowingo Dam tailrace. This census was conducted on an hourly basis during normal operating hours of the fish collection facility (sunrise to 1200 EST). If shad were taken before 1200 EST, the census continued until 1600 EST. Data collected included the hourly catch of American shad, number of anglers fishing for shad, and the number of generators operating. Length, sex, and scale samples were taken from shad whenever possible.

Another objective was to determine if the distribution of shad changes in the tailrace with changes in operation of Conowingo Hydroelectric Station. This may be indicated by the distribution of angler boats in relation to the number and size of generators operating. The tailrace was divided into east and west sections by an imaginary line from Unit No. 6 to the northern tip of Rowland Island, and the distribution of boats, number of boat anglers and status of generation was noted hourly. The census began 15 April and continued through 7 June.

RESULTS

The season catch totaled 288,445 fishes representing 11 families and 41 species (Tables 4 and 5). There were 369 lifts with a total fishing time of 140.7 hours. The predominate species was white perch (40.2%), followed by gizzard shad (19.4%) and channel catfish (19.4%). Two species not collected previously, the banded darter (Etheostoma zonale) and the logperch (Percina caprodes), were taken. Specimens of two hybrids, originally stocked in Conowingo Pond, were also collected. These were the tiger muskellunge (Northern pike x muskellunge) and the striped bass x white bass.

The difference in catch between high and low flow conditions are inconclusive (Table 6). Results of one way analysis of variance indicate no significant difference in catch per hour between these flow conditions for

the American shad ($F_{.05} [1,28] = 4.20$, $F_s = 2.24$) or blueback herring ($F_{.05} [1,27] = 4.21$, $F_s = 2.74$). White perch seem to prefer low flow conditions while more gizzard shad and channel catfish are collected under the high flow settings.

The 1978 catch of anadromous clupeids (alewife, blueback herring, and American shad) totaled 13,190 fishes. The anadromous fishes comprised 4.5% of the 1978 catch, up from a 1977 low of 2.4%. This apparent increase is due to a lesser catch of other species, particularly gizzard shad which decreased to 56,034 (19.4% of catch) from a 1977 high of 784,301 (61.5% of catch).

It must be recognized that the 1978 operation schedule was different than in past years. Effort was concentrated (daily operation) during periods of anadromous fish runs for the purpose of transportation. Between runs of anadromous fish, the facility operated every other day to monitor fish populations immediately below the dam. A comparison can be made from the catch per effort data (Table 7). The 1978 catch/100 hr appear similar to that of 1976 and 1977, but the decline in the anadromous fish catch is still evident when compared with earlier years. This data also indicates that all runs of anadromous fish were accounted for with the 1978 operations schedule of alternate day operation.

It is estimated that the 1978 mode of operation collected about 89% of all anadromous fish that might have been collected with a continuous operational schedule (Table 8). This was derived by applying the 1978 mode of operation to 1977 data (a year of continuous operation). The 1978 catch of blueback

herring (13,130) can then be expanded to approximately 14,700. Catch per 100 h also indicates similar abundance between 1977 and 1978 (9,735 vs 9,332 respectively). Only one significant run of blueback herring occurred (1-7 May) compared to the usual of three runs observed in past years. It is possible that some fish may have been omitted from the catch statistics when extremely high river flows flooded the facility and stopped operation between 16 and 23 May.

Alewife abundance was the lowest since the facility operation began in 1972 with only five observed. This is a substantial decline from the 143,880 collected in 1973. It is doubtful that this represents only a subsample of the 1978 run. Beginning 20 March regular observations were conducted in the lower Susquehanna River to detect the presence of the alewife. It was not sited until 7 April in Deer Creek. The maximum number observed was approximately 100 on 12 April. Susquehanna River water temperatures remained from 52-54 F throughout April, and we would expect to collect alewife in the tailrace at these temperatures.

The hickory shad was absent from the 1978 catch. It has not been taken in the facility since 1975. One hickory shad was observed taken by an angler along the west shore of the tailrace.

American Shad Catch

A total of 54 American shad was collected between 27 April and 16 June. This is an estimated 85% of all American shad expected to be collected under continuous operation (Table 8). The catch may be expanded to about 63 fish for comparison with past years.

One shad was transported to Safe Harbor Pond on 3 May with a load of blueback herring. A total of 46 tagged shad were released at Shures Landing.

Seven died prior to release. The most shad collected in one day was 10 on 3 June. For this reason, transportation of shad to points above Conowingo Dam was impractical.

A male shad tagged on 27 April was recaptured on 1 June. The fish was released at Shures Landing. No tags were returned by anglers.

The sex ratio of 54 shad examined in 1978 was 0.64 males to 1.00 females (Table 9). All of the males were ripe while most of the females were partly or fully spent. Ripe females were not observed.

Conditions of generation associated with the collection of shad are given in Table 10. The catch was sporadic and indicated no specific generation schedule under which most shad were collected. In past years most were taken at zero generation or when only one small unit and no large units operated.

The peak hourly catch of shad occurred between 0700 and 0800 EST when 13 fish (23.6%) were collected (Table 11). No shad were collected before 0500 EST and 6 were taken between 1100 and 1200 EST. The highest catch of shad (18) occurred at a water temperature of 75 F (Table 12).

Age determinations were made on seven American shad collected in the facility and 32 shad taken by anglers. Fish appeared older than normal with no three and four year olds collected. Four year olds were the dominate age class in previous years. A reexamination of the age composition of all shad collected since 1972 is found in Table 13. A trend toward increasing age began in 1976 with the number of age V fish approaching the number of age IV fish. In 1978, most fish were five and six year olds. This trend toward an older shad population parallels declining commercial catches of American shad (U.S. Dept. of Commerce data). Schaeffer (1977) reported similar results in the hickory shad population of the lower Susquehanna River. Schaeffer

found that 90% of the fish collected in Octorara Creek in 1976 were age V or older, compared to the normal age structure dominated by III and IV year olds. Commercial catches of hickory shad have also declined over the years. This suggests that there has been little recruitment (for both American and hickory shad) for the last few years.

Fish Transportation

From 2 May to 16 June, a total of 2,385 fishes were transported to points above Conowingo Dam (Table 14). The primary release site for blueback herring was the Pennsylvania Fish Commission boat launch at Long Level above Safe Harbor Dam. A total of 1,811 fish was released in two trips. A small load of herring (283) was also released into Conowingo Pond at the Broad Creek boat launch. Fish mortalities caused by transportation were few. Evidence of successful spawning has not been determined, but one adult blueback herring was collected at Safe Harbor Dam two weeks after release at Long Level.

Transportation of striped bass occurred from 8-16 June. A total of 228 were released into Conowingo Pond; most (115) were released on 16 June. A total of 62 striped bass x white bass hybrids was also transported above the dam. All striped bass and hybrids were fish less than 10 inches in length. No striped bass have been collected in Conowingo Pond.

Creel Census

Anglers caught 21 American shad along the west shore of the tailrace from 21 April through 7 June (Table 15). This is the lowest catch since the creel census began in 1973. Most (81%) were taken between 0600 and 1200

EST. No shad were caught before 0600 and only four between 1200 and 1600. Power generation appears to have little effect on the shore angler catch of American shad (Table 16). Shad angler catches were scattered throughout a water temperature range of 53 F to 75 F (Table 17).

Shore angler effort averaged 41.5 hours per day, and the catch rate was 0.014 shad per hour (Table 18). This is the lowest fishing effort recorded since the creel census began in 1973. Angling effort from boats was greatest on the east side of the tailrace below the large generating units (Table 19). This follows the pattern in which most fishermen relocate their boats along the east side whenever one or more large units begin generation.

Angler interviews were conducted from 17 April through 1 June with a total of 289 anglers contacted, representing about 46% of the total angler hours recorded. Interviews were conducted daily from 1100-1200 EST, or whenever fishermen were observed leaving the area. Results of these interviews indicate that the fishermen catch an average of 1.26 fish per hour, with most (71.33%) being white perch (Table 20). Similar catch per hour data (April to June) were reported by Plosila (1961) who conducted a creel survey of the Conowingo tailrace shoreline and stoplog gallery from 1 April - 31 October, 1958-1960. The catfishes comprised 77 to 89% of the 1958-60 catch; this probably reflected the stoplog gallery fishery where catfishes dominated the catch. The alosids comprised 1.05%, 3.78% and 4.95% of the 1958-1960 catches. Although alosids represented 4.23% of the 1978 catch, a direct comparison can not be made since a stoplog gallery survey was not conducted in 1978. If the 1958-60 stoplog gallery catch (predominantly catfishes) is not included, the percentage of alosids taken in the tailrace would be much higher than in 1978. It appears that angler effort has decreased since the Plosila survey, and may now be directed at species other than shad and herring.

ACKNOWLEDGMENTS

The author wishes to acknowledge the assistance of the following biologists: Rick Hill, Greg Rishel and Edward Tierney. Thanks also to Jeff Anderson and Jerry Yantis who assisted in the operation of the facility. Special thanks are extended to Howard Jarman, Station Superintendent, William J. Langan, Assistant Superintendent and the staff of Conowingo Hydroelectric Station, Susquehanna Electric Company, for providing data on the operation of Conowingo Dam and logistic support for the facility operation. P. James Dalley, Bureau of Sport Fisheries and Wildlife, assisted with the velocity and volume computations and gave advice concerning the operation of the facility. Advice provided by other members of the Susquehanna River Anadromous Fish Restoration Committee was also appreciated. Barbara J. Ankrim typed the manuscript.

LITERATURE CITED

- Bailey, R. M., J. E. Fitch, E. S. Herald, E. A. Lachner, C. C. Lindsey, C. R. Robins and W. B. Scott. 1970. A list of common and scientific names of fishes from the United States and Canada (third edition). Amer. Fish. Soc. Spec. Publ. No. 6: 150 p.
- Buchanan, Dennis G. 1975. Summary of the operation of the Conowingo Dam Fish Collection Facility during the spring of 1975. Ichthyological Associates, Inc., Drumore, Pa., Fish Facility Operation Report 4, prepared for Philadelphia Electric Company, 52 p.
- Buchanan, Dennis G. and Timothy W. Robbins. 1974. Summary of the operation of the Conowingo Dam Fish Collection Facility during the spring of 1974. Ichthyological Associates, Inc., Drumore, Pa., Fish Facility Operation Report 3, prepared for Philadelphia Electric Company, 46 p.
- Conowingo Dam Fish Collection Facility Operation and Maintenance Manual. 1972. Prepared for Philadelphia Electric Company, 24 p.
- Foote, Peter S. and Timothy W. Robbins. 1973. Summary of the operation of the Conowingo Dam Fish Collection Facility during the spring of 1973. Fish Facility Operation Report 2. Report prepared for Philadelphia Electric Company, 40 p.
- Kotkas, Enn and Gary L. McGhan. 1976. Summary of the operation of the Conowingo Dam Fish Collection Facility during the spring of 1976. Ichthyological Associates, Inc., Drumore, Pa., Fish Facility Operation Report 5, prepared for Philadelphia Electric Company, 60 p.
- McCreight, Brian R. 1978. Report on the 1978 Anadromous Fish Surveillance Program below Conowingo Dam. RMC Ecological Division, Drumore, Pa., Surveillance Report 8, 9 p.
- McGhan, Gary L. 1977. Summary of the operation of the Conowingo Dam Fish Collection Facility during the spring of 1977. Ichthyological Associates, Inc., Drumore, Pa., Fish Facility Operation Report 6, prepared for Philadelphia Electric Company, 69 p.
- Operations Sub-Committee. 1978. Operation Plan Conowingo Dam Fish Collection Facility and Egg Collection, Transportation and Planting. Prepared for Susquehanna River Anadromous Fish Restoration Committee, 6 p.
- Plosila, Daniel S. 1961. Lower Susquehanna River sport fishery survey, 1958-1960. IN the Susquehanna Fishery Study 1957-1960 Maryland Department of Research and Education and the Susquehanna Electric Company, 55-76.

Robbins, Timothy W. 1972. Summary of the operation of the Conowingo Dam Fish Collection Facility during the spring of 1972. Ichthyological Associates, Drumore, Pa., Fish Facility Operation Report 1, prepared for Philadelphia Electric Company, 31 p.

Schaeffer, John. 1977. The hickory shad - an endangered species in Maryland? A paper presented at the Potomac Chapter American Fisheries Society Meeting, Chesapeake Beach, Maryland, 1977.

U.S. Department of Commerce. Fishery statistics of the United States, Annual Digest.

TABLE 1

Susquehanna River flows (expressed as 24 hr average) and water temperatures at Conowingo Dam from 1 April-30 June 1978. River flow data provided by Susquehanna Electric Company. River temperatures taken at Conowingo Dam Fish Collection Facility. Dash indicates collection facility not operated.

Date	Temp (F)	Flow (1000 cfs)	Date	Temp (F)	Flow (1000 cfs)
Apr 1	-	166.9	16	-	223.6
2	-	143.6	17	-	217.0
3	-	156.1	18	-	196.2
4	-	174.5	19	-	200.6
5	-	147.5	20	-	173.2
6	-	133.2	21	-	134.1
7	-	147.9	22	-	106.8
8	-	148.4	23	-	87.8
9	-	126.1	24	64.0	73.9
10	-	134.4	25	64.0	77.4
11	-	112.9	26	-	81.2
12	-	94.3	27	66.5	76.8
13	-	82.1	28	-	65.2
14	-	77.0	29	66.5	54.9
15	53.0	75.2	30	-	45.8
16	-	68.9	31	70.0	41.4
17	53.0	59.0	Jun 1	70.5	37.7
18	-	54.5	2	72.0	32.8
19	53.0	51.4	3	73.0	33.0
20	-	49.6	4	74.5	32.5
21	53.0	49.0	5	-	31.9
22	-	51.4	6	75.0	29.8
23	53.0	56.2	7	75.0	26.0
24	-	59.6	8	74.5	26.2
25	52.5	53.2	9	74.0	24.3
26	-	48.0	10	75.5	31.6
27	54.0	43.4	11	-	38.5
28	-	40.1	12	74.0	34.3
29	53.0	38.0	13	-	32.9
30	-	35.1	14	74.0	30.3
May 1	55.0	35.2	15	-	27.9
2	57.0	27.1	16	72.0	24.4
3	58.0	26.3	17	-	25.6
4	58.0	25.6	18	-	24.3
5	57.0	29.5	19	-	20.3
6	57.0	24.3	20	-	20.3
7	57.0	26.2	21	-	21.3
8	-	28.7	22	-	19.9
9	58.0	30.7	23	-	19.2
10	-	34.6	24	-	21.9
11	57.0	34.9	25	-	19.0
12	-	35.9	26	-	18.3
13	59.5	37.8	27	-	25.2
14	-	50.2	28	-	18.9
15	62.0	151.3	29	-	17.4
			30	-	14.9

TABLE 2

Schedule of velocities and volumes for the Conowingo Dam Fish Collection Facility,
15 April-16 June 1978.

Period No.	Condition*	Service Unit Gate Settings		Entrance Weir Setting	
		No. 1	No. 2	Depth below tailrace (ft)	Velocity (max. ft./sec)
1	High Flow	35%	75%	5.1	6.0
2	Low Flow	35%	35%	3.1	6.0
3	Extra Low Flow	35%	0%	1.7	6.0

* Approximate water flows (cfs) through the facility are:

High Flow = 265 cfs

Low Flow = 150 cfs

Extra Low Flow = 75 cfs

TABLE 3
List of scientific and common names of fishes collected in the Conowingo Dam Fish Collection Facility, 1978 (according to Bailey, et al., 1970).

Scientific Name	Common Name	Scientific Name	Common Name
Family - Petromyzontidae	Lampreys	Family - Ictaluridae	Freshwater catfishes
<u>Petromyzon marinus</u>	Sea lamprey	<u>Ictalurus catus</u>	White catfish
Family - Anguillidae	Freshwater eels	<u>Ictalurus natalis</u>	Yellow bullhead
<u>Anguilla rostrata</u>	American eel	<u>Ictalurus nebulosus</u>	Brown bullhead
Family - Clupeidae	Herrings	<u>Ictalurus punctatus</u>	Channel catfish
<u>Alosa aestivalis</u>	Blueback herring	Family - Percichthyidae	Temperate basses
<u>Alosa pseudoharengus</u>	Alewife	<u>Morone americana</u>	White perch
<u>Alosa sapidissima</u>	American shad	<u>M. saxatilis</u> x <u>M. chrysops</u>	Striped bass
<u>Dorosoma cepedianum</u>	Gizzard shad	Family - Centrarchidae	Striped bass x white bass hybrid
Family Salmonidae	Trouts	<u>Ambloplites rupestris</u>	Sunfishes
<u>Salmo gairdneri</u>	Rainbow trout	<u>Lepomis auritus</u>	Rock bass
<u>Salmo trutta</u>	Brown trout	<u>Lepomis cyamellus</u>	Redbreast sunfish
<u>Salvelinus fontinalis</u>	Brook trout	<u>Lepomis gibbosus</u>	Green sunfish
Family - Esocidae	Pikes	<u>Lepomis macrochirus</u>	Pumpkinseed
<u>Esox lucius</u>	Northern pike	<u>Micropterus dolomieu</u>	Bluegill
<u>Esox masquinongy</u>	Muskellunge	<u>Micropterus salmoides</u>	Smallmouth bass
<u>E. masquinongy</u> x <u>E. lucius</u>	Tiger muskellunge	<u>Pomoxis annularis</u>	Largemouth bass
Family - Cyprinidae	Minnows and carps	<u>Pomoxis nigromaculatus</u>	White crappie
<u>Cyprinus carpio</u>	Carp	Family - Percidae	Black crappie
<u>Notemigonus crysoleucas</u>	Golden shiner	<u>Etheostoma olmstedii</u>	Perches
<u>Notropis aeneus</u>	Comely shiner	<u>Etheostoma zonale</u>	Tessellated darter
<u>Notropis hudsonius</u>	Spottail shiner	<u>Percis flavescens</u>	Banded darter
<u>Notropis spilopterus</u>	Spotfin shiner	<u>Percina caprodes</u>	Yellow perch
<u>Rhinichthys cataractae</u>	Longnose dace	<u>Stizostedion vitreum</u>	Logperch
Family - Catostomidae	Suckers		Walleye
<u>Carpiodes cyprinus</u>	Quillback		
<u>Catostomus commersoni</u>	White sucker		
<u>Hypentelium nigricans</u>	Northern hog sucker		
<u>Moxostoma macrolepidotum</u>	Shorthead redhorse		

TABLE 4

Numbers of fishes taken in the Cowwingo Dam Fish Collection Facility, 15 April-16 June 1978.

	15-23 Apr	24-30 Apr	1-7 May	8-14 May	15-28 May	29 May-4 Jun	5-11 Jun	12-16 Jun	Totals
Dates	33	31	70	34	41	67	58	35	369
No. Lifts	12.7	12.7	25.3	13.4	15.2	24.3	23.1	14.0	140.7
Fishing Time (hr)	53.0	52.5-54.0	55.0-58.0	57.0-60.0	62.0-66.5	66.5-74.5	74.0-75.5	72.0-74.0	
Water Temperature (F)									
Lampreys	-	-	-	1	-	-	-	-	1
Sea lamprey									
Freshwater Eels	12	9	20	79	146	742	1,190	3,825	6,023
American eel									
Herrings	-	6	12,576	1	4	6	445	92	13,130
Blueback herring	1	-	-	-	-	-	4	-	5
Alewife	-	2	4	-	-	22	25	2	55*
American shad	1,647	3,376	12,614	1,370	5,116	12,892	13,595	5,424	56,034
Gizzard shad									
Trouts	1	-	2	2	21	42	1	3	72
Rainbow trout	4	6	8	4	7	88	79	70	266
Brown trout	-	-	9	5	9	-	-	-	23
Brook trout									
Fikes	-	-	1	1	-	-	-	-	2
Northern pike	2	2	4	2	1	2	1	-	14
Muskellunge	-	-	6	2	-	5	-	-	13
Ilgar muskellunge									
Minnous and Carps	4	35	42	15	2,365	3,951	1,862	3,766	12,040
Carp	-	3	11	1	-	74	112	-	201
Golden shiner	7	127	20	-	-	497	521	25	1,197
Comely shiner	-	-	8,139	353	-	14	-	-	8,506
Spottail shiner	1	2	-	-	50	700	2,798	245	3,796
Spotfin shiner	1	1	-	-	-	2	-	-	4
Longnose dace									
Suckers	-	9	76	2	133	1,441	362	358	2,381
Quillback	11	32	29	20	47	37	5	8	189
White sucker	-	-	3	-	-	-	-	-	3
Northern hog sucker	-	20	385	49	-	104	-	-	697
Shorthead redhorse									

continued

* Includes one recaptured shad taken on 1 June

TABLE 4

Continued.

	15-23 Apr	24-30 Apr	1-7 May	8-14 May	15-28 May	29 May-4 Jun	5-11 Jun	12-16 Jun	Totals
Dates	12.7	12.7	25.3	13.4	15.2	24.5	23.1	14.0	369
No. Lifts	33	31	70	34	41	67	58	35	140.7
Fishing Time (hr)	53.0	52.5-54.0	55.0-58.0	57.0-60.0	62.0-66.5	66.5-74.5	74.0-75.5	72.0-74.0	
Water Temperature (F)									
Freshwater Catfishes									
White catfish	9	-	-	-	29	678	186	104	1,006
Yellow bullhead	-	-	-	-	-	25	-	-	25
Brown bullhead	-	-	-	-	-	43	75	13	131
Channel catfish	78	30	123	162	9,843	20,487	7,370	17,825	55,918
Temperate Basses									
White perch	1	2,049	48,206	24,507	677	8,028	20,899	11,524	115,891
Striped bass	-	-	-	-	-	57	713	501	1,271
Striped bass x white bass	-	-	-	1	2	6	223	157	389
Sunfishes									
Rock bass	8	2	3	2	4	18	13	-	50
Redbreast sunfish	-	1	46	64	111	1,322	2,057	749	4,350
Green sunfish	-	-	-	-	-	4	21	1	26
Pumpkinseed	1	-	5	-	8	195	207	142	558
Bluegill	1	1	65	7	-	282	594	504	1,453
Lepomis hybrid	-	-	-	-	-	-	4	-	4
Smallmouth bass	3	26	46	32	74	75	5	3	264
Largemouth bass	5	4	4	1	1	5	2	-	22
White crappie	2	13	75	17	1	229	150	256	742
Black crappie	7	2	32	7	-	61	5	32	146
Perches									
Tessellated darter	-	-	-	1	-	-	-	-	1
Banded darter	-	1	-	-	-	-	-	-	1
Yellow perch	14	26	10	8	-	317	146	2	523
Logperch	1	-	1	2	-	-	-	-	4
Walleye	25	29	214	25	121	228	218	158	1,018
Total	1,843	5,814	82,779	26,743	18,905	52,679	53,888	45,789	288,445

TABLE 5

Number of fishes taken in the Conowingo Dam Fish Collection Facility, 1972-1978.

No. Lifts Fishing time (hr)	1978 369 140.7			1972-1978 6105 2284.6		
	Total Fish	%	Fish/ 100 hr	Total Fish	%	Fish/ 100 hr
Lampreys						
Sea lamprey	1	*	1	46	*	2
Freshwater eels						
American eel	6,023	2.09	4,281	402,799	5.47	17,631
Herrings						
Blueback herring	13,130	4.55	9,332	918,548	12.48	40,206
Hickory shad	0	-	-	1,346	0.02	59
Alewife	5	*	4	177,889	2.42	7,786
American shad	55	0.02	39	919	0.01	40
Atlantic menhaden	0	-	-	12,541	0.17	549
Gizzard shad	56,034	19.43	39,825	1,604,786	21.81	70,244
Trouts						
Lake herring	0	-	-	1	*	**
Rainbow trout	72	0.02	51	585	0.01	26
Brown trout	266	0.09	189	2,789	0.04	122
Brook trout	23	0.01	16	34	*	1
Pikes						
Chain pickerel	0	-	-	12	*	1
Northern pike	2	*	1	8	*	**
Muskellunge	14	*	10	216	*	9
Tiger muskellunge	13	*	9	13	*	1
Minnnows and Carp						
Goldfish	0	-	-	47	*	2
Carp	12,040	4.17	8,557	114,575	1.56	5,015
Golden shiner	201	0.07	143	5,384	0.07	236
Comely shiner	1,197	0.41	851	9,075	0.12	397
Spottail shiner	8,506	2.95	6,045	20,410	0.28	893
Rosyface shiner	0	-	-	1	*	**
Spotfin shiner	3,796	1.32	2,698	79,145	1.07	3,464
Longnose dace	4	*	3	5	*	**
Suckers						
Quillback	2,381	0.82	1,692	78,439	1.07	3,433
White sucker	189	0.06	134	2,746	0.04	120
Creek chubsucker	0	-	-	7	*	**
Northern hog sucker	3	*	2	10	*	**
Shorthead redhorse	697	0.24	495	10,081	0.14	441
Freshwater catfish						
White catfish	1,006	0.35	715	25,918	0.35	1,134
Yellow bullhead	25	0.01	18	171	*	7
Brown bullhead	131	0.04	93	14,306	0.19	626
Channel catfish	55,918	19.39	39,743	639,177	8.69	27,978
Killifishes						
Mummichog	0	-	-	1	*	**
Needle Fishes						
Atlantic needlefish	0	-	-	2	*	**
Silversides						
Tidewater silverside	0	-	-	1	*	**
Temperature Basses						
White perch	115,891	40.18	82,367	3,094,824	42.06	135,465
Striped bass	1,271	0.44	903	13,582	0.18	595
Striped bass x white bass	389	0.13	276	389	0.01	17

continued

TABLE 5

Continued.

No. Lifts Fishing time (hr)	1978 369 140.7		1972-1978 6105 2284.6			
	Total Fish	%	Fish/ 100 hr	Total Fish	%	Fish/ 100 hr
Sunfishes						
Rock bass	50	0.02	35	561	0.01	25
Redbreast sunfish	4,350	1.51	3,092	28,697	0.39	1,256
Green sunfish	26	0.01	18	456	0.01	20
Pumpkinseed	558	0.19	397	17,116	0.23	749
Bluegill	1,453	0.50	1,033	20,984	0.29	918
<u>Lepomis</u> hybrid	4	*	3	8	**	**
Smallmouth bass	264	0.09	188	2,032	0.03	89
Largemouth bass	22	0.01	16	264	*	11
White crappie	742	0.25	527	27,898	0.38	1,221
Black crappie	146	0.05	104	842	0.01	37
Perches						
Tessellated darter	1	*	1	7	*	**
Banded darter	1	*	1	1	*	**
Yellow perch	523	0.18	372	13,168	0.18	576
Logperch	4	*	3	4	*	**
Walleye	1,018	0.35	723	14,854	0.20	650
Total	288,445		205,007	7,357,720		322,057

* Less than 0.005%.

** Less than 1

TABLE 6
Numbers of eight selected species taken in the Conowingo Dam Fish Collection Facility at high and low attraction flows, 17 April-16 June 1978.

Date	17 Apr		19 Apr		21 Apr		23 Apr		25 Apr		27 Apr		29 Apr		1 May		3 May		4 May			
	No. Lifts*	Fishing Time (hr)																				
American eel	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	
Blueback herring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	236	4
American shad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gizzard shad	94	55	176	637	147	78	705	193	70	679	96	920	759	40	334	2133	628	-	-	-	-	-
Carp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel catfish	24	3	2	2	1	6	1	6	1	7	5	85	3	1557	22	3057	40	-	-	-	-	-
White perch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Striped bass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	119	58	178	639	150	79	711	197	83	691	103	936	846	48	2929	496	5426	718	-	-	-	-

Date	5 May		6 May		7 May		9 May		11 May		13 May		15 May		24 May		25 May		27 May		
	No. Lifts *	Fishing Time (hr)																			
American eel	5	2	1	1	-	-	5	1	9	5	3	2	-	-	-	-	-	-	-	-	-
Blueback herring	740	147	103	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American shad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gizzard shad	175	698	302	211	2518	702	147	59	171	123	349	2	309	1409	124	332	954	690	942	576	1096
Carp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Channel catfish	5	13	8	8	1	2	13	3	5	13	8	34	501	738	76	277	87	1226	348	10	4
White perch	270	81	3032	49	1839	100	86	22	1732	27	287	63	4	8	1	26	-	-	-	-	-
Striped bass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1195	943	3448	274	4359	805	252	95	1917	170	648	458	881	2238	270	707	1437	2754	2138	-	-

continued

TABLE 6

Continued.

Date	29 May		31 May		1 Jun		2 Jun		3 Jun		4 Jun		6 Jun		7 Jun		8 Jun		9 Jun	
	LF	HF	LF	HF	LF	HF	LF	HF	LF	HF	LF	HF	LF	HF	LF	HF	LF	HF	LF	HF
No. Lifts *	6	4	6	5	5	4	5	4	4	4	5	4	5	4	5	4	4	5	5	5
Fishing Time (hr)	2.7	1.3	2.7	1.1	2.3	1.5	2.3	2.3	1.4	1.6	2.5	1.7	2.3	2.3	2.5	2.3	2.0	2.6	2.5	2.4
Volume	15	15	9	17	31	2	10	6	95	75	110	152	100	150	25	40	100	70	40	40
Species	American eel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blueback herring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	American shad	1150	1002	1050	686	1508	260	230	1477	790	209	1713	927	194	660	952	25	48	19	17
	Gizzard shad	456	786	736	526	136	1052	7	125	61	11	44	4	51	1672	524	226	70	147	147
	Carp	1860	1758	1638	1863	1160	781	1369	538	1268	34	106	279	44	341	1952	24	10	19	11
	Channel catfish	50	-	19	4	-	-	60	198	84	30	41	91	7	44	8	16	5	5	1
	White perch	-	-	-	-	-	-	2	4	17	1	-	5	19	4	4	5	5	5	1
	Striped bass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	3531	3561	3456	3098	2836	2096	1685	5263	2317	2298	395	2057	1520	164	799	4325	1563	371	213	243

134.8 hr

Date	10 Jun		12 Jun		14 Jun		16 Jun		Total		Catch/ Hour
	LF	HF	LF	HF	LF	HF	LF	HF	LF	HF	
No. Lifts *	6	4	6	4	6	4	5	4	62.4	72.4	
Fishing Time (hr)	1.7	1.7	2.8	1.7	2.4	2.0	2.3	2.3	62.4	72.4	
Volume	200	280	650	400	350	400	70	75	22.0	1978	27.3
Species	American eel	296	4	8	20	1	32	-	43.7	303	4.2
	Blueback herring	4416	104	153	2214	249	553	161	0.2	36	0.5
	American shad	-	100	114	938	46	19	125	296.5	25995	359.0
	Gizzard shad	549	401	765	618	546	5791	782	58.0	8321	114.9
	Carp	9576	810	539	1	1312	24	460	180.0	21545	297.6
	Channel catfish	449	29	40	3	64	28	239	385.2	1810	25.0
	White perch	-	-	-	-	-	-	-	13.5	165	2.3
	Striped bass	-	-	-	-	-	-	-	-	-	-
Total	15286	4530	1850	2363	4553	8966	2156	1607	999.1	60153	830.8

908 hr

122,498

HF - High Flow
LF - Low Flow
* - The clean out lift and the first lift with the crowder gates open are not included

TABLE 8

Application of alternate day sampling design to 1977 data, and results of expansion of 1978 data.

Species	Total 1977 Catch*	Alternate Day Catch**	% of Total	Total 1978 Catch	Expanded 1978 Catch
Blueback herring	24,395	21,805	89.4	13,130	14,687
Alewife	188	48	25.5	5	20
American shad	165	140	84.8	54	63
Total	24,748	21,993	88.9	13,189	14,770

* Includes daily totals from 15 April to 16 June

** Includes catch on days of additional operation for anadromous fishes

TABLE 9
Sex ratio and spawning condition of American shad, Alosa sapidissima, collected in the Conowingo Dam Fish Collection Facility, 1972-1978.

Sex Condition	Male			Female			Total	Undetermined	Total
	Ripe	Spent	Total	Green	Ripe	Spent			
1978	21	0	21	3	0	21	9	33	54*
%	38.9	0	38.9	5.5	0	38.9	16.7	61.1	9
1972-1978	247	1	248	96	15	51	174	336	918
%	26.9	0.1	27.0	10.5	1.6	5.6	18.9	36.6	36.4

* Does not include one recaptured shad (male) taken on 1 June and originally tagged on 27 April

TABLE 10

Number of American shad, *Alosa sapidissima* taken in the Conowingo Dam Fish Collection Facility under various conditions of generation of the Conowingo Hydroelectric Station, 1972-1978.

	No. Units Operating		Status of Unit No. 1	Status of Unit No. 2	No. Shad Caught			% of Catch		
	Small*	Large**			1972-1977	1978	Total	1972-1977	1978	Total
0	0		OFF	OFF	185	3	188	21.4	5.5	20.4
1	0		OFF	ON	336	9	345	38.8	16.4	37.5
1	0		OFF	OFF	37	0	37	4.3	-	4.0
1	0		ON	OFF	1	0	1	0.1	-	0.1
2	0		OFF	OFF	0	1	1	-	1.8	0.1
2	0		OFF	ON	20	0	20	2.3	-	2.2
3	0		OFF	ON	33	0	33	3.8	-	3.6
3	0		OFF	OFF	1	0	1	0.1	-	0.1
3	1		OFF	ON	6	0	6	0.7	-	0.7
4	0		OFF	ON	31	4	35	3.6	7.3	3.8
4	0		REDUCED	ON	8	0	8	0.9	-	0.9
4	1		OFF	ON	34	9	33	3.9	16.4	3.6
4	1		REDUCED	ON	5	0	5	0.6	-	0.5
4	1		ON	ON	1	0	1	0.1	-	0.1
4	2		OFF	OFF	1	0	1	0.1	-	0.1
4	2		OFF	ON	28	0	28	3.2	-	3.0
4	2		ON	ON	1	0	1	0.1	-	0.1
4	2		REDUCED	ON	1	0	1	0.1	-	0.1
4	3		OFF	ON	12	5	17	1.4	9.1	1.8
4	3		REDUCED	ON	1	0	1	0.1	-	0.1
4	4		OFF	ON	12	0	12	1.4	-	1.3
4	4		ON	ON	6	0	6	0.7	-	0.7
5	0		OFF	ON	4	0	4	0.5	-	0.4
5	1		OFF	ON	2	0	2	0.2	-	0.2
5	2		OFF	ON	5	0	5	0.6	-	0.5
5	3		OFF	ON	3	6	9	0.3	10.9	1.0
5	4		OFF	ON	5	0	5	0.6	-	0.5
6	0		ON	ON	1	0	1	0.1	-	0.1
6	1		OFF	ON	3	0	3	0.3	-	0.3
6	2		ON	ON	1	0	1	0.1	-	0.1
6	3		ON	ON	0	4	4	-	7.3	0.4
6	4		OFF	ON	20	0	20	2.3	-	2.2
6	4		ON	ON	2	4	6	0.2	7.3	0.7
7	4		ON	ON	27	7	34	3.1	12.7	3.7
7	4		REDUCED	ON	4	0	4	0.5	-	0.4
Changing			Changing		28	3	31	3.2	5.5	3.4
Total					865	55	920			

* 5,000 cfs

** 10,000 cfs

TABLE 11
Time of day American shad, *Alosa sapidissima*, were taken in the Conowingo Dam Fish Collection Facility, 27 April-16 June 1978.

Date	27 Apr	29 Apr	3 May	6 May	7 May	31 May	1 Jun	2 Jun	3 Jun	4 Jun	6 Jun	7 Jun
Water Temp (F)	54	53	58	57	57	70	70.5	72	73	74.5	75	75
Time (EST)												
0400-0459	-	-	-	-	-	-	-	-	-	-	-	-
0500-0559	1	-	1	-	-	-	-	2	2	-	2	-
0600-0659	-	1	-	-	-	-	-	-	1	-	-	-
0700-0759	-	-	-	2	-	1	-	-	2	-	1	-
0800-0859	-	-	-	-	1	2	1	1	2	1	3	-
0900-0959	-	-	-	-	-	1	1	1	-	1	-	4
1000-1059	-	-	-	-	-	-	-	1	-	-	-	-
1100-1159	-	-	-	-	-	1	-	-	-	-	-	-
Total	1	1	1	2	1	5	2	4	10	1	6	4

TABLE
Continued.

Date	8 Jun	9 Jun	14 Jun	16 Jun	1978	1972-1977	Total
Water Temp (F)	74.5	74	74	72	No.	No.	No.
					%	%	%
0400-0459	-	-	-	-	0	9	9
0500-0559	-	-	-	-	9	73	82
0600-0659	-	-	1	1	3	250	253
0700-0759	7	-	-	-	13	187	200
0800-0859	-	-	-	-	9	149	158
0900-0959	-	3	-	-	10	55	65
1000-1059	-	-	-	-	5	42	47
1100-1159	-	5	-	-	6	31	37
Total	7	8	1	1	55	796	851

TABLE 12

Comparison of the numbers of American shad, Alosa sapidissima, taken in the Conowingo Dam Fish Collection Facility with water temperature 1972-1978.

Temp (F)	1972-1977		1978		Total	
	No.	%	No.	%	No.	%
53	0	-	1	1.8	1	0.1
54	0	-	1	1.8	1	0.1
56	6	0.7	0	-	6	0.7
57	0	-	3	5.5	3	0.3
58	5	0.6	1	1.8	6	0.7
59	6	0.7	0	-	6	0.7
60	7	0.8	0	-	7	0.8
61	6	0.7	0	-	6	0.7
62	8	0.9	0	-	8	0.9
63	5	0.6	0	-	5	0.5
64	10	1.2	0	-	10	1.1
65	9	1.0	0	-	9	1.0
66	17	2.0	0	-	17	1.8
67	12	1.4	0	-	12	1.3
68	36	4.2	0	-	36	3.9
69	56	6.5	0	-	56	6.1
70	243	28.1	5	9.1	248	26.9
71	97	11.2	2	3.6	99	10.7
72	15	1.7	5	9.1	20	2.2
73	28	3.2	10	18.2	38	4.1
74	123	14.2	9	16.4	132	14.3
75	145	16.7	18	32.7	163	17.7
76	26	3.0	0	-	26	2.8
77	2	0.2	0	-	2	0.2
79	4	0.5	0	-	4	0.4
Total	866		55		921	

TABLE 13

Age composition of adult American shad, *Alosa sapidissima*, taken in the Conowingo Dam Fish Collection Facility and by anglers, 1972-1978.

Age Group	Collection Facility		Anglers		Total	%
	Males	Females	Males	Females		
<u>1972</u>						
III	8	-	-	-	8	8.2
IV	37	15	-	-	52	53.1
V	10	19	-	-	29	29.6
VI	-	9	-	-	9	9.2
<u>1973</u>						
IV	1	-	-	-	1	16.7
V	1	2	-	-	3	50.0
VI	-	1	-	-	1	16.7
VII	-	1	-	-	1	16.7
<u>1974</u>						
III	1	-	4	-	5	11.1
IV	2	1	7	14	24	53.3
V	2	3	2	8	15	33.3
VI	-	-	-	1	1	2.2
<u>1975</u>						
IV	4	7	15	9	35	68.6
V	-	2	4	8	14	27.5
VI	-	-	1	1	2	3.9
<u>1976</u>						
III	-	-	1	-	1	2.1
IV	4	3	7	8	22	45.8
V	2	8	2	8	20	41.7
VI	2	1	1	-	4	8.3
VII	-	1	-	-	1	2.1
<u>1977</u>						
III	-	-	2	-	2	2.1
IV	2	6	18	5	31	32.3
V	2	8	13	33	56	58.3
VI	-	-	-	7	7	7.3
<u>1978</u>						
V	2	1	8	6	17	43.6
VI	-	2	4	12	18	46.1
VII	-	2	1	1	4	10.3
Total	80	92	90	121	383	

TABLE 14

Daily numbers and release locations of blueback herring, Alosa aestivialis, American shad, Alosa sapidissima, striped bass, Morone saxatilis, and striped bass x white bass hybrids transported above Conowingo Dam, 2 May - 16 June 1978.

Date	Species	Release Location	
		Conowingo Pond	Safe Harbor Pond
2 May	Blueback herring	283	-
3 May	Blueback herring	0	875
	American shad	0	1
5 May	Blueback herring	0	935
8 Jun	Striped bass	14	0
	Striped bass x white bass	2	0
10 Jun	Striped bass	40	0
	Striped bass x white bass	12	0
12 Jun	Striped bass	35	0
	Striped bass x white bass	5	0
14 Jun	Striped bass	24	0
	Striped bass x white bass	6	0
16 Jun	Striped bass	115	0
	Striped bass x white bass	37	0
Total	Blueback herring	283	1811
	American shad	0	1
	Striped bass	228	0
	Striped bass x white bass	62	0
	Total	573	1812

TABLE 15
Hourly catch of American shad, *Alosa sapidissima*, and number of anglers fishing from shore just downstream from the Conowingo Dam Fish Collection Facility, 1978.

Date Water Temp (F)	21 Apr 53.0		3 May 58.0		4 May 58.0		7 May 57.0		11 May 57.0		14 May 60.0		15 May 62.0	
	No. Fishermen	No. Shad												
0400-0459	0	0	0	0	0	0	6	0	0	0	0	0	0	0
0500-0559	2	0	2	0	2	0	7	0	1	0	0	0	0	0
0600-0659	6	0	5	0	9	0	15	0	2	0	8	0	1	0
0700-0759	6	1	5	0	11	0	15	1	2	0	6	0	5	0
0800-0859	6	1	3	0	13	0	14	1	8	0	4	0	5	1
0900-0959	6	0	4	0	4	2	12	0	7	1	9	0	1	0
1000-1059	6	0	4	0	4	0	11	0	6	0	9	0	3	0
1100-1159	4	0	6	1	4	0	11	0	8	0	14	1	4	0
1200-1259	5	0	6	0	4	0	17	0	7	0	16	0	10	0
1300-1359	4	0	2	0	5	0	40	0	8	0	16	0	11	0
1400-1459	6	0	2	0	2	0	9	0	7	0	14	0	9	1
1500-1559	6	0	2	0	3	0	22	0	4	0	5	0	7	0
Total	57	2	36	1	58	2	179	5	60	1	101	1	56	2

continued

TABLE 15
Continued.

Date Water Temp (F)	25 May 64.0		28 May 65.0		3 Jun 73.0		7 Jun 75.0		1978		1973-1978*	
	No. Fishermen	No. Shad	No. Fishermen	% Shad								
0400-0459	0	0	0	0	0	0	0	0	6	0	1	0.2
0500-0559	2	0	0	0	2	0	3	0	21	0	30	6.9
0600-0659	6	0	0	3	4	3	3	0	59	3	80	18.4
0700-0759	5	2	3	0	4	0	6	1	68	5	73	16.8
0800-0859	4	0	0	0	3	0	4	0	64	3	69	15.9
0900-0959	2	0	2	0	3	0	3	0	53	3	80	18.4
1000-1059	4	0	4	0	2	0	0	0	53	1	54	12.4
1100-1159	3	0	6	1	0	0	0	0	60	2	48	11.0
1200-1259	3	0	0	0	0	0	0	0	64	3		
1300-1359	7	0	4	0	0	0	0	0	95	0		
1400-1459	8	0	2	0	0	0	0	0	59	1		
1500-1559	6	0	2	0	0	0	0	0	57	0		
Total	50	2	25	1	18	3	19	1	659	21	435	

* Creel census was not conducted after 1200 hr from 1974 to 1977. Total column does not include American shad taken after 1159 hr in 1973 and 1978.

TABLE 16
 Status of generation of Conowingo Hydro-electric station in relation to west shore angler catch of American shad, *Alosa sapidissima*,
 No angler survey in 1972.

No. Units Operating Small*	Large**	Status of Unit No. 1	Status of Unit No. 2	No. Shad Caught		% Catch		Total
				1973-1977	1978	1973-1977	1978	
0	0	Off	Off	0	2	-	9.5	0.4
1	0	Off	On	146	149	31.1	14.3	30.4
2	0	Off	On	8	8	1.7	-	1.6
3	0	Off	On	14	14	3.0	-	2.9
3	0	On	On	1	0	0.2	-	0.2
4	0	Off	On	12	12	2.6	-	2.4
4	0	Reduced	On	14	14	3.0	-	2.9
4	0	On	On	2	2	0.4	-	0.4
4	1	Off	On	9	12	1.9	14.3	2.4
4	1	Reduced	On	1	1	0.2	-	0.2
4	2	Off	On	6	6	1.3	-	1.2
4	2	On	On	5	5	1.1	-	1.0
4	2	On	On	4	4	0.8	-	0.8
4	2	Off	On	10	10	2.1	-	2.0
4	3	On	On	7	7	1.5	-	1.4
4	3	Off	On	11	11	2.3	-	2.2
4	4	On	On	11	11	2.3	-	2.2
4	4	Reduced	On	1	1	0.2	-	0.2
5	3	Reduced	On	6	6	1.3	-	1.2
5	4	Off	On	9	9	1.9	-	1.8
5	4	On	On	4	2	0.8	9.5	1.2
5	4	On	On	13	6	2.8	-	2.7
6	4	Off	On	17	13	3.6	23.8	4.5
6	4	On	On	2	22	0.4	9.5	0.8
7	3	On	On	118	4	25.2	9.5	24.5
7	4	On	On	9	120	1.9	-	1.8
7	4	Reduced	On	5	9	1.1	-	1.0
7	4	Changing	On	24	2	5.1	9.5	5.3
Undetermined								
Total				469	21			490

* 5,000 cfs unit
 ** 10,000 cfs unit

TABLE 17

Comparison of the percentage of American shad, Alosa sapidissima, taken by shore anglers just downstream of the Conowingo Dam Fish Collection Facility with water temperature 1973-1978. No angler survey conducted in 1972.

Temp (F)	1973-1977		1978		Total	
	No.	%	No.	%	No.	%
53	0	-	2	9.5	2	0.4
56	1	0.2	0	-	1	0.2
57	7	1.5	6	28.6	13	2.7
58	11	2.3	3	14.3	14	2.9
59	17	3.6	0	-	17	3.5
60	21	4.5	1	4.8	22	4.5
61	43	9.2	0	-	43	8.8
62	53	11.3	2	9.5	55	11.2
63	69	14.7	0	-	69	14.1
64	36	7.7	2	9.5	38	7.8
65	12	2.6	1	4.8	13	2.7
66	58	12.4	0	-	58	11.8
67	1	0.2	0	-	1	0.2
68	65	13.8	0	-	65	13.3
69	12	2.6	0	-	12	2.4
70	23	4.9	0	-	23	4.7
71	3	0.6	0	-	3	0.6
72	12	2.6	0	-	12	2.4
73	7	1.5	3	14.3	10	2.0
74	14	3.0	0	-	14	2.9
75	4	0.8	1	4.8	5	1.0
Total	469		21		490	

TABLE 18

Daily angler effort and number of American shad, Alosa sapidissima, caught along the west shore of the Conowingo Dam tail-race, 1978.

Date	Angler Hours	No. Shad Caught
15 Apr	12	0
17 Apr	13	0
19 Apr	22	0
21 Apr	57	2
23 Apr	72	0
25 Apr	36	0
27 Apr	59	0
29 Apr	90	0
30 Apr	123	0
1 May	21	0
2 May	7	0
3 May	36	1
4 May	58	2
5 May	20	0
6 May	95	0
7 May	179	5
9 May	15	0
11 May	60	1
13 May	47	0
14 May	101	1
15 May	56	2
22 May	13	0
23 May	31	0
24 May	10	0
25 May	50	2
27 May	23	0
28 May	25	1
29 May	40	0
31 May	8	0
1 Jun	13	0
2 Jun	0	0
3 Jun	18	3
4 Jun	25	0
6 Jun	0	0
7 Jun	19	1
Total	1,454	21
No. Days	35	
Average Per Day	41.5	0.6
Catch Per Angler Hr		.014
<u>Alternate Day Census</u>		
Total	972	13
No. Days	24	
Average Per Day	40.5	0.5
Catch Per Angler Hr		.013

TABLE 19
The distribution of boats in the Conowingo Dam tailrace under various conditions of generation of Conowingo Hydro-electric Station, 1973-1978.

No. Units Operating Small*	No. Boat Hrs East Side		No. Boat Hrs West Side		1973-1977		1978		1973-1977		1978	
	1973-1977	1978	Total	Total	1973-1977	1978	1973-1977	1978	Total	Total	1973-1977	1978
0	53	2	55	76	49.1	8.7	42.0	50.9	91.3	58.0		
1	185	1	186	21	26.0	3.1	25.0	74.0	96.9	75.0		
2	35	2	37	98	29.2	13.3	27.4	70.8	86.7	72.6		
3	50	0	50	67	42.7	-	42.7	57.3	-	57.3		
4	160	7	167	215	43.7	43.7	43.7	56.3	56.3	56.3		
5	3	0	3	8	27.3	-	27.3	72.7	-	72.7		
6	3	0	3	0	100.0	-	100.0	-	-	-		
7	7	0	7	5	58.3	-	58.3	41.7	-	41.7		
8	223	28	251	115	66.8	87.5	68.6	33.2	12.5	31.4		
9	7	0	7	2	77.8	-	77.8	22.2	-	22.2		
10	29	0	29	7	80.6	-	80.5	19.4	-	19.4		
11	237	5	242	65	78.5	100.0	78.8	21.5	-	21.2		
12	18	4	22	4	85.7	80.0	84.6	14.3	20.0	15.4		
13	7	0	7	0	100.0	-	100.0	-	-	-		
14	6	5	11	2	85.7	83.3	84.6	14.3	16.7	15.4		
15	221	0	221	49	81.8	-	81.9	18.1	-	18.1		
16	74	1	75	9	89.2	100.0	89.3	10.8	-	10.7		
17	6	7	13	3	85.7	77.8	81.3	14.3	22.2	18.7		
18	57	20	77	7	89.1	100.0	91.7	10.9	-	8.3		
19	10	4	14	5	71.4	80.0	73.7	28.6	20.0	26.3		
20	170	1	171	17	90.9	100.0	90.9	9.1	-	9.0		
21	110	20	130	13	93.2	80.0	90.9	6.8	20.0	9.1		
22	110	89	199	23	91.7	87.3	89.6	8.3	12.7	10.4		
23	1797	98	1895	277	86.6	89.9	86.8	13.4	10.1	13.2		
24	40	0	40	3	93.0	-	93.0	7.0	-	7.0		
Changing												
Total	3618	294	3912	1526	70.3	72.4	70.5	29.7	27.6	29.5		

* 5,000 cfs unit
** 10,000 cfs unit

TABLE 20

Fishing pressure, mean catch per effort and catch composition of anglers interviewed along the west shore of the Conowingo trailrace, 17 April - 1 June 1978.

	Apr	May	Jun	Survey Totals	
Total Angler Hours	484	895	75	1454	
No. Parties Interviewed	45	140	3	188	
No. Anglers Contacted	62	223	4	289	
Hours Fished	160	502	11	673	
Mean Catch per Effort (all species)	0.61	1.47	1.45	1.26	

Species				Number	%
White perch	6	593	8	607	71.33
Channel catfish	45	8	4	57	6.70
Smallmouth bass	22	31	-	53	6.23
Blueback herring	-	25	-	25	2.94
White crappie	5	9	4	18	2.11
Carp	1	15	-	16	1.88
Yellow perch	7	8	-	15	1.76
American shad	2	9	-	11	1.29
Gizzard shad	-	11	-	11	1.29
Walleye	2	8	-	10	1.17
Redbreast sunfish	-	8	-	8	0.94
Bluegill	-	5	-	5	0.59
Largemouth bass	4	-	-	4	0.47
Black crappie	2	2	-	4	0.47
Rock bass	-	3	-	3	0.35
Shorthead redhorse	-	2	-	2	0.23
Quillback	-	1	-	1	0.12
Striped bass	1	-	-	1	0.12
Total	97	738	16	851	