Final Report

7/1/03 - 12/31/05

Push-net survey for young-of-the-year American shad, American eel elver trapping in Rock Creek, and production of yolk-sac fry American shad

NOAA Award Number NA03NMF4740315

3-ACA-154

M. Jon Siemien
Chief, Fisheries Research Branch
District of Columbia, Department of Health
Environmental Health Administration
Fisheries & Wildlife Division
51 N. Street, N.E., Room 5003
Washington, D.C. 20002

Final Report

Project Title: Push-net survey for young-of-the-year American shad, American eel elver trapping in Rock Creek, and production of yolk-sac fry American shad

Award No.	NA03NMF4740315
Report Period:	July 1, 2004 - December 31, 2005
Original Award Period	July 1, 2003 - December 31, 2004
Award Period Extention (1)	January 1, 2005 – December 31, 2005

OBJECTIVES

The push-net survey was designed to help determine the abundance of young-of-the-year American shad in the District. While our sampling techniques have not been successful at finding adult American shad, we know they are present because of angler reports. This part of this study was designed to help determine the population of young-of-year (YOY) American shad present in the District. The Interstate Commission on the Potomac River Basin, in conjunction with the US Fish and Wildlife Service, stocked larval American shad into the Potomac just below Great Falls over the years 1995 through 2002. While the yearly goal in the stocking was one million larval fish, there were almost 16 million larvae stocked over this period. This stocking has been successful with documented adult returns to the Great Falls area. The US Fish and Wildlife Service also documented increasing numbers of YOY in the Potomac in the District and just downstream of Woodrow Wilson Bridge through their push-net survey. Since 2002 was the final year of the USFWS push-net survey, our survey was designed to document any changes in the population now that the stocking near Great Falls has ended.

The second survey was designed to document the existence and abundance of young eels in Rock Creek, a tributary to the Potomac. To date, no targeted studies have looked at eel abundance anywhere in the District, and since we regularly see eel elvers in our electrofishing surveys we are now trying to document their actual abundance.

The third element to this project is the production of yolk-sac fry American shad for stocking in the District. While occasional adult American shad are collected during our regular sampling surveys in the District, populations are still far below their historic levels. To supplement the existing population we are going to use capture and artificially spawn wild fish and use the fry produced to stock into District waters.

Part I

Push Net Survey for Young-of -the-Year American Shad

Introduction

A push net survey was implemented in the 2003 sampling regime for the District of Columbia. The purpose of the survey is to 1) improve knowledge of alosids stock dynamics to develop more accurate databases in District waters and to 2) continue programs to restock alosids into historical spawning waters and expand the stock for restoration programs. These objectives are inline with the Chesapeake Bay Alosid Management Plan (FMP). The plan was approved and implemented in 1989 by states of Pennsylvania, Maryland, and Virginia, the District of Columbia, and the Potomac River Fisheries Commission.

American and hickory Shad are anadromous species and members of the Clupeid (herring) family. Spawning for both species come about as a result of increasing water temperatures and increasing photoperiods. Hickory shad start their freshwater migration spawn before American Shad. They arrive in District waters early to late March. American shad then follow them. American shad arrive in the late March to early April. In the District, spawning for both species generally takes place through the month of May. Both species are broadcast spawners. Females migrate first followed by males that fertilize the eggs.

Relatively smaller than American and hickory shads, alewife and blueback herring are also spring spawners. They are less specific to critical spawning habitat. They make use of a variety of habitats including rivers; and creeks with gravel, sand, detritus or SAV substrates. Both males and females broadcast milt and eggs, respectively and simultaneously, over a particular substrate. The adults then migrate back to sea. Juveniles remain in the area waters until the fall. As water temperature drop, they migrate to the Chesapeake Bay and eventually the Atlantic Ocean. However, the Maryland Department of Natural Resources has noted that some juveniles over winter their first year in deeper waters of the bay.

Study Methods

The District conducts push net sampling during August and September at five locations on the Potomac River. The sites are P5PN (Fletchers Boathouse), P4PN (upstream of Key bridge/adjacent to three sisters island), P3PN (adjacent to Theodore Island), P2PN (adjacent to National Airport), P1PN (upstream from the Woodrow Wilson Bridge), and A1PN (downstream of Pennsylvania Ave. Bridge) was added in 2005 to the sampling regime. This site is located on the Anacostia River.

Samplings are done at dusk and performed eleven times a year. A 50"x 38" x8" (width x depth x length) mesh net is hung on a pivoting tubular metal frame and fished from the bow of the boat for a ten minute period. A 0.83 mile transect in length is covered at each station. Fishing is performed starting from an upstream position then moving downstream, all sites are fished in this manner except P1PN which is done in the opposite way. Transects are performed at a constant speed of 5 mph. All alosid are collected, enumerated, measured and saved for otolith extraction.

The data collected is used to determine relative abundance of young-of-year American shad and to estimate the spawning success of American shad within the District. The USFWS has been stocking American shad fry upstream of Little Falls Dam on the Potomac River, since 1995 and also collects American shad otoliths to determine the success of their stocking program.

Results

Charts shown are from data for 2004-2005 sampling season. They illustrate the number of alosids by site and species per 1000 cubic meters (Table 1 & 2). In 2004 more America shad were collected than any alosid, but that did not hold true the following year, when blueback herring where more numerous. In 2004 American shad were numerous throughout the Potomac River compare to 2005 where they were mostly in the lower and middle Potomac River (Table 3). In 2004 eleven sampling dates were done and fourteen were done for 2005. Only one hickory shad has been caught in the last two years. Last year was the first time the Anacostia River (A1PN) was sampled and it compared surprisingly well to the middle and lower reaches of the Potomac River. Last year the Anacostia River had a greater abundance of American shad, alewife, and blueback herring than the upper Potomac River.

Conclusion

Over the last two years an average of 5,678 American shad have been collected during this survey. The experience and knowledge gained from the previous sampling years, has prompted a potential for future sampling to begin at an earlier date to investigate whether other alosids such as hickory shad are migrating out of the Potomac River earlier than their counterparts. Now that baseline data is being established, over the next several years the Districts fisheries research branch will be able to determine spawning success (trends) and relative abundance from year to year.

Part II

American eel elver trapping in Rock Creek

Introduction

For the last three years the District of Columbia Research Branch, along with other coastal states, has participated with the Atlantic States Marine Fisheries Commission in an elver survey. The surveys are conducted to assess American eel young-of-year (YOY) abundance. Elvers less than 85 mm are considered young-of-year. Eels of this size represent the first year class of eels migrating back from the ocean.

Methods

The elver survey was carried out by following protocol provided by the Atlantic States Marine Fisheries Commission (ASMFC). The ASMFC protocol requires, minimally sampling one site four days per week for six weeks. The sampling gear consists of an Irish elver ramp trap. The trap is approximately 61 cm wide x 122 cm long. It is made of wood and consists of a ramp that's covered with enkmat, a plastic erosion control material inside a narrow box. The ramp runs three-fourth the length of the trap and ends in a small well at the top of the ramp. Water is fed into the trap from a freshwater source through a tube next to the well. The water fills the well and trickles down the ramp, attracting elvers. Elvers climb the ramp, fall into the well, and are carried into a mesh bag that is attached to the well. Elvers are then collected from the bag counted measured and weighed. All traps are tied to trees with padlocks in case of floods and to deter theft.

Traps are set from early March and are fished until the end of May. Traps are set on Mondays and checked everyday throughout the week and removed on Fridays. All traps are located in Rock Creek, a tributary of the Potomac River, and are accessible by wading.

Results
To data no elvers have been caught since the start of this survey. Different locations have been used such as sites where elvers have been seen during backpack electrofishing. The elvers that have been observed during electrofishing are not numerous at any given time.

Conclusion
Though no elvers have been landed using this sampling method, the fisheries research branch remains optimistic. In the future, experimentation with different traps and methods will be employed to obtain some type of baseline elver data. Perhaps prolonging this survey several weeks will help our productivity. Hopefully with some modifications to equipment or adjustments to sampling time improvements will be seen in the coming years.

Part III

Gill Net Survey for Adult American Shad and Fry Production

Introduction
A gillnet survey was implemented in the 2004 sampling regime for the District of Columbia. The purpose of this gillnet survey is to improve knowledge of American shad stock dynamics as well as a means to get brood stock. A more accurate assessment of the stock will allow for the development of a dependable database to develop and implement an American shad restocking program. We plan to develop a program to restock American shad into historical spawning waters of the Potomac and expand the stock for restoration programs.

This survey's primary target is American shad (*Alsoa sapidissima*). American shad are anadromous fish that spend the majority of their life at sea and only enter freshwater in the spring to spawn. Their spawning runs on the Potomac River usually occur early April to mid May, depending on water temperature. They are broadcast spawners that release thousand of eggs in the water. Fertilized eggs hatch within several days, and remain in area waters till fall before migrating out of the Potomac. This (migration) coincides with the District of Columbia Push Net Survey that is done in late summer/early fall to target young of year American shad.

Methods
Adult American shad typically begin to arrive in District waters in early April as part of their annual spring spawning run. The run usually last from early April to mid May when water temperature ranges from 12 to 20 degrees C. The Fisheries Research Branch does evening and night sampling in an effort to capture pre-spawned adults, through the use of gill nets, as well as electrofishing. The ripe fish are strip spawned immediately after being captured. The shad are then measured and returned to the river. The fertilized eggs are then allowed to water harden and transported to our hatchery. The eggs remain in incubators where a fertility estimate, as well as an enumeration of viable eggs is made. The fry generally hatch after 5 to 10 days in the incubator. The fry are kept for 3 to 5 days and then released.

Gill Netting

Gillnetting consists of fishing one to three nets that are approximately 300ft in length and 8ft to 16ft in depth with 5 ½ " stretch mesh. The nets are fished for roughly an hour each. To get a better understanding of how to fish these nets and to maximize our catch per unit effort different methods were employed. Some nets are left free floating with the currents, while others drifted attached to a boat. After an hour the nets are retrieved and all fish are identified, counted and released. American shad are sexed, measured and stripped for incubation at the hatchery.

Strip Spawning

As the gill nets are fished the American shad are sexed, measured, weighed, and scales are taken. The males and females are separated into 2 different live wells; once all the nets have been fished the female shad are closely inspected for ripeness. The green and spent females are then returned to the river. The eggs from 3-5 ripe females are stripped into a large mixing bowl; the milt of 6-10 males will then be put on the eggs. Ideally we would like to have a 2 to 1 male to female ratio, but that rarely works out. After the males and females are stripped they are returned to the river. A small amount of river water is added to the bowl with the eggs and sperm (enough to cover the eggs completely) to activate the sperm. The mixture is then gently mixed by hand in order to thoroughly mix the eggs and sperm. The mixture is then allowed to sit for 5 to 10 min., after which the eggs are run through a strainer to remove any scales, ovaries, fecies, and any other contaminants. The eggs are then rinsed several times with river water in an effort to remove any blood or fecies that was not removed in the straining process. The eggs are then allowed to water harden for about an hour in an egg box before being taken to the hatchery.

Incubation and Hatching

When the eggs arrive at the hatchery they are immediately put into hatching jars. The hatching jars are regulated to have a flow of approximately 3 gallons per min. this allows the eggs to roll very gently. The next morning the eggs are examinined and the broken eggshells and other debris are siphoned off the top (due to the rolling action the good eggs stay towards the bottom of the jar). A volumetric estimate is then made to determine the number of eggs. The estimate is made by having ¼ liter increments marked on the side of the hatching jars. With the flow turned off the eggs are allowed to settle and the level is recorded. Using a straw dropped to the bottom of the hatching jar, cross sections of the eggs are then pulled out. Using this 25ml sample we are able to extrapolate the number of eggs as well as a fertilization percentage. The flow is then turned back on to the jar and the eggs are allowed to incubate. The eggs are examinined every day and any dead eggs are removed if fungal / bacterial problems arise the eggs are treated with formilin. The eggs begin to hatch after 5 to 7 days at a water temp of 18 to 21 degrees C the larvae instinctively swim up wards where they flow out of the hatching jar and into a 6 ft round tank. The larvae then remain in this tank for 3 - 5 days after which they are collected, bagged up and stocked.

Results

This project has been on going since 2003, vast improvements have been made over the past few years. Starting in July 2003 hatchery equipment was researched and other aquaculture facilities in the area were toured, in order to get a feel for how the hatchery needed to be set up.

In the spring 2004 season hatching equipment was set up in anticipation of receiving American shad eggs. The fishery staff workers spent a day gill netting with either Maryland state fishery staff or US Fish & Wildlife staff who were working down river from the District to capture American shad for egg

stripping. Our staff then spent a total of 7 days gill netting for American shad within the District. Over the 7 days we fished 3 different sites with improving success at each new site. During these 7 days we were only able to capture 5 females and 1 male American shad: four of the females were post spawn (spent) while one was not ripe (green). No eggs were collected and sampling was discontinued due to increasing water temperature.

Gill netting for the 2005 season started April 20, 2005 and ended May 10, 2005. During this three-week period five surveys were conducted yielding 24 America shad. Sampling was conducted at three different sites on the Potomac River. One of the sites was located approximately 300 yards below Fletcher's Boathouse, another was located 100 yards above Three Sisters Island and the last site was located just below the confluence of the Potomac River, Anacostia River, and Washington Channel. Table 1 represents the five surveys and the abundance and diversity of fish caught during this period.

Gillnetting in the upper reaches of the river is difficult because the water is shallow and boulders are more pronounced. At times the current is extremely strong in the upper reaches, so an alternate method was utilized. Electrofishing was attempted on several occasions. Electrofishing specifically for American Shad was done five times yielding 74 shad.

The American shad production began on April 20th as well. In an effort to guarantee that we had some eggs we worked with Maryland Department of Natural Resources and received 3 batches of eggs to supplement what we were able to get. On April 26, 2005 the hatchery received 2 liters of eggs from the gillnetting survey in the District, along with 10 liters received on the 20th from MD. These 12 liters of eggs were all put into hatching jars that were on a flow through system. All died due to poor water quality related to high iron content in the well water. The Iron precipitated out and smothered the eggs in the hatching jars. On April 27th we received 2 liters of eggs and again on the 28th we received another 2 liters from Maryland. We were able to collect 1½ liters of eggs in the District on the 28th. All 5 ½ liters of eggs were put into hatching jars that were on a makeshift recirculating system. This took care of the iron problem but we still ran into a fungal / bacterial problem with the eggs, after a short time the eggs began to clump up and die. Most of the eggs died but a few did hatch out on May 5th, there were so few that we were unable to collect them or stock them. On May 5th 2 liters of American shad eggs were brought to the hatchery these eggs were collected using our electrofishing boat in the upper regions of the river. These 2 liters were put into hatching jars, which were on the recirculating system; we made some changes to the system and added an UV light filter. We had no problems with these eggs and after taking our sample of eggs we estimated our fertility to be 95% and that we had around 68,000 good eggs. On May 9th the eggs began to hatch, by the next day all had hatched into the 6ft round tank. On May 12th we stocked an estimated 60,000 American shad larvae in the Anacostia River.

Conclusion

Over the past 3 years we have made a great deal of progress in terms of our sampling techniques, as well as our larval shad production. As far as the gill netting we have figured out when, and where we need to focus our efforts in order to capture the adult American shad. We feel that the gill net sight near the confluence of the Potomac, Anacostia, and Washington Ship Channel will be our most productive and easiest to fish with the gill net. The contours of the river in this area are very similar to where Maryland and the Fish & Wildlife Service capture there brood stock down river. The river is also fairly wide and water is not quite as unpredictable as it is up river. With the experience we have gained, and continue to gain I expect our catches to increase in years to come. In terms of our fry production we have filtration systems to deal with the iron problems through out the entire hatchery. We also have in place a biological filtration system for the hatching jars as well as the capability to treat the eggs with formilin in the event of possible infections with the eggs. We hope to have the capability to mark the fry with

oxytetracycline (OTC) set up and in place before the next season. With all of our advancements in the brood stock collection as well as the fry production we hope to see a marked improvement in both for the 2006-spawning season.

Table 1. Alosids per 1000 cubic meter

2004 # fish/1000 cubic m						
Species	Stations					
	P5	P4	P3	P2	P1	Total
American shad	133.42	157.45	264.91	167.77	72.91	156.39
Alewife	2.96	7.10	12.93	5.62	6.51	7.00
blueback herring	4.32	11.76	41.14	62.83	35.62	33.18

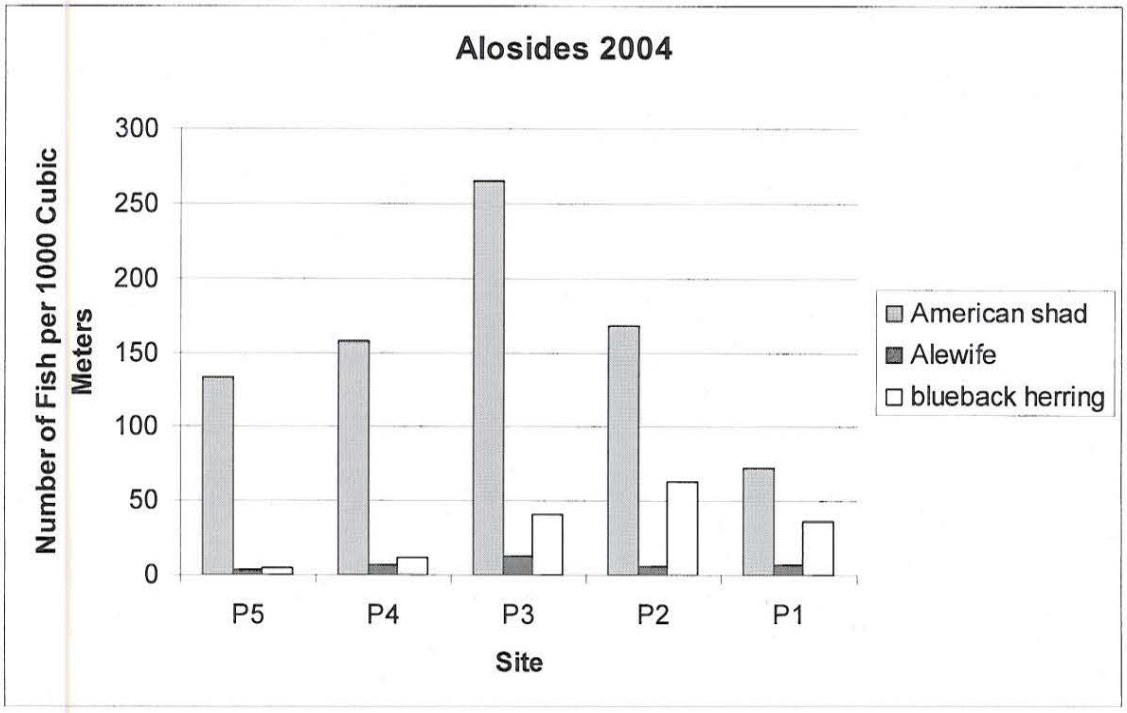
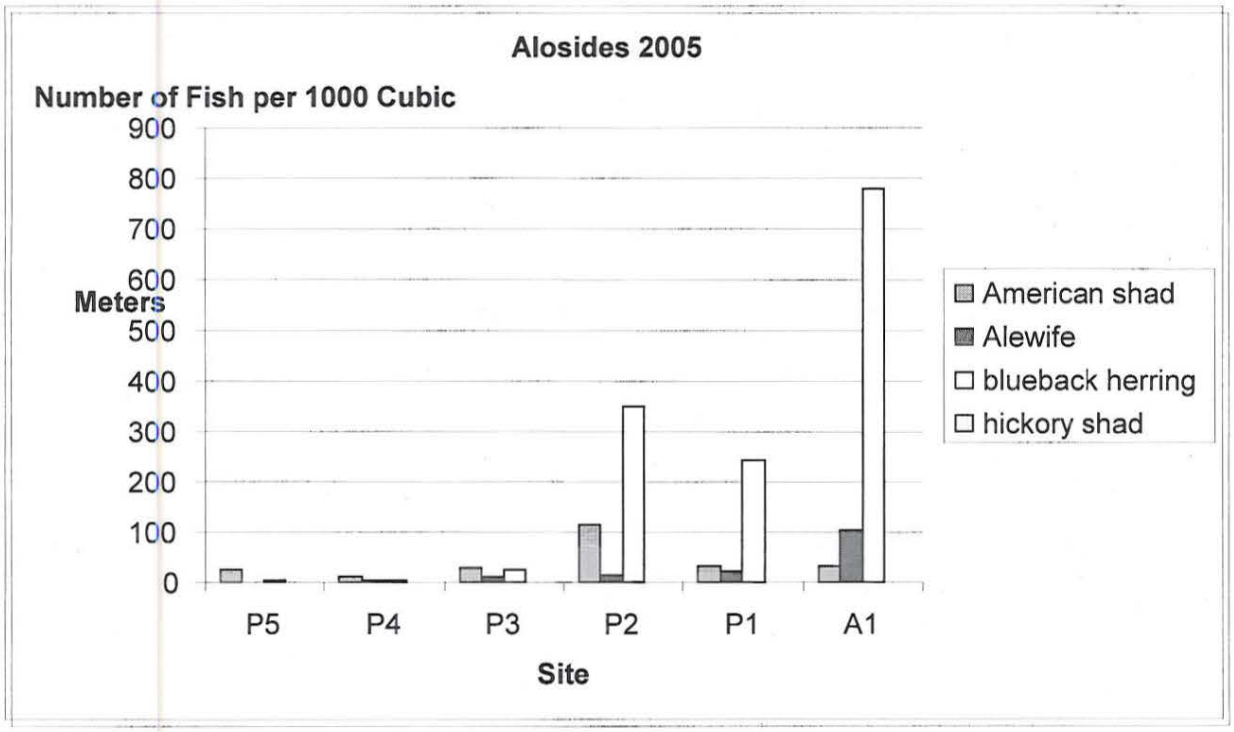
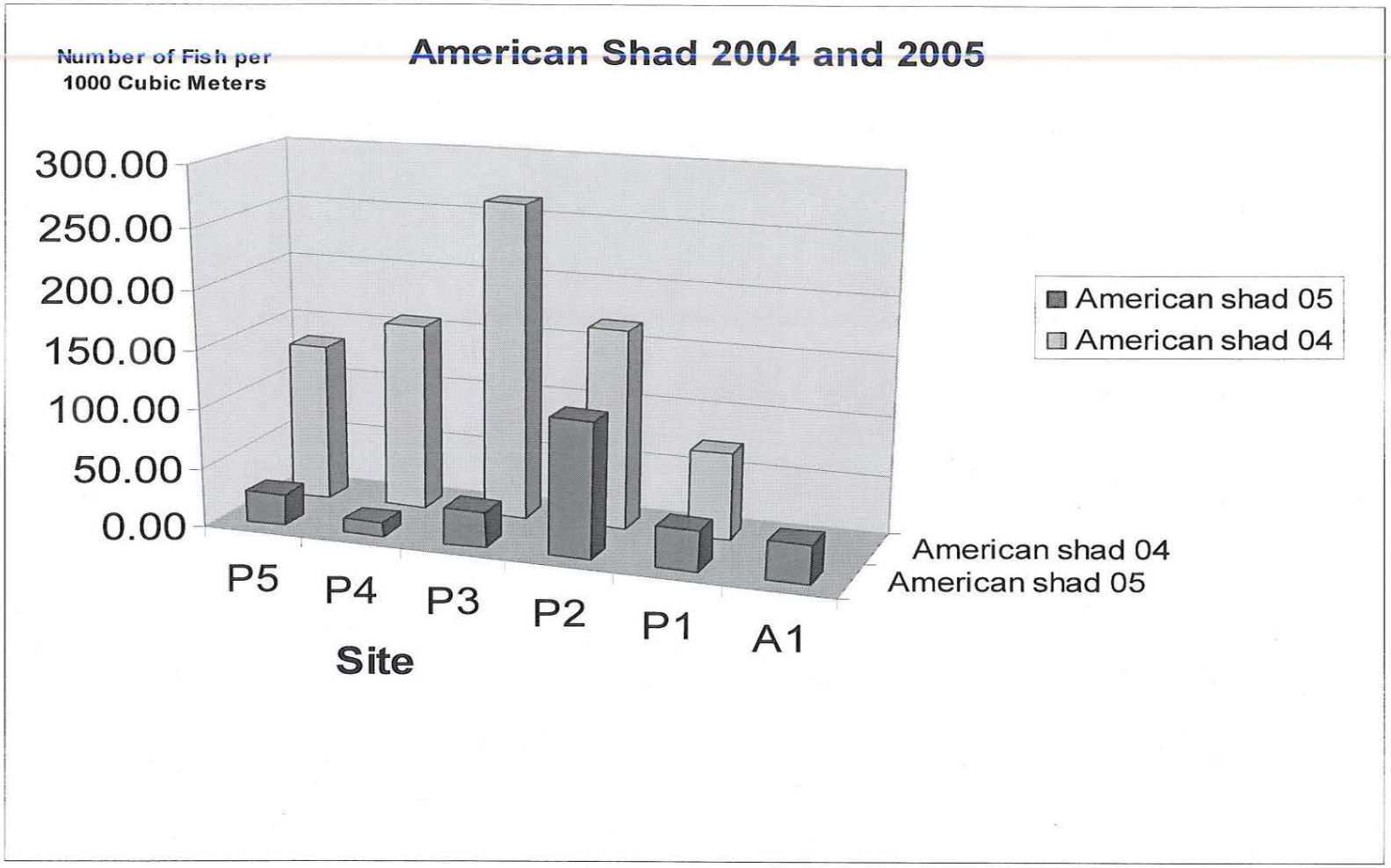


Table 2. Alosids per 1000 cubic meter

2005 # fish/1000 cubic m							
Species	Stations						
	P5	P4	P3	P2	P1	A1	Total
American shad	26.58	11.77	29.93	113.44	33.79	32.45	42.77
Alewife	0.56	2.01	10.62	13.96	21.27	104.12	27.26
blueback herring	4.46	3.98	23.57	349.97	243.61	779.84	251.81
hickory shad						0.05	0.01




American Shad 2004 and 2005
Number of Fish per 1000 Cubic Meters
300.00
250.00
200.00
150.00
100.00
50.00
0.00
P5
P4
P3
P2
P1
A1
Site
American shad 05
American shad 04
American shad 04
American shad 05

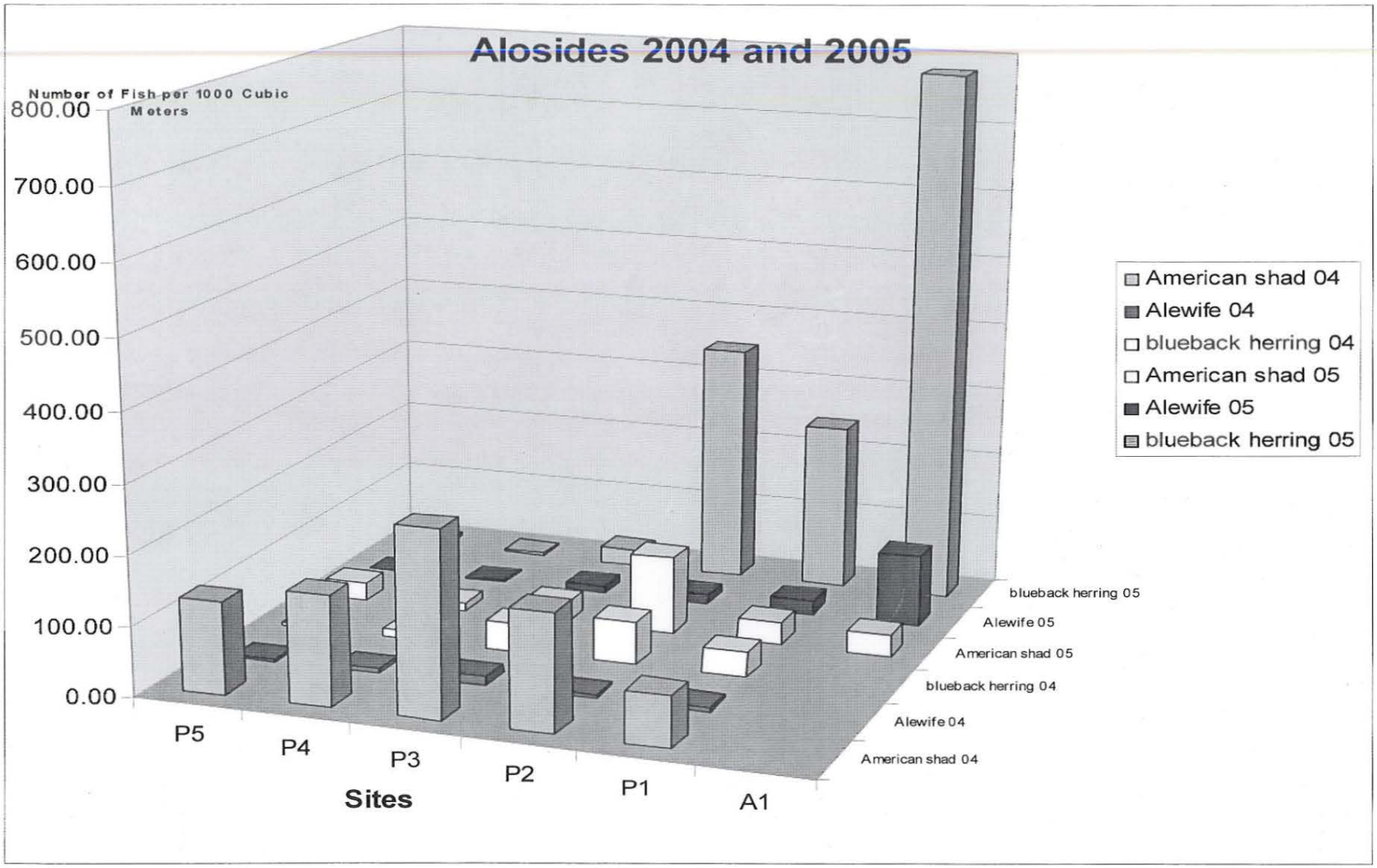

Alosides 2004 and 2005
Number of Fish per 1000 Cubic Meters
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
P5
P4
P3
P2
P1
A1
Sites
American shad 04
Alewife 04
blueback herring 04
American shad 05
Alewife 05
blueback herring 05

Table 5. Species Caught During Gillnetting

April 20, 2005	1st Gillnet
American Shad	2

April 26, 2005	1St Gillnet	2nd Gillnet
American Shad	2	6

April 27, 2005	1st Gillnet	2nd Gillnet	3rd Gillnet
American Shad	1	-	2
Gizzard Shad	13	3	10
Channel Catfish	1	-	-
Blue Catfish	2	1	-
Stripped Bass	-	1	-

April 28, 2005	1st Gillnet	2nd Gillnet
American Shad	2	6
Gizzard Shad	-	15
Channel Catfish	1	-
Blue Catfish	-	6
Stripped Bass	-	1

May 10, 2005	1st Gillnet	2nd Gillnet	3rd Gillnet
American Shad	3	-	-
Gizzard Shad	7	23	18
Channel Catfish	-	1	2
Blue Catfish	1	-	-
Carp	-	1	-