DRAFT

PASQUOTANK RIVER BASIN REGIONAL COUNCIL

Soundview Restaurant
HWY 64 at the HWY 32/37 bridge
Roper, NC

February 4, 1999
4:00 pm

AGENDA

4:00	Call to Order & Welcome	Erie Haste, Jr. Chairman
4:05	Introductions	ALL
4:10	Acceptance of Minutes from Joint Meeting with Chowan Regional Council on July 23, 1998 in Winton	Chairman Haste
4:20	Developing A Demonstration Project: 1- "Let's Review Our Program of Work" 2- Discuss Project Proposal Criteria	Guy Stefanski APNEP Staff
4:35	Organizational Considerations - Regional Council Vacancies - Election of New Officers	Joan Giordano APNEP Staff
4:50	Herring Fishery: Status Report	Harrell Johnson Division of Marine Fisheries
5:15	Status of Shellfish Habitat in the Pasquotank Basin	Craig Hardy Division of Marine Fisheries
5:40	New Business: 1- Coordinating Council Meeting on 1/15 2- Plans for next meeting (develop agenda items)	Chairman Haste
5:50	Public comment	
6:00	Adjourn	Chairman Haste

PASQUOTANK RIVER BASIN REGIONAL COUNCIL

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MINUTES

The meeting was called to order by the Chairman, Erie Haste, Jr. He welcomed the group and asked that self-introductions be made. See Attachment A for attendance. He then asked for acceptance of the minutes from the July 23rd meeting held in Winton. During discussion of the minutes, Yates Barber asked whether a letter, expressing the concerns of the Chowan (CRBRC) and Pasquotank Regional Councils (PRBRC) relative to recommending that an Environmental Impact Study (EIS) pertaining to the Nucor Plant siting in Hertford Co. be done, had been sent to the appropriate persons in Raleigh. Joan Giordano replied that the concerns enumerated by both those Regional Councils (RC), and the EIS recommendation which occurred by motion of them both, were handed in person, to the people for whom they were intended within 1 week of being passed. She and Guy Stefanski added that those recommendations were well received and created quite a bit of interest at the Department level. Joan added that the Environmental Assessment (EA) document had been completed and a copy was available at her office. Concern was expressed for the opportunity to respond to the document. Yates Barber made a motion to accept the minutes and it was seconded by Carl Parrott. Motion carried.

The next agenda item concerned the necessary guidelines for submitting demonstration project proposals. Guy Stefanski began with an overview of the Program of Work prepared by the PRBRC in April, 1998. (See Attachment B.) He also distributed a handout containing guidance for submitting proposals as well as sample proposals done by the Tampa Bay National Estuary Program in Florida. (See Attachments C.1, C.2,C.3 & C.4) Discussion ensued resulting in the decision to name members to a demonstration project ad hoc committee at the next meeting, the rationale being that (some) existing RC vacancies will be filled at that time and a bigger pool of participants will be available.

The group decided the next meeting date would be April 8, 1999, at Sentell's Restaurant in Columbia, beginning at 4:00pm. Sentell's Restaurant is on Hwy. 64 just outside of town. If you are coming from the east, go through Columbia and continue for about 1 mile, looking for signs for the restaurant When coming from the west, the restaurant's location is before you get to Columbia. **A map to the restaurant is included with this mailing.**

Paul O'Neal suggested that each PRBRC member go to their respective county and make them aware of the availability of demonstration project money, while asking them for their help in determining ideas for projects. He thought county planning depts. might be a good place to start. He will approach Jack Simoneau, Currituck Co. planner, about coming to our next meeting to discuss possibilities with us. Chairman Haste asked that this be included in the minutes.

The group then shared several ideas for potential projects. Among them were the (installation) re-utilization of a fish ladder at Lake Phelps; snagging and cleaning creeks; adding culverts to creeks; and stocking creeks. Chairman Haste acknowledged the exchange of ideas as being most useful and asked staff to come to the next meeting with draft proposals (pertaining to these ideas) in-hand. Guy Stefanski emphasized the need for RC members to initiate demonstration project ideas and draft idea development, rather than staff. He explained that as a condition of NC's Albemarle-Pamlico National Estuary Program (APNEP) grant from the EPA, EPA is interested in seeing "grass roots" public involvement. He added that the momentum for addressing and correcting environmental issues and concerns should come from the citizens and local government.

Chairman Haste recommended that as other basin projects are brought to light through RC interaction and liaison, the PRBRC would be well advised to invite those project participants to address our group and enlighten us to their efforts. Depending upon the nature of the projects, and the pleasure of the PRBRC, we could potentially join with them, contribute our expertise and 26K grant money, and become partners. Harrell Johnson, NC Div. of Marine Fisheries, apprised the group of some work that Dr. Maury Powers (ECSU) was doing relative to water quality research. Chairman Haste requested staff to invite Dr. Powers to the next PRBRC meeting to hear the details of his work, with the ultimate goal of possible partnering. He further requested RC members to contact Joan Giordano with any other names of potential partners.

The group was also reminded that Asst. Secretary for the Environment, Bill Holman, at the last Coordinating Council meeting, acknowledged DENR's cooperation in assisting the RCs with the refinement (or in certain cases) the "fleshing out" of portions of their project proposals, if needed.

The next agenda item pertained to organizational considerations: Regional Council Vacancies and the Election of New Officers. Joan Giordano reported that the letters regarding local government vacancies on the RCs were done and would be put in the mail the following morning. She added that each Chair of the RCs would receive copies of the letters pertaining to their basin and that the deadline for responses from the Boards of County Commission was March 8th. It is anticipated that this correspondence will rejuvenate RC membership. All 10 of the counties included in the Pasquotank basin received letters asking for a county and/or municipal representative. She refreshed the group to the composition of the RCs stating that the vacancy letters satisfied **only** the local government appointments. In the case of interest-group vacancies, nominations from the RCs, and others, needs to be undertaken. These nominations will then be sent to DENR Secretary Wayne McDevitt for final selection. Chairman Haste asked Mrs. Giordano to include an interest-group nomination form with the minutes so that members would be able to identify and contact potential members. (See Attachment D) The interest-group vacancies include:

Camden Co.	Recreational fishing rep.
Chowan Co.	Soil & Water Conservation District rep.
Dare Co.	At-large rep.
Gates Co.	Silviculture rep.
Perquimans	Conservation rep.

With respect to the election of new officers, Chairman Haste appointed Yates Barber as a nominating committee of one, and asked him to develop a slate of nominees to be presented at the next meeting. RC members wishing to submit a name in nomination for the offices of Chairman, Vice-Chairman or Secretary, are asked to contact Yates Barber, 252/338-3557. **NOTE: Since the meeting, Mr. Barber has put forth a slate of nominees containing 1 candidate for Chairman, that being Erie Haste, Jr. Elections will take place at the next meeting (4/8/99).**

The next order of business was a presentation by Harrell Johnson, NCDMF dealing with the status of the herring fisheries in the Albemarle sound watershed (Pasquotank basin.) (See Attachment E.1, E.2 & E.3)

Following Mr. Johnson's presentation, Craig Hardy also from the NCDMF, gave a presentation on the status of shellfish habitat in the Pasquotank basin. (See Attachment F)

New Business:

Chairman Haste reported on the activity of the last Coordinating Council meeting held in River Bend on January 15, 1999. Highlights included: a presentation on a project being done by Drs. Hans Paerl (UNC-CH) and Joe Ramus (Duke Marine Lab) dealing with the utilization of the state ferry system for purposes of water quality sampling with special emphasis on atmospheric deposition of nitrogen; presentation of a draft MOA with the State of Virginia pertaining to cooperative efforts between our two states with regard to environmental concerns contained in the CCMP; presentation of the draft (and subsequently ratified) demonstration project guidelines; final amendments and ratification of the CC by-laws; and the presentation by Chairs of the Roanoke and Neuse RCs dealing with resolutions their Councils have passed.

During the public comment period Yates Barber drew the group's attention to maps and charts depicting the Pasquotank basin relative to the overall Albemarle-Pamlico Estuarine Study (APES) area. He invited members to avail themselves of copies if they so wished . In another comment Mr. Barber mentioned the current issue (March 1999) of the National Fisherman had a article on the Asian invasion of introduced species such as the Asian Swamp Eel and the European Green Crab. He wished the group to know that these species are real threats (despite their arrival to our area being a long way off) and wanted the group to be aware of their potentially harmful introduction into our waterways. He added that foreign species of plants and animals are carried far from their natural habitats in the ballast of ships.

There being no further business, the meeting was adjourned.

Attachment A

Feb. 4, 1999

PASQUOTANK REGIONAL COUNCIL

Soundview Rest.

	NAME	AFFILIATION	PH. NO.
1.	Guy Stefanski	APNEP Staff	919/733-5083 (585)
2.	Joan Giordano	APNEP Staff	252/946-6481 (269)
3.	Yates Barber	APES/Currituck Co Vol.	252/338-3557
4.	[illegible]	Hertford Co	252-426-521
5.	[illegible]	Dare Co. Local Govt	252-261-2784
6.	[illegible]	Coastal Fisheries	252-796-0294
7.	Carlisle Harrell	Tyrrell Co.	252-796-2781
8.	Harry Leeuwenburgh	Chowan Co.	252-299-2233
9.	S. Paul O'Neal	Currituck Co.	252-453-3011
10.	[illegible]	Washington Co	252-793-5333
11.	Hamel Johnson	NCDMF	252-264-3911
12.	Craig Hardy	N.C. DMF	252-726-7021
13.	Greg Allen	NC DMF	252-473-1512
14.			
15.			

Excuse Annette
2/4/99

Attachment B.

Pasquotank River Basin Regional Council Workshop: Designing a 2-Year Program of Work

April 22, 1998
Elizabeth City, NC

Introduction

The Pasquotank River Basin Regional Council held a workshop on April 22, 1998 in Elizabeth City, NC, to begin to develop a two year program of work for the Council.

At this and earlier sessions, members had identified a number of issues of major concern in this Basin:

- salinity in Currituck Sound
- restoration of fish and wildlife habitats
- need for environmentally sensitive local plans
- non-point source pollution from agriculture and stormwater
- municipal sewage treatment plant problems
- "dead spots" from point source pollution
- impacts of growth on water quality
- excessive deforestation along waterways
- sedimentation and erosion problems
- groundwater depletion and contamination.

They also expressed concern about the level of attention being given to water clean-up efforts by state government; the danger that agriculture would be unfairly singled out for its contributions to pollution problems; the lack of a simple rating system for identifying water quality in rivers; the need to set the record straight with regard to water quality in Elizabeth City; and the need for better public education on the subject of pfisteria and other water quality related issues.

After considerable discussion, taking into account where they think there is the greatest opportunity to generate public interest and partnerships, the Council agreed on a work program that includes:

1. a high profile basinwide clean-up event
2. selected pilot projects in basin sub-areas
3. broad policy issues to pursue in partnership with others
4. organizational issues.

The following is a summary of the first round of discussion on this two year program of work.

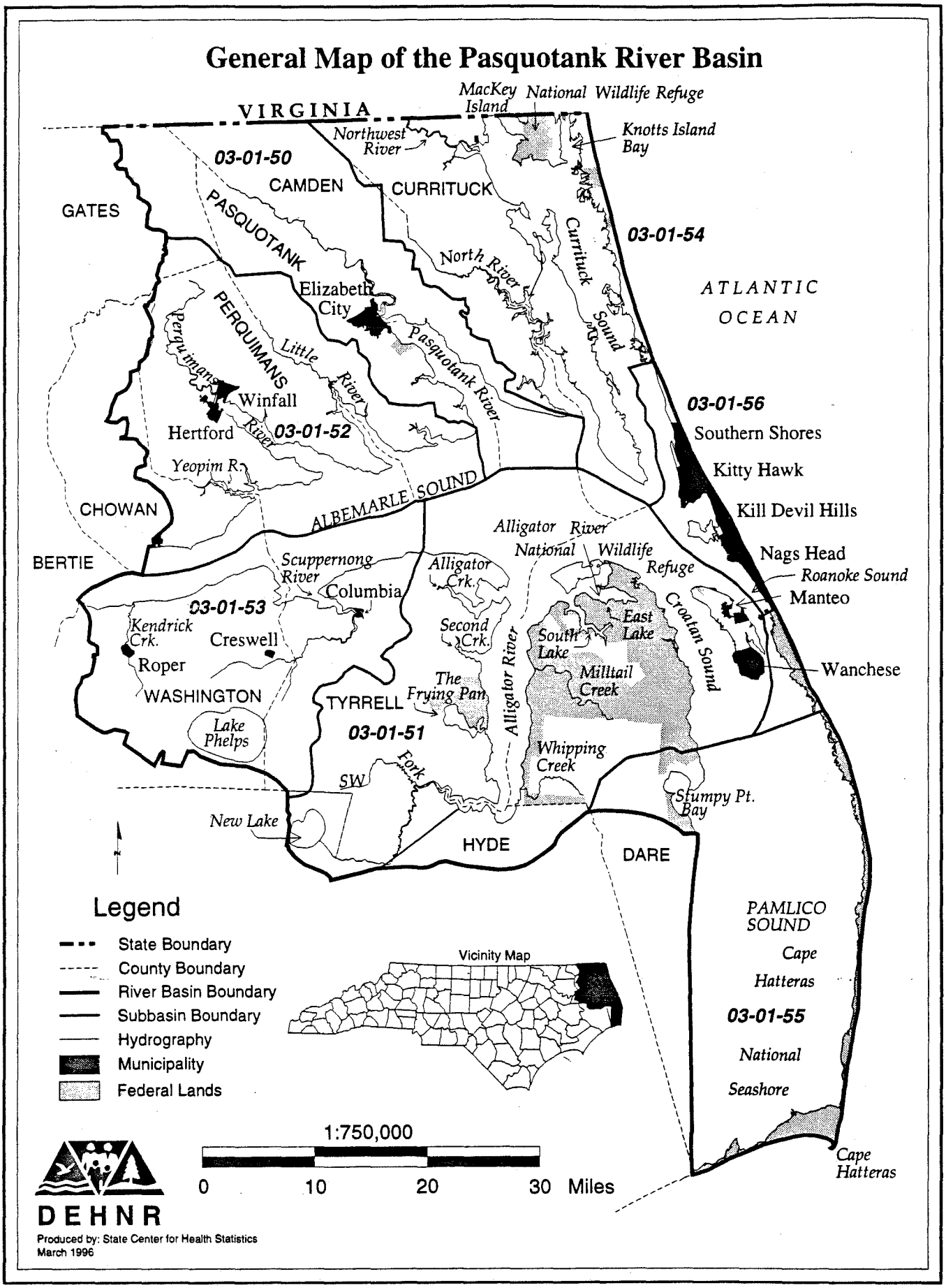


Figure 1. General Map of the Pasquotank River Basin in North Carolina

2-Year Program of Work

1. Basinwide Clean-up Event

Council members believe it is essential to raise public awareness and get people involved in protecting water quality in the region. For this reason, they decided to undertake a high profile activity that will focus on the importance of healthy rivers and sounds to the quality of life in the area. Specifically, they propose to sponsor (or co-sponsor) a basinwide clean-up day to get trash out of tributaries and the sound. They will seek multiple partners and wide-spread publicity for the event. The event could be used to focus attention on a variety of stewardship efforts in the Basin, and the need for everyone to be involved. If successful, it could become an annual event.

Timeframe and Implementation

Over the next two months, Council members and staff will contact the organizers of "Big Sweep", the large coastal clean-up day that already takes place, explore partnership opportunities, and bring a report back to the full Council. At that time, the Council will decide whether to try to piggy-back and expand on "Big Sweep", or select a separate time and approach for a clean-up event to be held in the coming year.

2. Sub-area Demonstration Projects

The Council identified the following process for selecting and implementing a series of pilot projects in different parts of the Basin over the next 2 years.

Step 1: Identify potential action areas. The Council identified the following four objectives they have an interest in pursuing through pilot projects over the next two years.

> **a. Maintain desirable levels of salinity in Currituck Sound.** Salinity in the Sound varies with winds and tides. Salinity levels have a major effect on the quality of the sound as a habitat for various fish, plants, and water fowl. There is concern that salinity levels are changing in ways outside normal natural fluctuation, but there is not full understanding or agreement on this. The Council does not know what data are available or how much monitoring is being done. Council members believe it is important to clarify what is happening with regard to salinity in the Sound, what kinds of problems this creates in terms of water quality and habitat preservation, and what kinds of management goals and strategies exist or are needed.
>
> **b. Improve water quality in tributaries.** Council members are aware of serious deterioration in water quality in certain tributaries in the

Basin. Fish have disappeared, and there is discoloration and debris in the water. The Council is interested in having a clearer understanding orfwhich tributaries and creeks are the most deteriorated, and what is or might be done to begin to reverse these trends.

c. Restore shellfish habitat. Decline and closure of shellfish beds is a major concern of citizens in the coastal areas of the Pasquotank Basin. It is one of the most visible manifestations of habitat degradation in the region. Council members are interested in knowing more about the status of shellfish habitats in the basin and what is or might be done to restore some of these areas to productive use.

d. Reduce groundwater/surface water contamination from septic systems. Council members are concerned that failing septic systems present a growing water quality problem in the Basin. They believe it may be a significant source of nonpoint source pollution. The Council is interested in getting a better understanding of how much of a threat this poses, where the state stands on the use of alternative technologies, and what the Council might do on its own or working with other River Basin Councils to address this concern.

Step 2: Scoping and Identification of Potential Solutions and Projects. Because the Council believes they need further information before pursuing specific projects, they agreed to undertake a scoping process on each of these potential action areas.

Specific questions the Council would like to pursue through presentations and discussions include:

- what kind of background information is available documenting the problem?
- what kind of monitoring or other data exist?
- who else is involved in working on this issue and what are they doing?
- how effective are current management programs and enforcement?
- how big a problem is this and is it a promising area for the Council to pursue at this time?

Staff were asked to identify and invite key resource people who could provide brief presentations and respond to questions on these topics. Council members will attempt to learn what is being done by local governments or organizations to address any of these issues, review local plans and perhaps invite some local presenters.

Step 3: Identify potential solutions and demonstration projects. Once these briefings and discussions have been completed, the Council will select one or more of these action areas to focus on. Specific actions they may undertake include:

- serving as a catalyst for selected demonstration projects
- seeking a variety of types of funding to support initiatives
- undertaking public education initiatives and local action days
- forging a broad range of partnerships.

In making their selections, the Council will be looking for those action areas and projects which they believe offer the greatest opportunities for water quality improvements, public education and involvement, and partnership development throughout the Basin.

Timeframe and Implementation

Identification of potential action areas (step 1) was completed at this workshop. The schedule for the scoping process and selection of pilot projects (steps 2 and 3) is:

June 1998 meeting:	Scoping of salinity levels in the sound and tributary clean-up
July 1998 meeting:	Scoping of shellfish restoration and septic systems/ groundwater protection
August 1998 meeting:	Briefings on funding and local partnership possibilities, including the Clean Water Management Trust fund, and selection of focus areas and pilot projects.

Once the scoping and selection process is complete, the Council will focus on recruiting partners and implementing pilot projects (step 4).

3. Policy Issues

In addition to the specific initiatives the Council will pursue within the basin, they identified several policy issues they intend to bring to the attention of the CCMP Coordinating Council and the state.

- **Need to keep Oregon Inlet open.** The Council wants to be sure the state shares their concern about the need to keep the inlet open, recognizing that both natural and man-made forces affect this.

- **Need for a consistent definition of wetlands.** The Council believes the lack of a clear, consistent and reasonable definition of what is a wetland

makes planning and permitting difficult and poses hardships for property owners.

• **Need to understand and address acid rain problems.** The Council believes the state needs to look at and help them understand the implications of acid rain for water quality in the region.

• **Need to direct Clean Water Management Trust Fund dollars to CCMP Implementation.** The Council believes the Coordinating Council and the state should work to direct some portion of Trust Fund dollars to the River Basin Initiatives.

• **Need for educational initiatives across river basins.** The Council believes the Coordinating Council should help develop some broad public awareness initiatives that incorporate all of the APES River Basins.

4. Organizational Issues

The Council agreed they need to meet monthly over the next few months as they select their specific action initiatives. Once specific workplan initiatives have been selected they will be able to design and structure a meeting schedule and work teams to carry them out.

Attachment C.2

ACTION PLAN DEMONSTRATION PROJECT
TAMPA BAY NATIONAL ESTUARY PROGRAM

Alafia River Oyster Bar Restoration

INTRODUCTION

Oyster bars are important natural communities which provide food, filter water and create habitat structure for many important fish and wildlife species. Historic dredge and fill activities and declining water quality have impacted oyster reefs throughout Tampa Bay. This project will initiate a program to place clean oyster shell along the south side of the Alafia River channel. Clean oyster shell is relatively inexpensive and will need to be carefully placed along portions of the Alafia Channel where submerged aquatic vegetation does not exist and the sediments will support the clutch material. Placement of the clean oyster material will be accomplished by barge with trained supervision.

Oyster communities provide a valuable food source for many important wildlife species such as redfish (*Sciaenops ocellatus*) as a targeted recreational fishery and the American oystercatcher (*Haematopus palliatus*) a listed Species of Special Concern in Florida. The oyster reef, once established, will additionally provide a renewed area where the community can fish or birdwatch after restoration of habitat. The project will additionally provide an informational brochure describing the project for distribution at local civic groups and bait shops.

Pinellas and Hillsborough Counties have active artificial reef construction programs. However, oyster bar restoration has not been accomplished in Tampa Bay to date. The Florida Department of Natural Resources will provide technical assistance using experience gained from oyster bar construction projects in the Florida Panhandle. Existing natural oyster communities and observed growth on seawall areas indicate an adequate supply of oyster spat in the area. Construction of oyster communities is expected to greatly enhance water quality and habitats leading to enhanced estuarine productivity.

PROJECT OBJECTIVES

Over the last 100 years, the Tampa Bay estuarine system has lost a significant portion of its natural communities to urbanization activities. The project is structured to facilitate replacement of one important natural community back to the bay, thereby enhancing the resource that are dependant upon oyster communities. The site will be monitored for three years by the Environmental Protection Commission of Hillsborough County (EPCHC) to determine the success of the project and applicability for other areas in Tampa Bay as well as other estuaries around the country.

The project will include a strong public education element through the creation of a brochure detailing the project and benefits to the Tampa Bay cultural and natural community.

MANAGEMENT OPTIONS

In consideration of the project site, the project participants examined locations where oyster communities once existed and have been removed due to dredge or fill activities. A site was selected based upon its ability to enhance local resources while providing recreational or educational opportunities. Additional consideration was given to proximity with onshore transfer area to expedite loading of barge and placement of shell.

Potential oyster sites were ruled out in areas of unconsolidated or fine sediments to prevent burial of shell material. Natural subtidal areas were eliminated from consideration to prevent unintentional impacts to existing or future seagrass communities or other benthic infauna. Locations where heavy boat traffic or future maintenance dredging is planned were not considered viable locations.

The no action scenario accepts existing conditions, which will not allow improvements to water quality and habitats provided by oyster communities.

SELECTED OPTION

The location at the mouth of the Alafia River was selected since:

1) it historically contained oyster communities prior to channel dredging and spoil disposal for industrial shipping activities at the Alafia River

2) it will provide habitat and food for a variety of species who utilize tributary and estuarine systems

3) the oysters will promote water quality benefits by filtering water entering Tampa Bay from the Alafia River basin

4) it will ease transportation access and transfer to the Alafia River Channel from the Williams Park boat ramp, and

5) the site is located in an area with significant recreational and commercial fishing activity that will benefit from oyster bar development, and

6) the area is adjacent to a significant bird nesting island (Alafia Banks), managed by the National Audubon Society, and characterized as one of the most productive bird nesting sites in the southeastern United States.

The Alafia River location is ideal for a number of important resource based criteria as well as

its availability to transfer oyster shell material for reef construction.

PROJECT SCOPE

The project will be accomplished by the Tampa Bay Regional Planning Council (TBRPC) and the Environmental Protection Commission of Hillsborough County (EPCHC). The TBRPC and EPCHC will design the reef along the south side of the Alafia River and apply for any required permits with the US Army Corps of Engineers, the Florida Department of Environmental Protection and Hillsborough County.

The TBRPC and EPCHC will further make application to the Pollution Recovery Fund administered by the EPCHC for additional project support. The Pollution Recovery Fund was established to restore areas impacted from environmental violations. A portion of the fund is specifically earmarked for projects in and around the Alafia River. Receipt of additional support from the EPCHC Pollution Recovery Fund will greatly expand the size and magnitude of the project.

After receipt of permits the TBRPC will submit an RFP to hauling companies and barge firms to transport and place material in the approved location. Clean oyster shell from local shell mines will be transported to the Williams Park boat ramp and loaded onto a small barge. The barge will transport the shell within one mile to a permitted location on the south side of the Alafia River. The shell will be offloaded along the subtidal fringe of the river creating an oyster attachment site similar to natural communities found in undisturbed locations around Tampa Bay. Placement of the material will be accomplished within marked locations and be supervised by staff from TBRPC and EPCHC. Initial indications are that an oyster reef up to one-acre in size can be constructed along the fringe of the Alafia River channel. Final size will be based upon permitting agency negotiations and transportation costs.

After placement of the material the EPCHC will monitor the site for three years, quarterly the first year after construction and semi-annually for the next two years. Monitoring will be critical to document lessons learned and feasibility for construction of oyster bars in other locations. The TBRPC will document the project after one year in an interim final report as well as prepare the informational brochure to be handed out at the boat ramps, bait shops and civic groups in the area and around Tampa Bay.

The project will not only benefit the immediate area surrounding the mouth of the Alafia River, in terms of enhanced water quality and improved habitats, but also the Tampa Bay estuary and ultimately the Gulf of Mexico, since many recreationally and commercially important species of fish are dependent upon estuaries and low salinity habitats within their life history.

The actual project is expected to be accomplished within one year with monitoring to continue for three years. Design of the project will be accomplished in 30-60 days by TBRPC and EPCHC. Permits will be submitted by TBRPC and reviewed within 90-120 days by the permitting agencies. The RFP process and construction will take 60 days and will be supervised by TBRPC and EPCHC. EPCHC will perform the monitoring, which will be initiated prior to

submittal of the permit applications and continue on a quarterly basis after construction. A final interim report will be prepared by TBRPC after one year to document the project. A final report will be prepared after three years of monitoring to identify program results. The brochure will be developed by the TBRPC after the reef has been constructed.

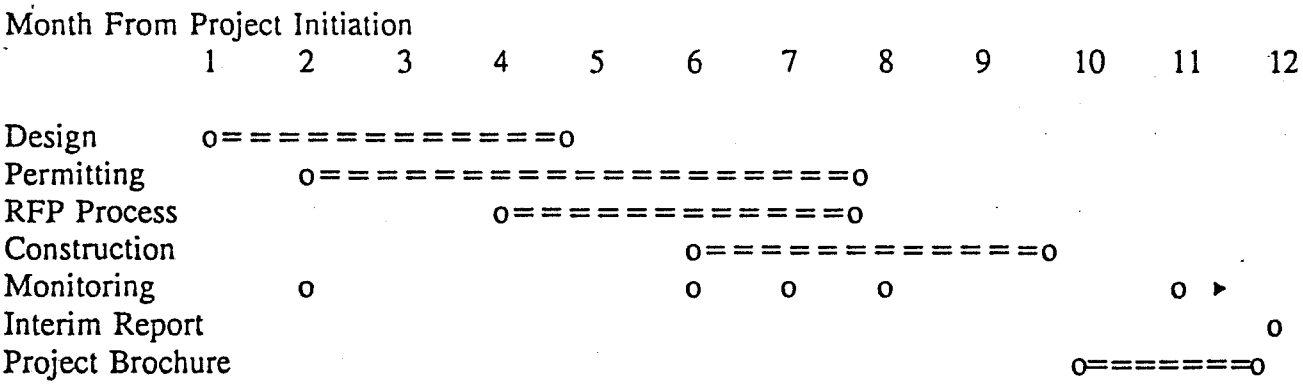
MONITOR

The EPCHC will conduct an initial site evaluation to document existing conditions along the Alafia River to determine acceptable locations for placement of shell material. Staff from EPCHC and/or TBRPC will supervise placement of oyster shell from the selected contractors. After shell placement the EPCHC will describe the area covered by new shell material and area to be monitored. It is expected that the new material will be placed from the mean tide line to depths up to ten feet deep. This will allow establishment of oyster spat over a range of depths to reduce mortalities. After placement, the EPCHC will monitor the project quarterly for the first year and semi-annually for the next two years to determine spat colonization, recruited oyster survival, burial of reef area and level of establishment compared with depth.

An evaluation can be extrapolated on the level of water quality improvements based upon surface area colonized and average filtering rates available in existing literature. Wildlife usage will also be assessed based upon actual sightings and known usage by local species. Results will be documented in an interim report after one year and a final report after three years.

TIMELINE

The project will be accomplished in the following time frame:



The project is designed to be completed in its entirety within a one year time frame. Monitoring will continue for two additional years to document the project and ensure success.

REVIEW

The project will receive oversight review from a design committee that will be established with representatives from the following organizations and areas of interest:

- o TBRPC - project coordination, implementation, public education
- o EPCHC - project coordination, permitting, implementation, monitoring
- o Florida Department of Environmental Protection (FDEP) - permitting, shellfish management
- o Florida Department of Natural Resources - technical assistance, project design
- o Tampa Bay National Estuary Program - project management, technical support
- o Cargill Fertilizer - adjacent terminal facility, support oyster transfer
- o Lewis Environmental Services - technical support
- o National Audubon Society - Alafia Banks bird sanctuary

This committee will review the initial project workscope, support development of the permitting package and assist with expedition of any required permits. The committee will be reconvened after project construction to evaluate the project and identify any additional monitoring that will support the project. The design committee can also support efforts to develop additional funds to expand the project through FDEP Pollution Recovery Trust Funds that are potentially available for restoration efforts in and around the Alafia River. The project can be redirected based on input from the design committee or permit review agencies prior to construction activities. The proposals in response to the RFP will be reviewed by TBNEP and TBRPC staff to ensure compliance with any permits.

APPLICATION

Oyster systems are prevalent in nearshore coastal waters of the United States. The communities are critically important in terms of maintaining natural resource systems and providing commercial products for human consumption. The construction of oyster communities in Tampa Bay has not been accomplished to date. Identification of methods and materials, monitoring of construction and oyster reef development and education of Tampa Bay residents will greatly enhance our understanding and ability to restore estuarine systems. Lessons learned from the Tampa Bay project can and will support oyster systems in other locations around the bay as well as document restoration methods for other estuaries around the country. The development of the Comprehensive Conservation and Management Plan (CCMP) by TBNEP will include methods and financial plans for restoring the Tampa Bay environment. The oyster restoration project will support the CCMP effort to document restoration efforts that not only apply to Tampa Bay but to the nation as well.

DELIVERABLES

- o one or more constructed oyster communities in Tampa Bay
- o final interim report after one year
- o final report after three years to include entire monitoring project
- o program brochure for public distribution

COST ESTIMATES

17,000 total
4,500 shell transport
3,000 barge transport
6,000 TBRPC 2,917 minimum match
4,000 EPCHC 2,917 minimum match

STATEMENT OF WORK

TASK 1. Project Design

Estimated Costs: $3,150
Due Date: 4th month

TASK 2.

Estimated Costs: $5,000
Due Date: 8th month

TASK 3.

Estimated Costs: $2,000
Due Date: 8th month

TASK 4.

Estimated Costs: $7,500
Due Date: 10th month

TASK 5.

Estimated Costs: $4,000
Due Date: 12 month

TASK 6.

Estimated Costs: $534
Due Date: 12th month

Attachment C.3

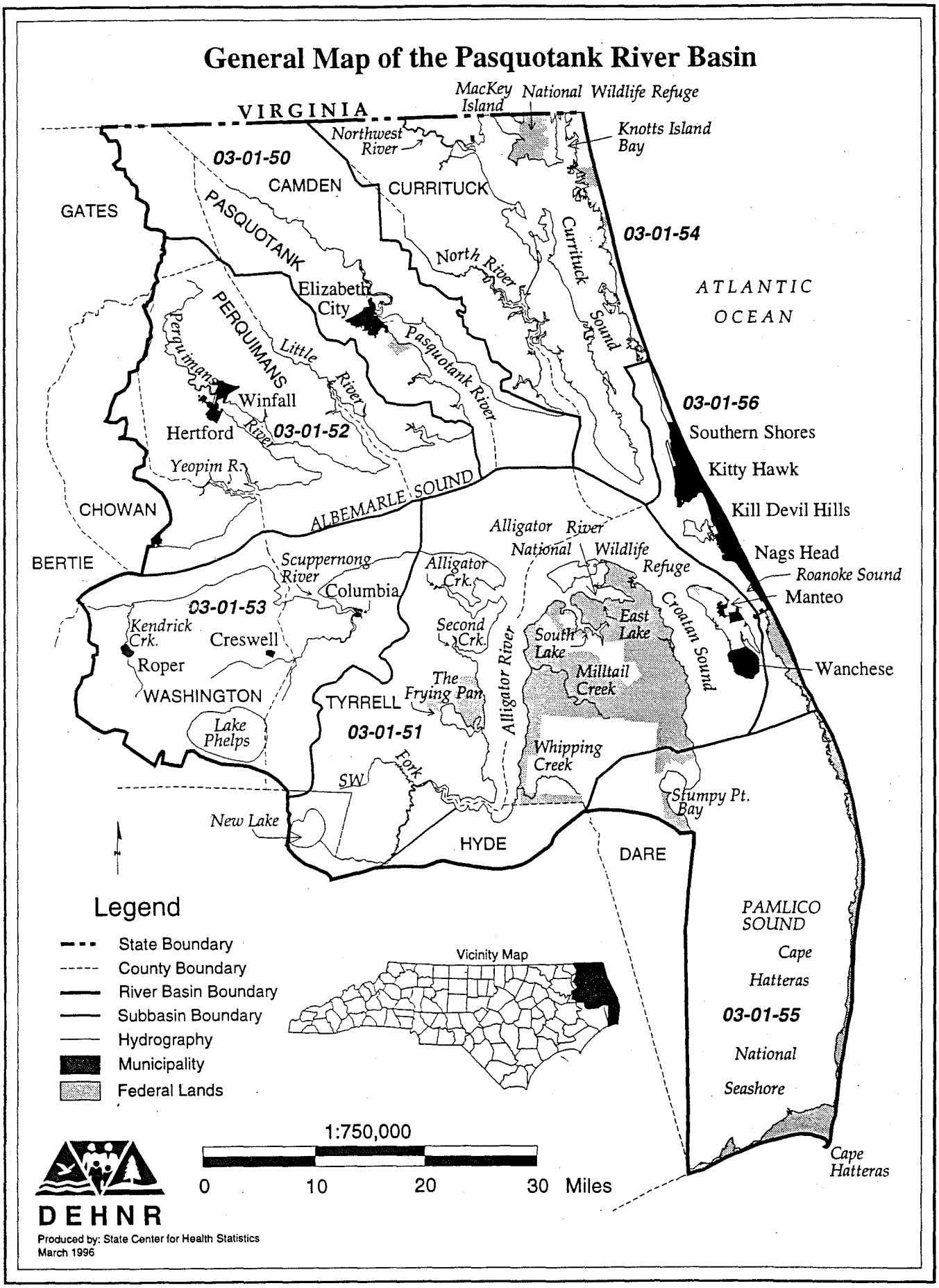
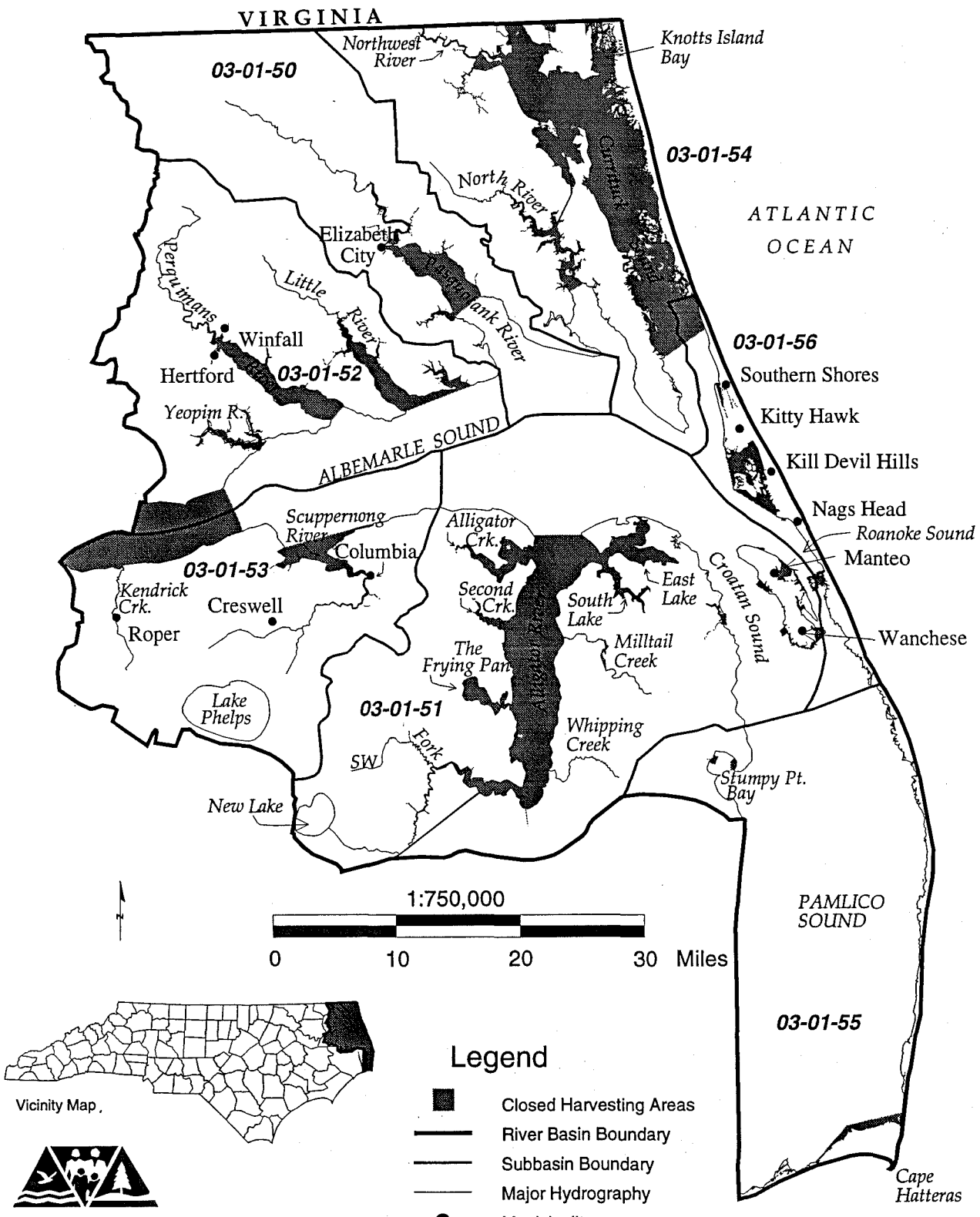


Figure 1. General Map of the Pasquotank River Basin in North Carolina

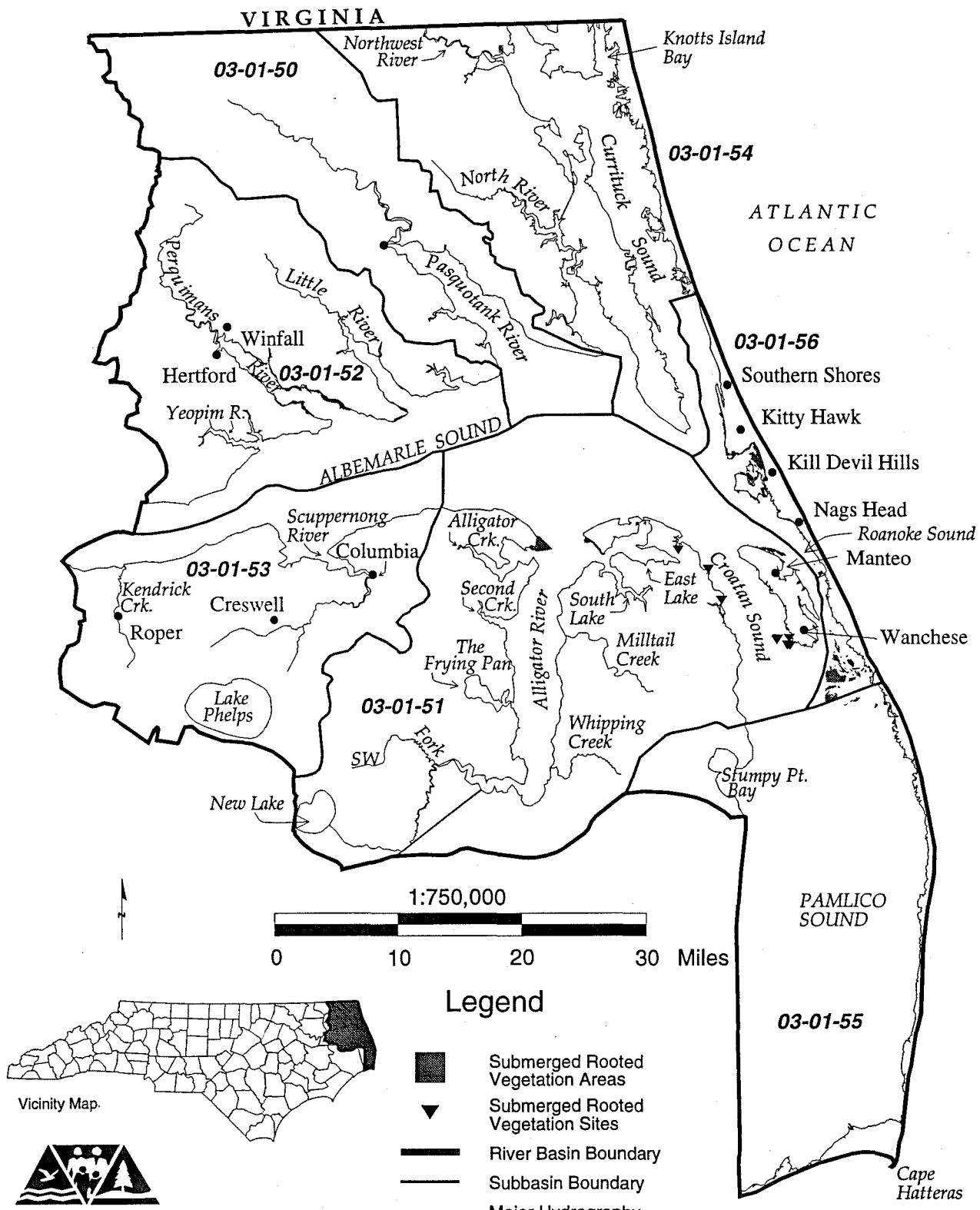
Closed Shellfish Harvesting Areas
Pasquotank River Basin



DEHNR

Produced by: State Center for Health Statistics
March 1996

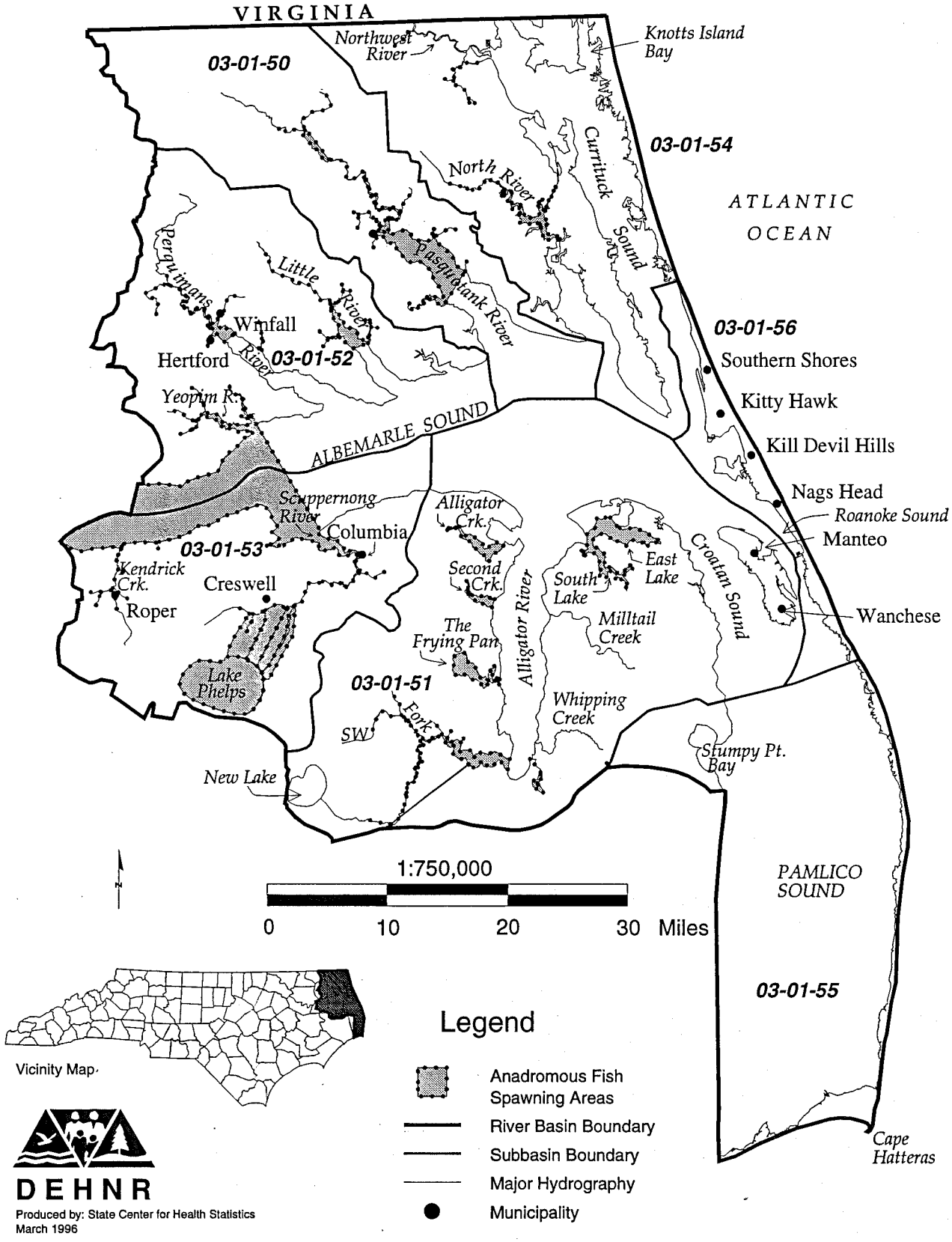
Submerged Rooted Vegetation in the Pasquotank River Basin



DEHNR

Produced by: State Center for Health Statistics
November 1996

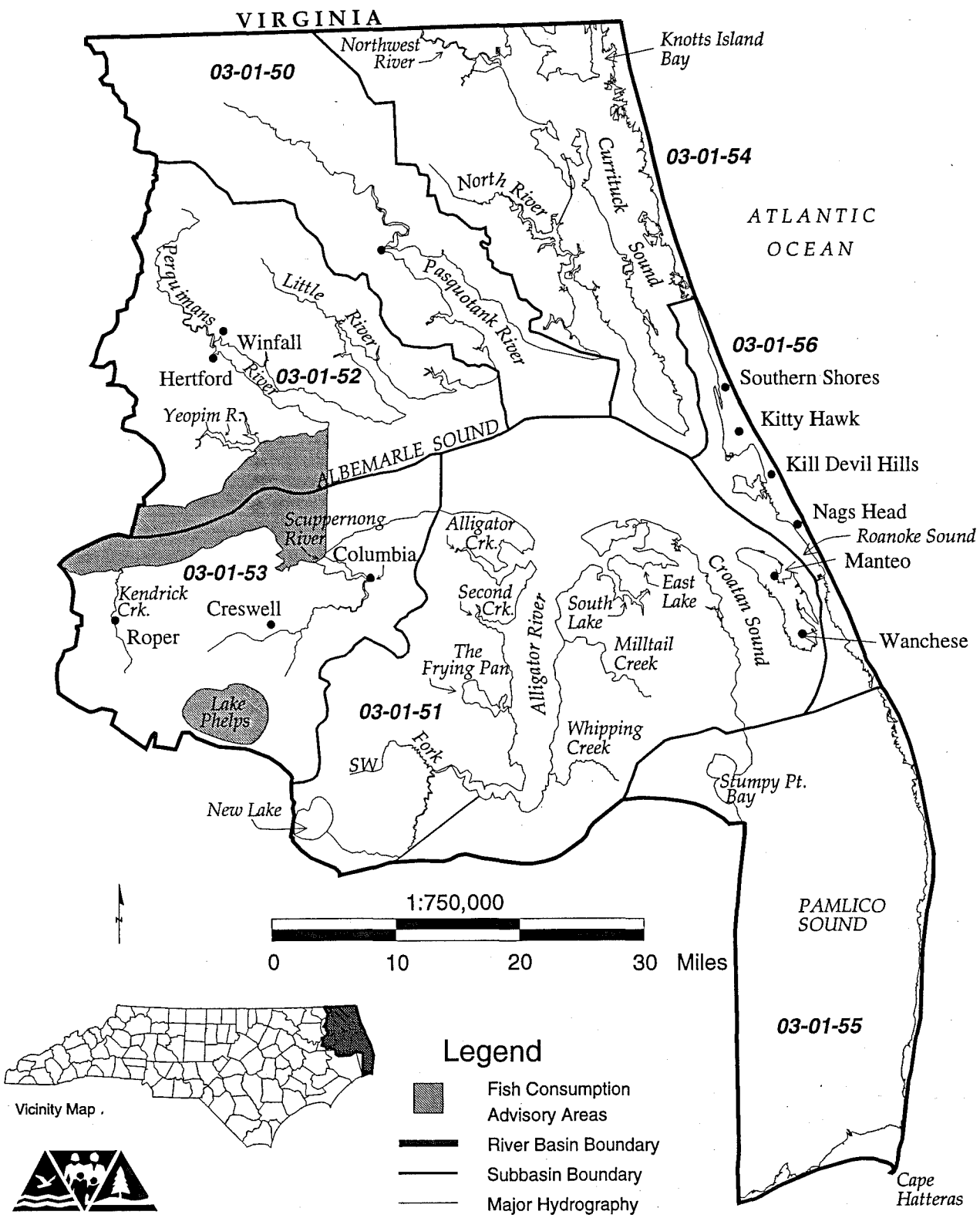
Anadromous Fish Spawning Areas
Pasquotank River Basin



DEHNR

Produced by: State Center for Health Statistics
March 1996

Fish Consumption Advisories in the Pasquotank River Basin



DEHNR

Produced by: State Center for Health Statistics
November 1996

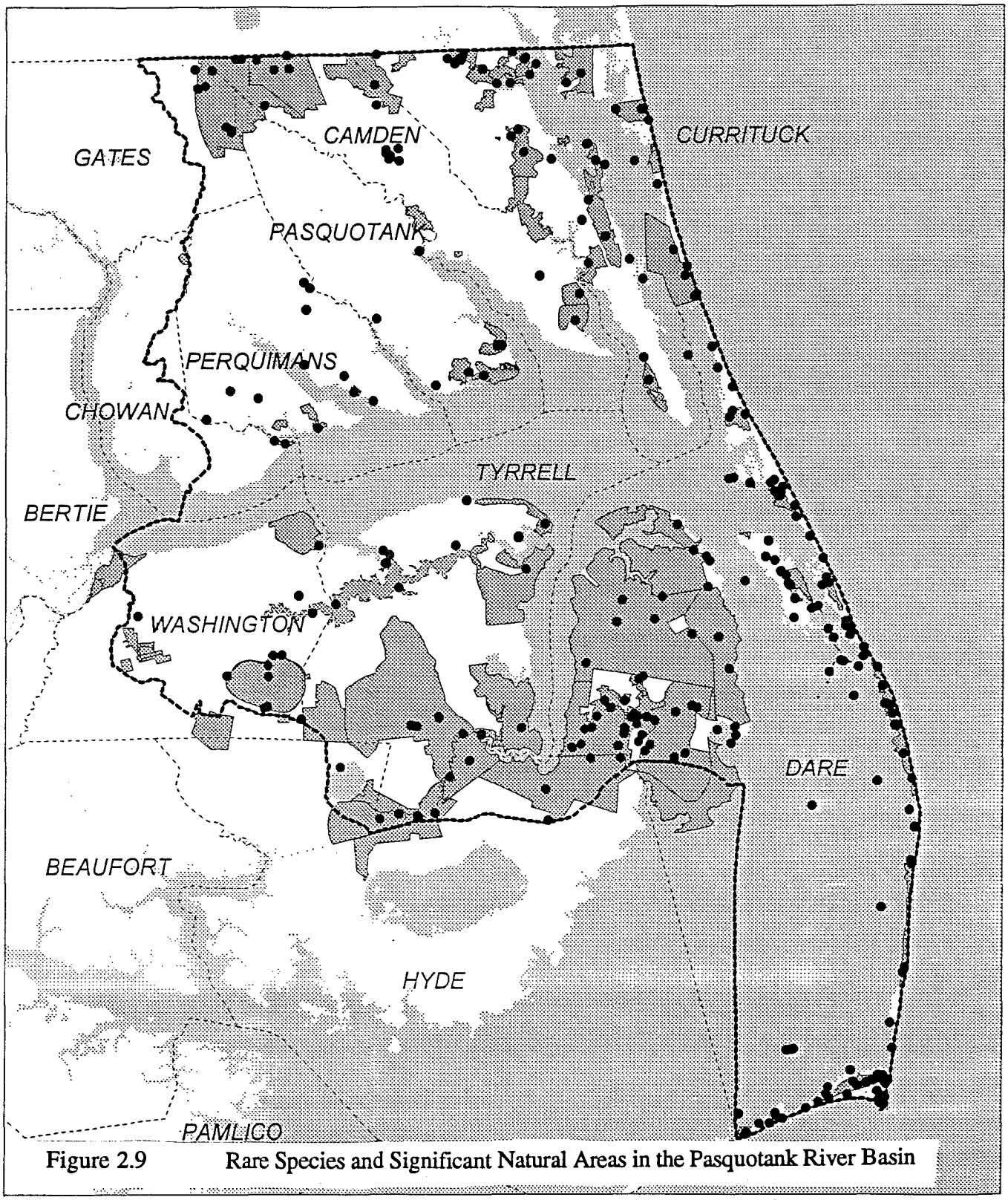


Figure 2.9 Rare Species and Significant Natural Areas in the Pasquotank River Basin

- Rare Species
- Significant Natural Area
- Pasquotank River Basin
- Water
- County Lines

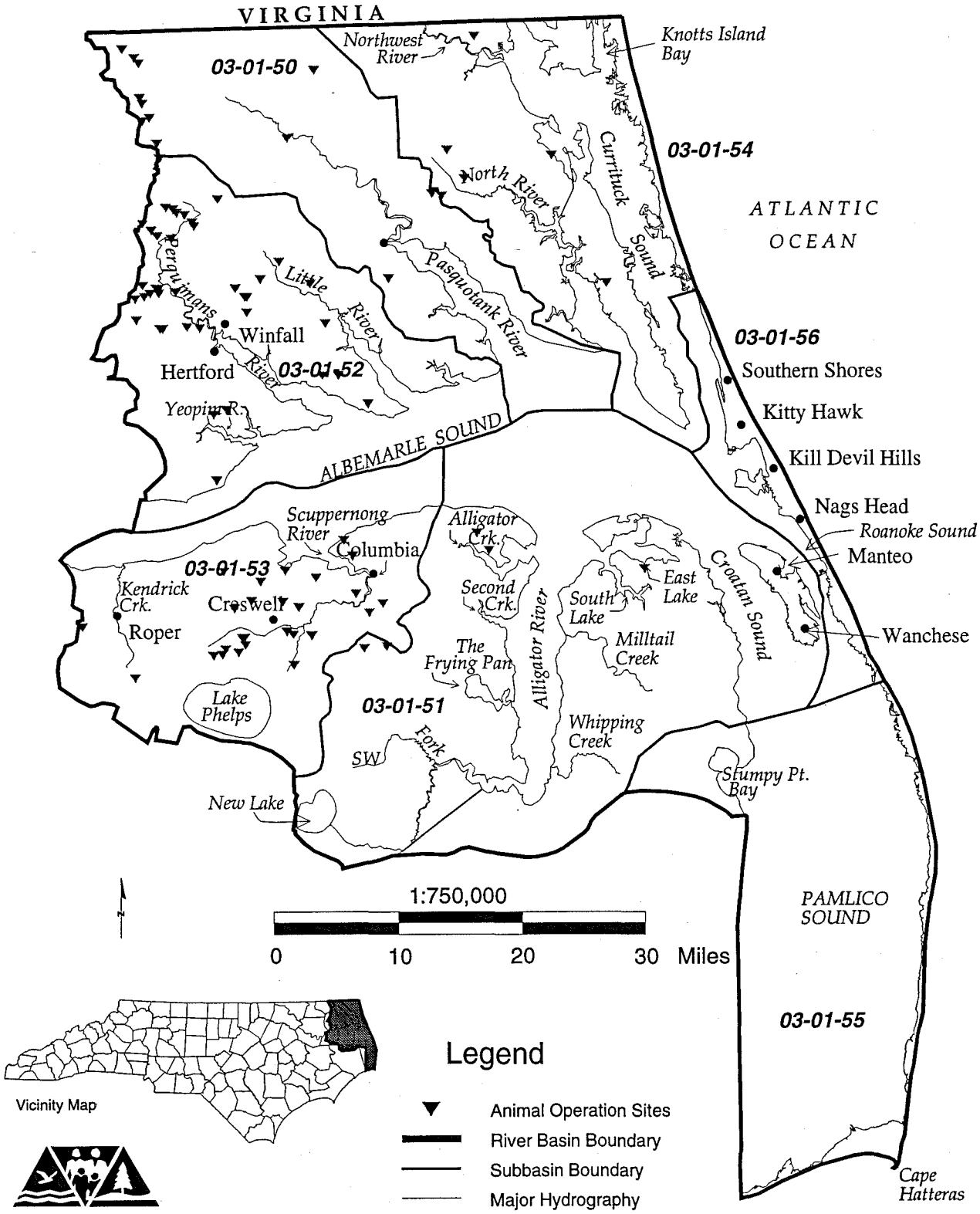
N

0 10 20 Miles

Rare Species and Significant Natural Areas in the Pasquotank River Basin

NC Natural Heritage Program
Division of Parks & Recreation
July 1997

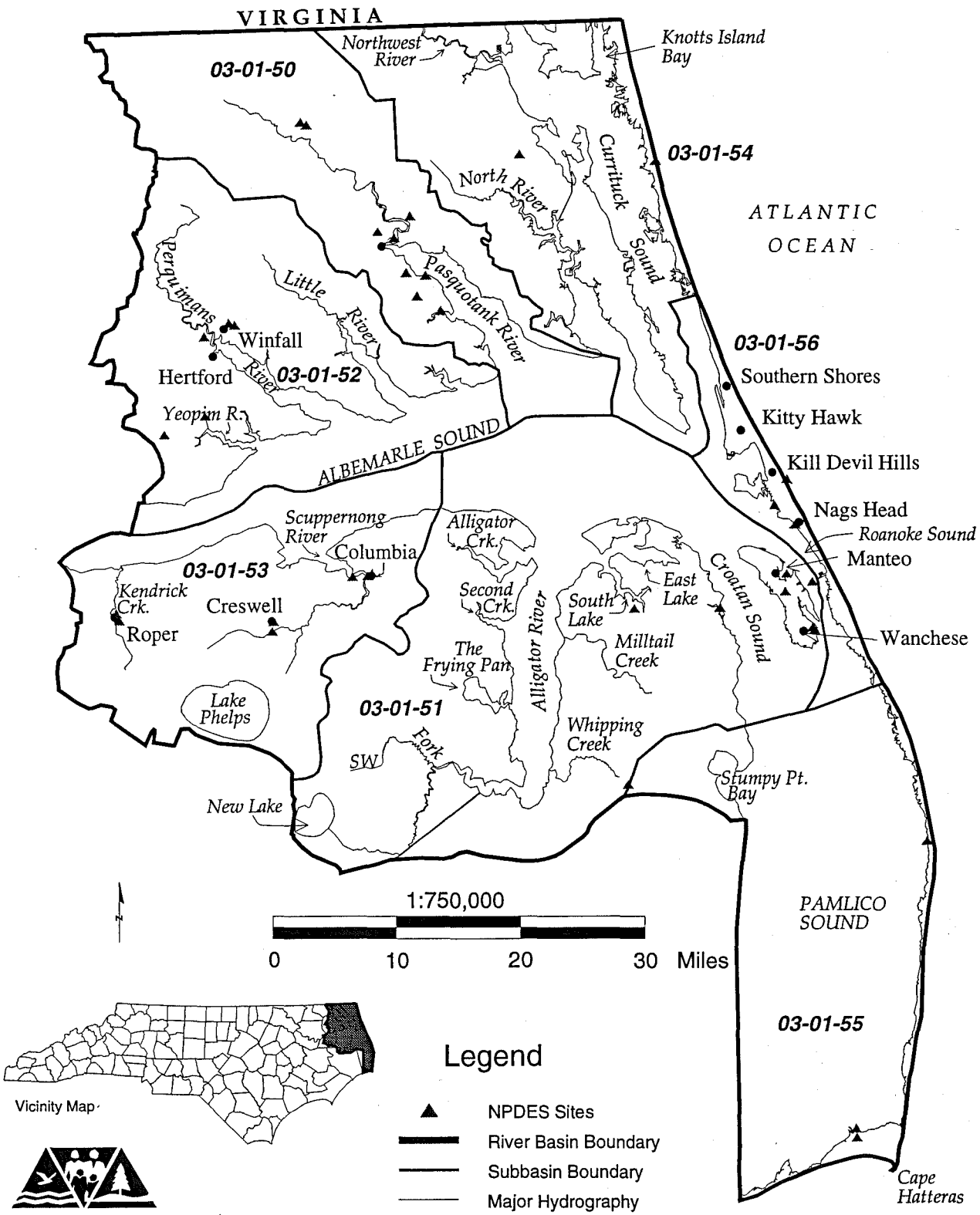
Location of Animal Operations in the Pasquotank River Basin



DEHNR

Produced by: State Center for Health Statistics
November 1996

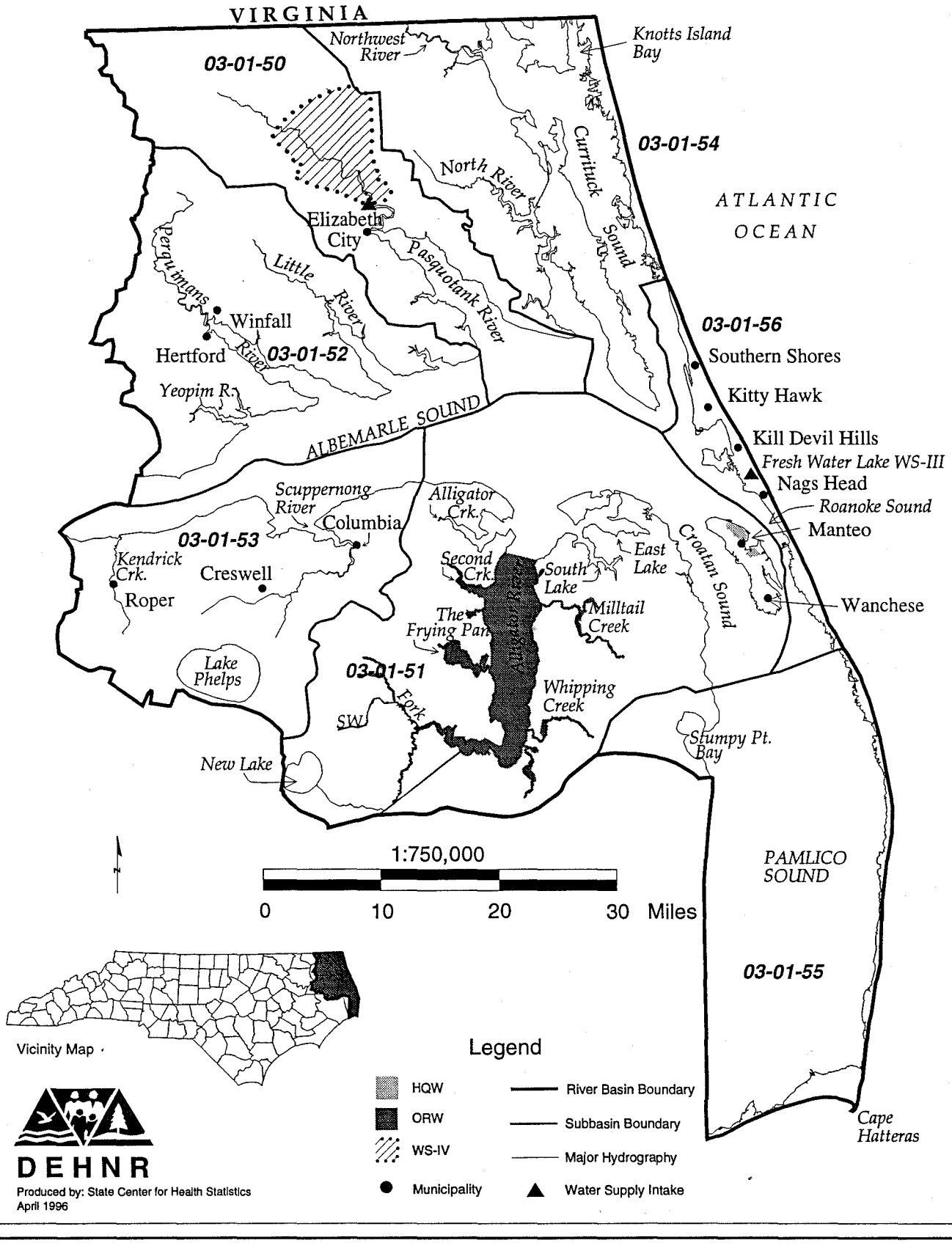
NPDES Permitted Discharges in the Pasquotank River Basin



DEHNR

Produced by: State Center for Health Statistics
November 1996

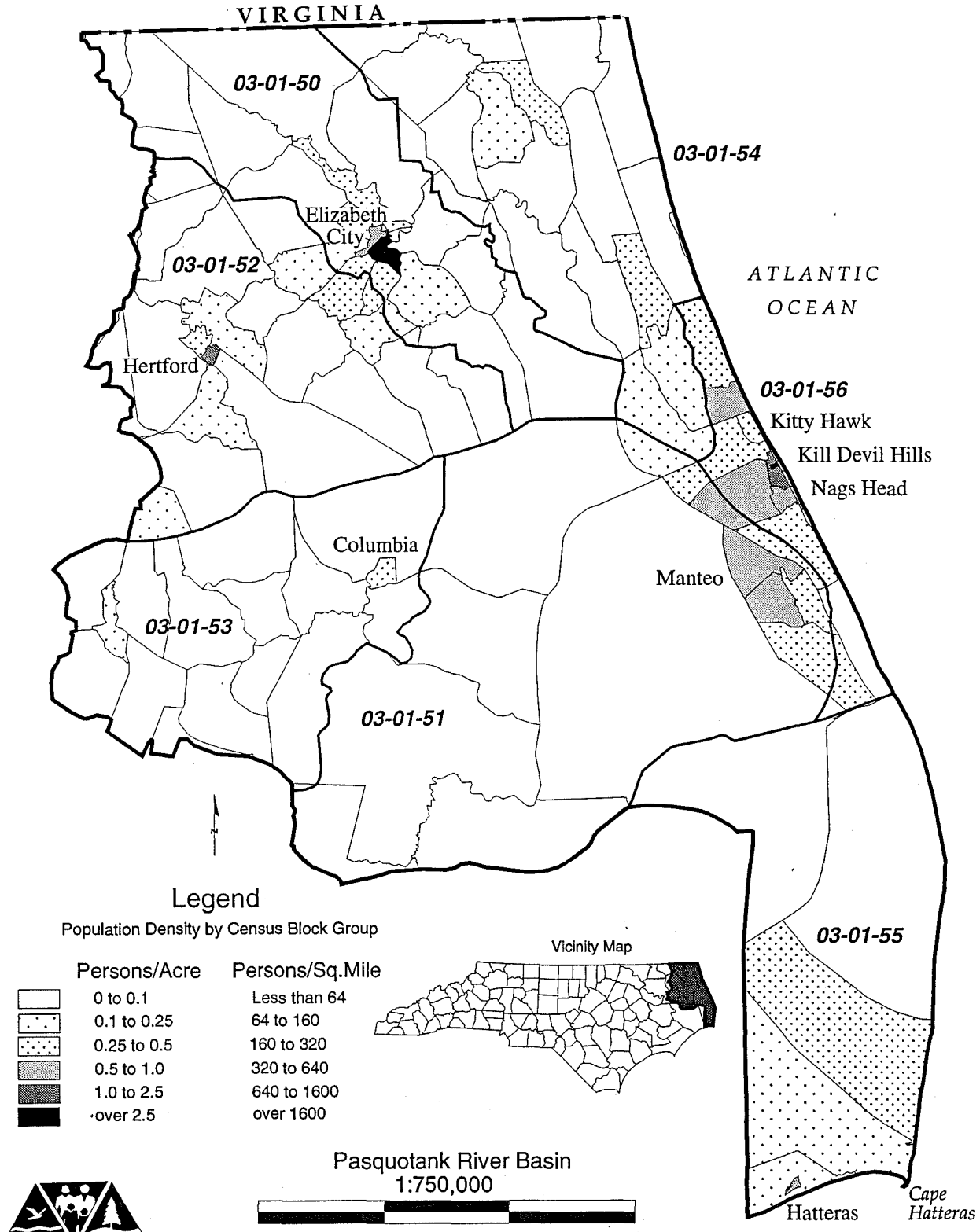
Water Supply Watersheds, Outstanding Resource Waters and High Quality Waters, Pasquotank River Basin



DEHNR

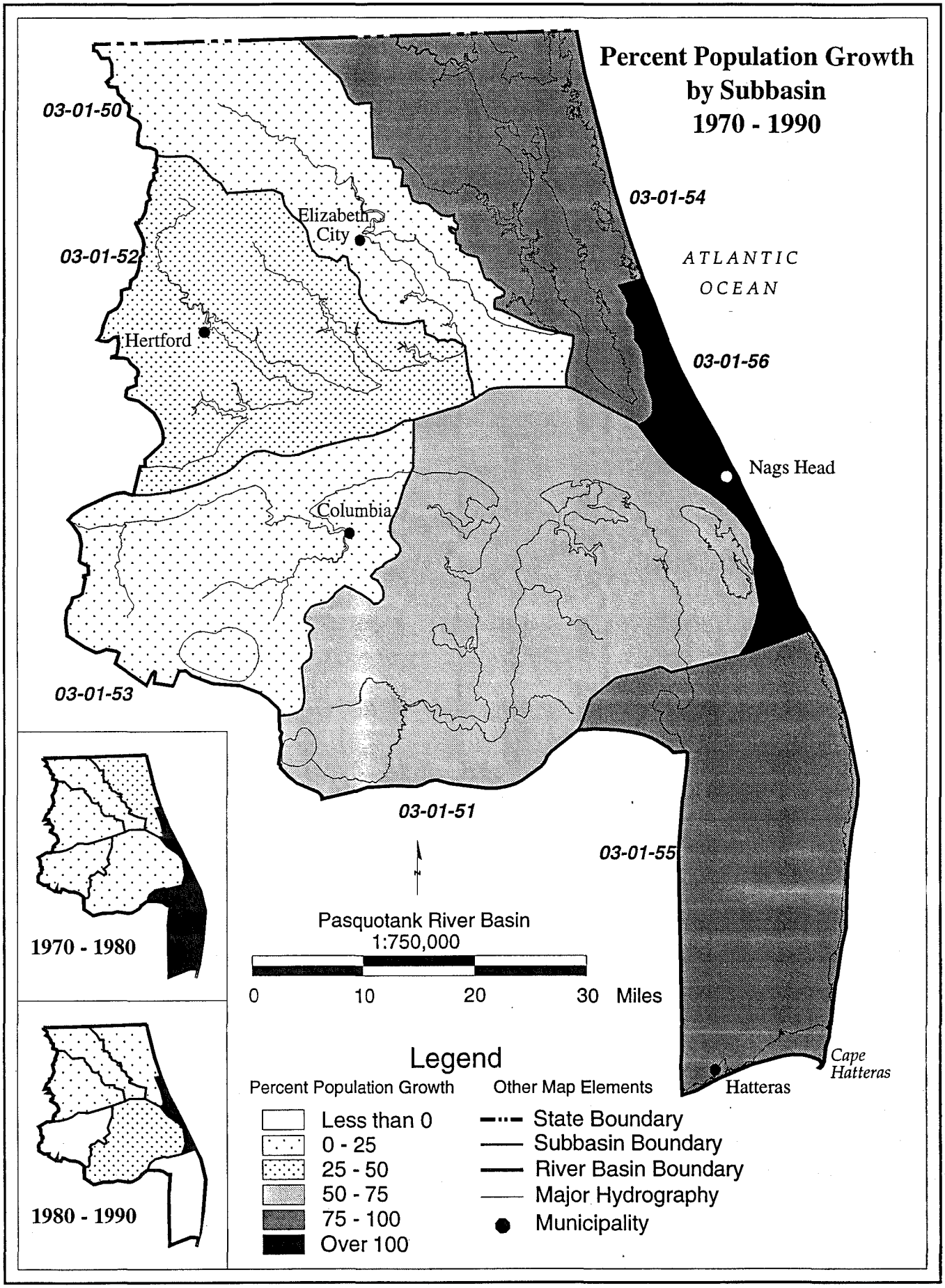
Produced by: State Center for Health Statistics
April 1996

1990 Population Density by Census Block Group
Pasquotank River Basin



DEHNR

Produced by: State Center for Health and Environmental Statistics
July, 1995


Percent Population Growth
by Subbasin
1970 - 1990
03-01-50
03-01-52
03-01-53
03-01-54
03-01-56
03-01-51
03-01-55
Elizabeth City
Hertford
Columbia
Nags Head
ATLANTIC
OCEAN
Cape
Hatteras
1970 - 1980
1980 - 1990
Pasquotank River Basin
1:750,000
0
10
20
30 Miles
Legend
Percent Population Growth
Less than 0
0 - 25
25 - 50
50 - 75
75 - 100
Over 100
Other Map Elements
State Boundary
Subbasin Boundary
River Basin Boundary
Major Hydrography
Municipality

Attachment C.4

January 15, 1999

ALBEMARLE-PAMLICO NATIONAL ESTUARY PROGRAM

DEMONSTRATION PROJECTS

The Comprehensive Conservation and Management Plan (CCMP) of the Albemarle-Pamlico National Estuary Program (A-P NEP) was officially endorsed by the Governor of North Carolina and the U.S. Environmental Protection Agency (EPA) in November 1994. In September 1994, EPA awarded the North Carolina Department of Environment and Natural Resources (DENR) a grant to demonstrate specific recommendations or action items contained in the CCMP. The Division of Water Quality (DWQ) is administering the grant and has oversight of the CCMP implementation process. The EPA grant has been extended to September 30, 1999 and the total amount of the grant is $1,755,363.

As a part of the implementation strategy, the CCMP recommends the establishment of Regional Councils to foster public input from each of the five major river basins in the Albemarle-Pamlico region. Membership to the Councils consists of citizens and local government officials, representing every county and interest group in the region. In March 1995, Governor Hunt issued an Executive Order directing the creation of the Councils. All five Regional Councils have been established and meet on a regular basis.

A primary role of the Regional Councils is to establish local environmental priorities, based on those outlined in the CCMP, Governor Hunt's Coastal Agenda, and the DWQ's basinwide management plan recommendations. In addition, their role extends to developing support for the most cost-effective methods of dealing with those recommendations. Priorities of resource management vary from basin to basin because concerns for water quality, habitats and fisheries are diverse and widespread. The Regional Councils have been encouraged to develop and implement strategies which are most amenable to local action. Funds from the existing EPA grant have been dedicated to help support local demonstration projects recommended by the Regional Councils. Total funds available for demonstration projects are approximately $130,400. Individual projects approved for funding are eligible to receive a total of $26,080 for a single watershed and $52,160 for a combined watershed project.

Demonstration projects are scaled-down versions of innovative or unique engineering or management strategies that are designed to test the cost and effectiveness of these actions in addressing priority problems in a particular watershed. These projects also aid in defining the time and resources required for basinwide implementation. Demonstrations may include engineering projects, model ordinances, improved management of living resources, and modifications to remove institutional barriers to achieving progress on priority problems.

In order to be eligible for funding, proposed demonstration projects must address a priority problem identified in the CCMP and involve the demonstration of specific management or engineering strategies (not planning or assessment activities). Each Regional Council may submit its own demonstration project proposal or work with another Council(s) with similar problems and submit a combined proposal. Proposals should include all the required information outlined in the "Criteria for Selection of Demonstration Projects" and the "Demonstration Project Checklist".

Regional Councils are tasked with the solicitation, review, ranking, and selection of projects to be funded. In addition, Regional Councils are strongly encouraged to utilize an existing and approved system or process to evaluate project applications. One example is the evaluation system used by the Clean Water Management Trust Fund in its review of proposals. The Coordinating Council must approve all projects selected for funding.

Albemarle-Pamlico National Estuary Program
Regional Councils

Criteria for Selection of Demonstration Projects

Preparing a Demonstration Project Proposal

A demonstration project is a scaled-down version of an innovative or unique engineering or management strategy. The project proposal should call for immediate action. Available funding will not pay for planning, but is strictly intended for implementation of specific management or engineering strategies (shovel in the ground type projects). These projects are being funded to demonstrate the process of implementation and the effectiveness of a specific control strategy prior to basinwide or regional application. The demonstration project proposals submitted to the Coordinating Council for funding should discuss each of the components described in the Demonstration Project Checklist. It is important that each of the components be addressed under its own section in the proposal. Use of the checklist will ensure that the proposal is complete.

Selection Criteria

Regional Councils convened under Governor Hunt's Executive Order #75 (as amended #118) are eligible to receive funds from the existing U.S. Environmental Protection Agency grant to support local demonstration projects. In selecting demonstration projects, proposals will be reviewed according to and funds provided based on the following criteria:

1. Projects must address a priority problem in the estuary or its watershed as identified in the Comprehensive Conservation and Management Plan (CCMP), Governor Hunt's Coastal Agenda, or a basinwide management plan approved by the North Carolina Department of Environment and Natural Resources.

2. Proposals should demonstrate that the problem identified for action has been adequately characterized and evaluated and show that the cause(s) of the problem have been adequately assessed.

3. A majority of the members of the Regional Council(s) should support the project(s) recommended for funding. The proposal must be signed by the chair(s) or co-chair(s) of the Council(s).

4. Proposals should establish the commitment to action made by the respective local government entity, other agencies and/or educational institutions and the private sector. Commitment to ensuring regulatory, administrative, financial, and political cooperation that would enhance project success would be beneficial.

5. Proposals should establish that the opportunities and likelihood for success and improvements in environmental quality are good.

6. Proposals must accurately and thoroughly address all required components, as described in the Proposal Checklist.

7. Demonstration of innovative techniques or approaches which can be transferred throughout the watershed or other watersheds in the region will improve chances of selection or approval.

8. Proposals must guarantee that the project will include the development of cost estimates for full-scale application of the strategy throughout the watershed.

9. The proposal should describe appropriate public education and outreach methods to reach constituents and stakeholders throughout the watershed/region.

Albemarle-Pamlico National Estuary Program - Regional Councils
Demonstration Project - Proposal Checklist

____ 1. Discussion of the priority problem, identifying the probable causes and resource uses affected.

____ 2. Statement of the specific objectives of the project related to the problem, source, or cause.

____ 3. Discussion of the various management options considered.

____ 4. Discussion of the chosen option with reference to likelihood of success, public support, and time and resources (cost effectiveness).

____ 5. A complete outline of the specific plan needed to abate and control the problem or protect the resource. Each outline should address:

What: Describe specific environmental objectives and related measures of success and what will be done to attain them. For example, specify nutrient load reductions and use designations in the proposed location.

Who: Identify who will act, plan, and enforce; spell out roles and resource commitments for each participating agency, institution, or other entity.

How: Outline the procedure/process used to perform this project.

Where: Describe the location this project will affect.

When: Include schedules.

Budget: Provide detailed cost estimate.

____ 6. Description and schedule of activities to monitor success of the project.

____ 7. Timetable and description of reports (e.g., quarterly, final) concerning progress, costs, and results.

____ 8. Discussion of methods and schedules for review, evaluation, and redirection of the project.

____ 9. Discussion of possible basinwide and/or region wide application of the strategy.

____ 10. Commitment to develop cost estimates for basinwide application of the project.

____ 11. Discussion of public education and outreach methods.

____ 12. Formal endorsement of the demonstration project by the Regional Council(s).

Albemarle-Pamlico National Estuary Program
Regional Councils

Format for Demonstration Project Proposals

I. Discussion of Priority Problem(s)

II. Options Considered

III. Discussion of Selected Option/Project Abstract
- A. Project Title
- B. Lead Agency/Organization
- C. Objectives
- D. Likelihood of Success
- E. Public Support
- F. Time and Resources Required
- G. Cost Effectiveness
- H. Deliverables

IV. Detailed Project Description/Scope of Work
- A. What
- B. Who
- C. How
- D. Where
- E. When
- F. Budget

V. Activities to Monitor Success
- A. Monitoring Requirements
- B. QA/QC Plan

VI. Reports on Progress, Costs, and Results

VII. Review, Evaluation, and Redirection

VIII. Basinwide or Regional Application
- A. General Discussion
- B. Cost Estimate

IX. Public Education and Outreach

X. Endorsement by Regional Council(s) and Other Partners

Attachment D.

REGIONAL COUNCILS
INTEREST GROUP NOMINATION FORM

***** ORGANIZATION/PERSON MAKING NOMINATION *****

Name: _____

Address: _____

_____ ZIP_____

Phone: (W)_____ (H)_____ Fax: _____

Co. of Residence or Headquarters Location:_____

***** PERSON YOU WISH TO NOMINATE *****

Name: _____

Address: _____

_____ ZIP_____

Phone: (W)_____ (H)_____ Fax: _____

Co. of Residence: _____ River Basin: _____
(Chowan, Roanoke, Pasquotank, Tar-Pamlico, Neuse)

Profession/expertise: _____ No. yrs _____

Category of Representation: (Circle one)

agriculture	silviculture	commercial fishing
conservation	tourism	environmental science
business/industry	at-large	recreational fishing

Soil and Water Conservation Districts

If desired, please attach a resume or vitae.

AFFILIATIONS/MEMBERSHIPS: (attach additional sheet if needed)

1. _____

2. _____

3. _____

This form may be reproduced as necessary.

(OVER)

Briefly, please describe why you feel this person would be a good nominee to serve on a Regional Council:

Hansen

Attachment E.1

MARINE FISHERIES COMMISSION
INFORMATION PAPER
RIVER HERRING
November 24, 1998
Prepared by: Sara E. Winslow

ISSUE:

The North Carolina Marine Fisheries Commission (MFC) recently amended their guidelines to designate, as priority for the development of Fishery Management Plans, those species on the North Carolina Division of Marine Fisheries Stock Status Report (SSR) determined to be stressed-declining or depressed. The update (1997) SSR lists river herring as depressed in the Albemarle Sound area and unknown for the other systems. Consequently, a provisional plan is required within 90 days of the issuance of the SSR. The purpose of this paper is to discuss the most recent river herring data and stock assessment.

BACKGROUND:

Blueback herring and alewife are anadromous fishes. These fish spend the majority of their life in salt water and return to fresh water to spawn. The major harvest occurs on these fish as they make their spawning migration. The Albemarle Sound area has historically been the center for the harvest in North Carolina.

Landings peaked in North Carolina during 1887 at 23.7 million pounds (mlb). The landings and value have fluctuated significantly over the years. From 1960-1970, North Carolina comprised 18-32% of the total Atlantic Coast river herring landings. River herring landings in North Carolina from 1985-1996, accounted for 43-85% of the total Atlantic Coast harvest. The most recent peak occurred in 1985 at 11.5 mlb which was higher than any of the 13 previous years (Figure 1). The 1969 landings of 19.7 mlb had a dockside value of $303,000, while in 1985 the value was $845,906. The trend since 1985 continued down with 1994 landings being the lowest recorded (911,409 lb, $127,706) up to that time.

In 1995, a fishing season was implemented by MFC rule (DENR 1997, 15 NCAC 3M .0513), which prohibited taking blueback herring, alewife, American shad and hickory shad by any method from April 15 through January 1. The total river herring landings in 1995 was 453,986 lb with a dockside value of $134,934.

During 1996, the rule was suspended extending the season for ten days. Once the season was extended, the Chowan River pound net fishery operated on a 250,000 lb total allowable catch (TAC). A total of 398,476 lb was harvested in the Chowan River pound net fishery. The total harvest in 1996 was 529,502 lb ($132,389) from all gears and all areas.

The rule remained in effect during the 1997 season and 334,890 lb ($128,988) of river herring were harvested in the state. The Chowan River pound net fishery accounted for 58.3% (195,221 lb) of the total.

In 1998, Chowan River pound net fishermen were required to obtain a Special Pound Net

Permit to fish for River Herring in the Chowan River Management Area (northwest of a line from Black Walnut Point across to Reedy Point, to the NC/VA state line; including the Meherrin River). These fishermen were required to list the number of nets they intended to fish during the season. The permittee was required to call DMF, Elizabeth City office daily to report landings and maintain a logbook that was to be submitted at the end of the season. Permittee was required to drop two outside corners on each pound net from Friday afternoon until Sunday afternoon, during April. A TAC of 400,000 lb was established for the Chowan River pound net fishery based on a Stock Assessment update.

A total of 19 Special Pound Net Permits were issued, permitting 114 pound nets, which contained 176 pounds. Fifteen permits were utilized and 75 pounds were set. Due to the TAC not being met, the rule was suspended and the season extended for 15 days, only to individuals possessing a valid Special Permit to fish for River Herring in the Chowan River Management Area. In an effort to extend the season as long as possible, on April 20, 1998 the fish dealers implemented a 5,000 lb daily landing limit per fishermen. A total of 368,666 lb (preliminary) was harvested from the Chowan River pound net fishery. The preliminary total for the state is 523,702 lb, with a value of $208,901.

It should be noted that river herring landings during some years prior to the implemented season did not necessarily reflect the amount of fish available, but may have reflected to some degree, environmental and market conditions. Since 1988, regulations enacted for striped bass conservation (gill net mesh size restrictions, yardage restrictions, area closures) have impacted river herring harvest in the Albemarle Sound area.

Historically, up to 85% of the states total river herring landings have occurred from the Chowan River pound net fishery. Since the season was implemented in 1995, the percentage has ranged from 57-75% of the total.

During the 1970s, the gill net harvest of river herring accounted for approximately 15% of the total Albemarle Sound area harvest. However, from 1987-1991 the percentage of gill net landings increased to 24-40% of the total river herring harvest from the Albemarle area. During 1994-1998, 22.2-38.1% of the river herring harvest in the Albemarle Sound area was from gill nets. Figure 2 shows the pound net landings versus the gill net landings from the Albemarle Sound area, 1978-1998. In 1986, approximately 6 mlb were harvested in pound nets and 900,000 lb from gill nets. During 1988, pound nets landed 2.3 mlb and gill nets 1.5 mlb. A total of 425,000 lb were harvested from pound nets and 175,000 lb from gill nets in 1994. The proportion of the total harvest from the gill nets has increased significantly over time.

The number of gill net trips, by poundage groups for 1994-1998, from the Albemarle Sound Management Area are shown in Table 1. During each year, over 94% of the total trips harvested from 1-300 pounds.

Fishing effort in the Chowan River pound net fishery has continuously declined each year since 1987 (Figure 3). The average number of pound nets set each week in 1977 was 539, compared to 451 in 1987. Prior to the season being implemented in 1995, effort had decreased to 147 nets in 1994. Aerial flights were made during each spring 1995-1998 to determine the number of pound

nets set. Based on the flights, the average number of nets set during the 1995 season was 60 nets, 79 nets were set in 1996, 92 nets in 1997 and 66 nets were set in 1998.

Catch per unit of effort (CPUE) measured by the number of Pound Net Weeks (PNW - number of pound net sets times the number of weeks fished) has also fluctuated. The CPUE from pound nets has increased during three of the last four seasons. In 1977, the CPUE was 14,895 lb per net, declining to 5,189 lb in 1987, to only 2,622 lb per net in 1994, an all time low (Figure 4). In 1994, DMF began a new harvest data collection system through the trip ticket program which may affect comparisons with former years. Although CPUE for pound nets in the Chowan River has increased since 1995, there are no data on CPUE for gill nets although DMF trip ticket data show that gill nets have accounted for 22.2-38.1% of the river herring harvest.

A comparison of the number of Endorsement to Sell Licenses (ETS) are presented in Table 2 for 1994-1998. These numbers do not reflect the actual number of individuals participating in the fishery, because multiple ETS's maybe held by one person.

The juvenile abundance indices for blueback herring and alewife have fluctuated over the years in the Albemarle Sound area. Eleven core stations have been consistently sampled monthly during June-October of each year since 1972. The highest CPUE recorded for blueback herring was in 1973 (362.9 fish/seine), the lowest was in 1994 (0 fish/seine), part of a very low CPUE trend covering 1986-1997 (Figure 5). In 1996 and 1997 an increase in CPUE was observed. The 1998 blueback herring CPUE was 0.44. The twenty-seven year average CPUE for blueback herring is 54. In 1980, a CPUE of 12.4 fish/seine was recorded for alewife (Figure 6). During 1995-1998, an increase in alewife CPUE was observed, higher than any since 1988. The 1996 CPUE (3.2) was above the twenty-seven year average (2.5 fish/seine). The 1998 CPUE for alewife was 1.2.

The age structure of the commercial river herring harvest in the Albemarle Sound area has been characterized since 1972, with 3-5 year old fish dominating both species. A total of 915 blueback herring samples were obtained from the Chowan River pound net fishery in 1998. This was the highest sample size obtained in approximately 15 years. The 1998 sample was comprised of fish 2 years old through 7 years old, sexes combined. Fifty-three percent of the sample was 5 year old fish (1993 year class). The percentage of repeat spawners has decreased from 25% in the early 1970s to less than 3% in the late 1990s. Data for both species and sexes 1972-1998, show a general decline in the mean size at age (1-2 inches). However, in 1995 and 1996, an increase in the mean size was observed in most ages, but dropped again in 1997 and 1998 (Figure 7 and 8).

All of these factors combined indicate that blueback herring and alewife are recruitment overfished. The ASMFC report, "Stock Assessment of River Herring from Selected Atlantic Coast Rivers" (Crecco and Gibson 1990) determined that the status of alewife was "overfished", and blueback herring "fully exploited" in the Chowan River based on data from the 1980s. An updated stock assessment analysis utilizing 1972-1997 data (Carmichael 1998, in preparation) shows the Chowan River blueback herring spawning stock biomass (SSB) has been extremely low for ten years. Due to the low SSB, recruitment has been ,extremely poor. The stock assessment suggests that if SSB can be brought up to 4 million kg (10 mlb), then recruitment may accelerate.

In order to rebuild the spawning population and stablize recruitment in the blueback herring and alewife stocks, conservation actions must be imposed to reduce fishing mortaility rates. Due to the current low stock status, a low harvest in total poundage can represent a large impact in terms of population numbers.

CURRENT RULE: 15A NCAC 3M .0513

.0513 RIVER HERRING AND SHAD

(a) Until the adoption of a fishery management plan for river herring (Blueback Herring, Alewife) or shad (American Shad, Hickory Shad) by the North Carolina Marine Fisheries Commission, it is unlawful to take blueback herring, alewife, American shad and hickory shad by any method from April 15 through January 1.

(b) Upon adoption of and in order to comply with the management requirements incorporated in the Fishery Management Plan(s) for River Herring (Blueback Herring, Alewife) or Shad (American Shad, Hickory Shad) developed by the North Carolina Marine Fisheries Commission, the Fisheries Director may by proclamation, take any or all of the following actions in the river herring and shad fisheries:

(1) Specify size;
(2) Specify season;
(3) Specify area;
(4) Specify quantity;
(5) Specify means/methods; and
(6) Require submission of statistical and biological data.

(c) It is unlawful to possess more than 10 American shad or hickory shad, in the aggregate, per person per day taken by hook-and-line.

MANAGEMENT OPTIONS FOR PRELIMINARY PLAN:

The following are a series of management options for the Finfish Committee and MFC to consider in the development of the preliminary plan for river herring as called for in the MFC Guidelines. The following list is meant to be as inclusive as possible and provide possibilities that can either be developed further or eliminated for consideration.

Option 1: No Action/Status Quo
Option 2: Moratorium
Option 3: Reduce Season/Lift Days
Option 4: Reduce Effort - Pound Net and Gill Net
Option 5: Establish a Total Allowable Catch for the Gill Net Fishery and Pound Net Fishery
Option 6: Closed Areas
Option 7: Limited Entry/Permits
Option 8: Increase Mesh Size of Drift Gill Nets to No Less Than 3" Stretched Mesh
Option 9: Pound Net Buyout Program

Table 1. Number and percent of river herring gill net trips, by poundage groups, from the Albemarle Sound Management Area, 1994-1998.

ALBEMARLE SOUND MANAGEMENT AREA: GILL NETS

	1994		1995		1996		1997		1998	
POUNDAGE	# TRIPS	PERCENT	# TRIPS	PERCENT	# TRIPS	PERCENT	# TRIPS	PERCENT	# TRIPS	PERCENT
1-50	1816	74.2	1524	65.4	2222	84.4	1650	78.1	1739	77.9
51-100	219	8.9	383	16.5	187	7.1	148	7	177	8
101-150	112	4.6	152	6.6	77	2.9	76	3.6	90	4
151-200	74	3	85	3.6	30	1.1	47	2.2	57	2.6
201-250	52	2.1	54	2.3	7	0.3	49	2.3	28	1.2
251-300	44	1.8	36	1.5	25	1	26	1.2	23	1
301-400	55	2.3	44	1.9	21	0.8	47	2.2	29	1.3
401-500	27	1.1	15	0.6	10	0.4	24	1.1	13	0.6
501-600	13	0.5	16	0.7	15	0.6	16	0.8	25	1.1
601-700	5	0.2	7	0.3	9	0.3	8	0.4	14	0.6
701-1000	14	0.6	4	0.2	17	0.6	16	0.8	21	0.9
1000+	16	0.7	9	0.4	14	0.5	7	0.3	17	0.8
Total trips	2447		2329		2634		2114		2233	
Total Pounds		174,869		155,157		119,697		125,044		145,211
Percent to total harvest		29		36		22.6		38.1		27.8
Percent trips 1-300 lbs		94.6%		95.9%		96.8%		94.4%		94.7%
Poundage 301-1000+		84,555		48,302		58,844		59,274		74,763
		48.3%		31.1%		49.2%		47.7%		51.5%
Poundage 501-1000+		57,173		29,043		48,513		35,503		60,821
		32.7%		18.7%		40.5%		28.4%		41.9%
Poundage 1000+		36,198		13,750		22,317		9,642		22,831
		20.7%		8.9%		18.6%		7.7%		15.7%

Table 2. A comparison of the number of Endorsements to Sell Licenses in the river herring fishery, 1994-1998.

ALBEMARLE SOUND AREA					
	Number of endorsements				
Poundage groups	**1994**	**1995**	**1996**	**1997**	**1998**
0-500 lb	132	123	170	235	144
501-1000 lb	10	12	8	8	12
1001-3000 lb	24	17	6	11	12
3001-5000 lb	7	7	4	5	4
5001+ lb	9	4	7	7	5
TOTAL	**182**	**163**	**195**	**266**	**177**

CHOWAN RIVER AREA					
	Number of endorsements				
Poundage groups	**1994**	**1995**	**1996**	**1997**	**1998**
0-500 lb	23	16	12	24	10
501-1000 lb	5	4	6	4	2
1001-3000 lb	6	5	4	9	3
3001-5000 lb	3	3	1	3	1
5001+ lb	18	8	13	10	16
TOTAL	**55**	**36**	**36**	**50**	**32**

OTHER AREAS					
	Number of endorsements				
Poundage groups	**1994**	**1995**	**1996**	**1997**	**1998**
0-500 lb	69	78	133	161	86
501-1000 lb	6	8	8	2	11
1001-3000 lb	5	17	2	5	4
3001-5000 lb	1	1	1	2	2
5001+ lb	1	1	0	0	0
TOTAL	**82**	**105**	**144**	**170**	**103**

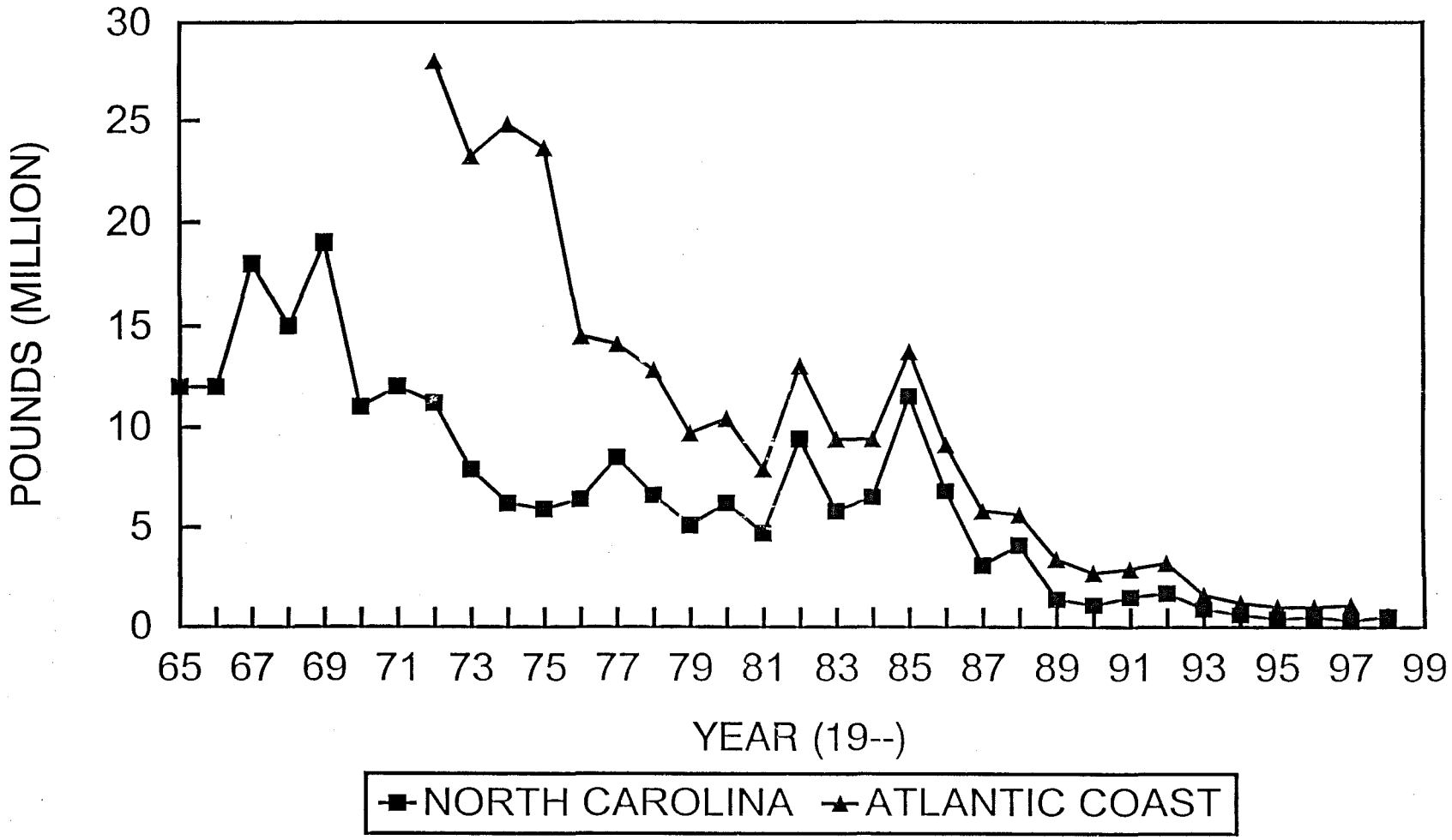


Figure 1. River herring landings, North Carolina and Atlantic Coast, 1965-1998.

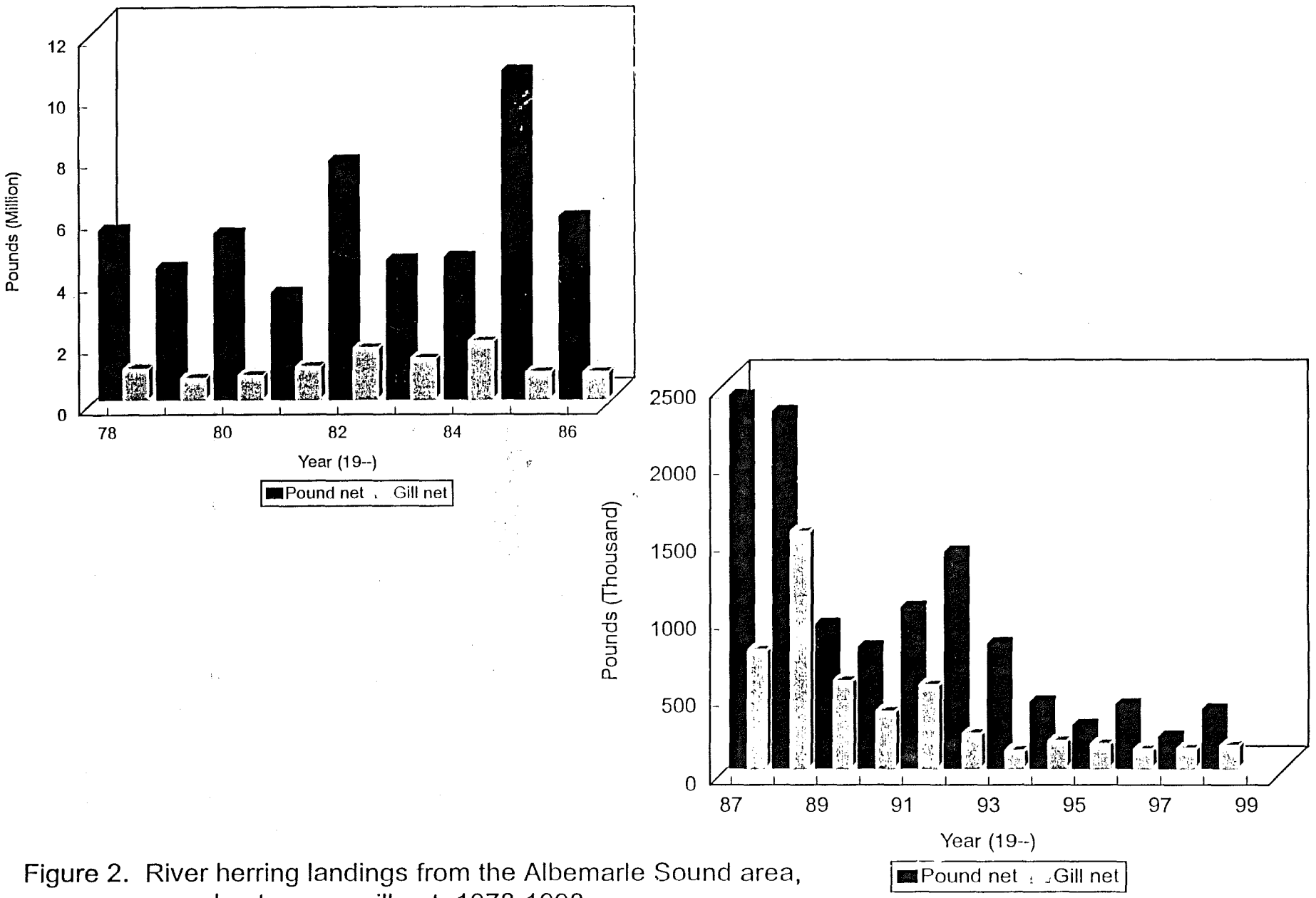


Figure 2. River herring landings from the Albemarle Sound area, pound net versus gill net, 1978-1998.

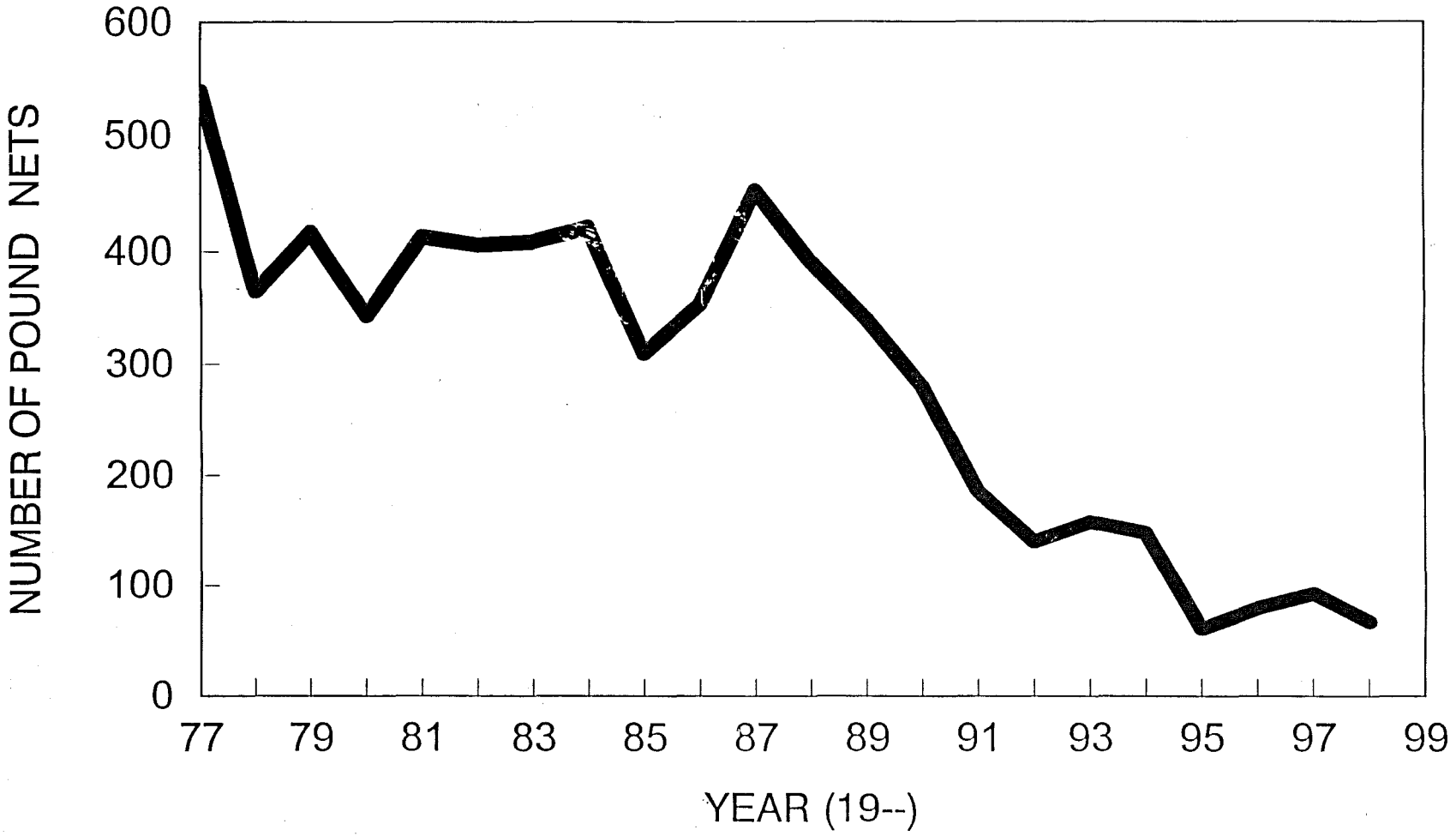


Figure 3. Mean number of pound nets set in the Chowan River, 1977-1998.

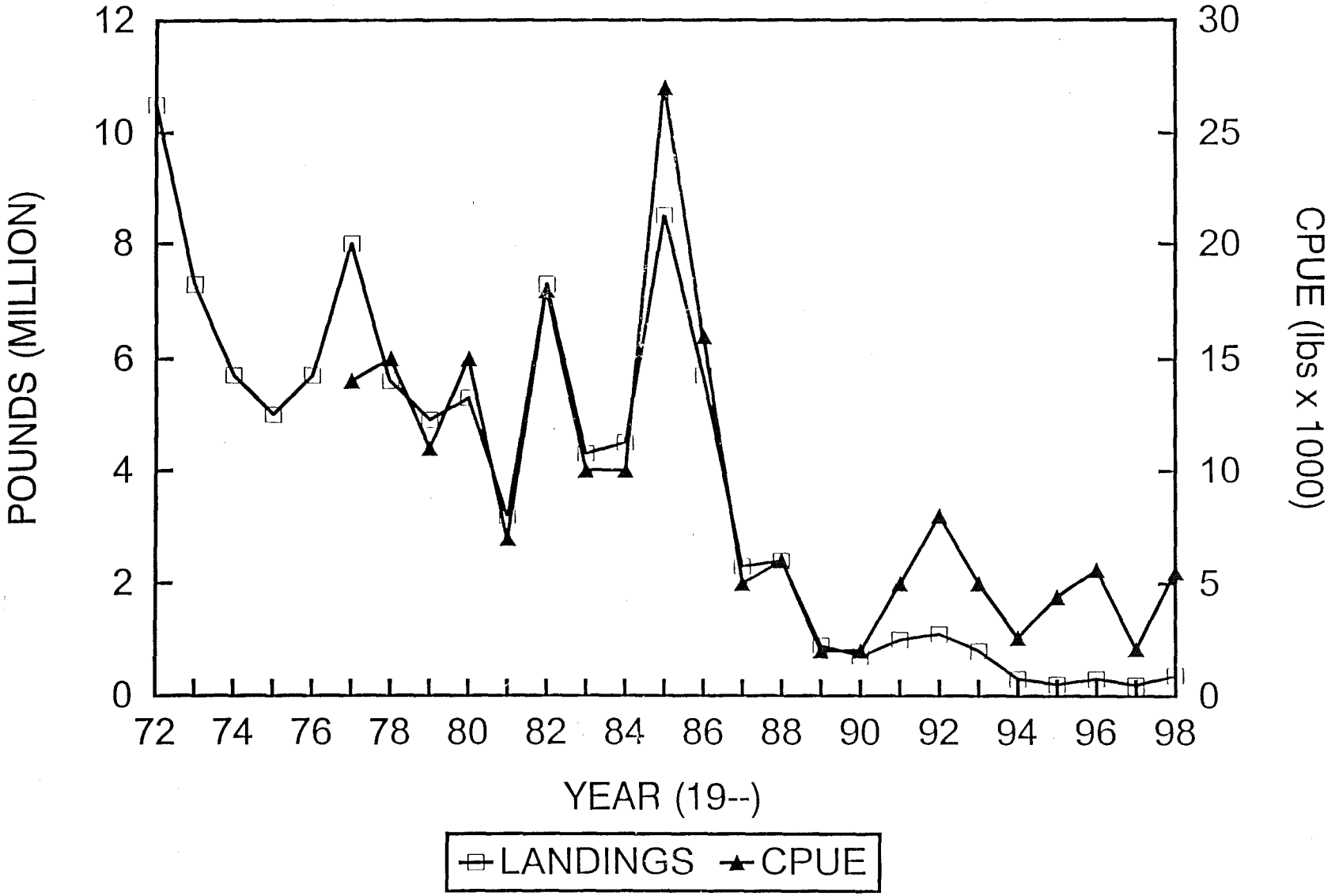


Figure 4. Chowan River pound net landings and catch-per-unit-of-effort, 1972-1998.

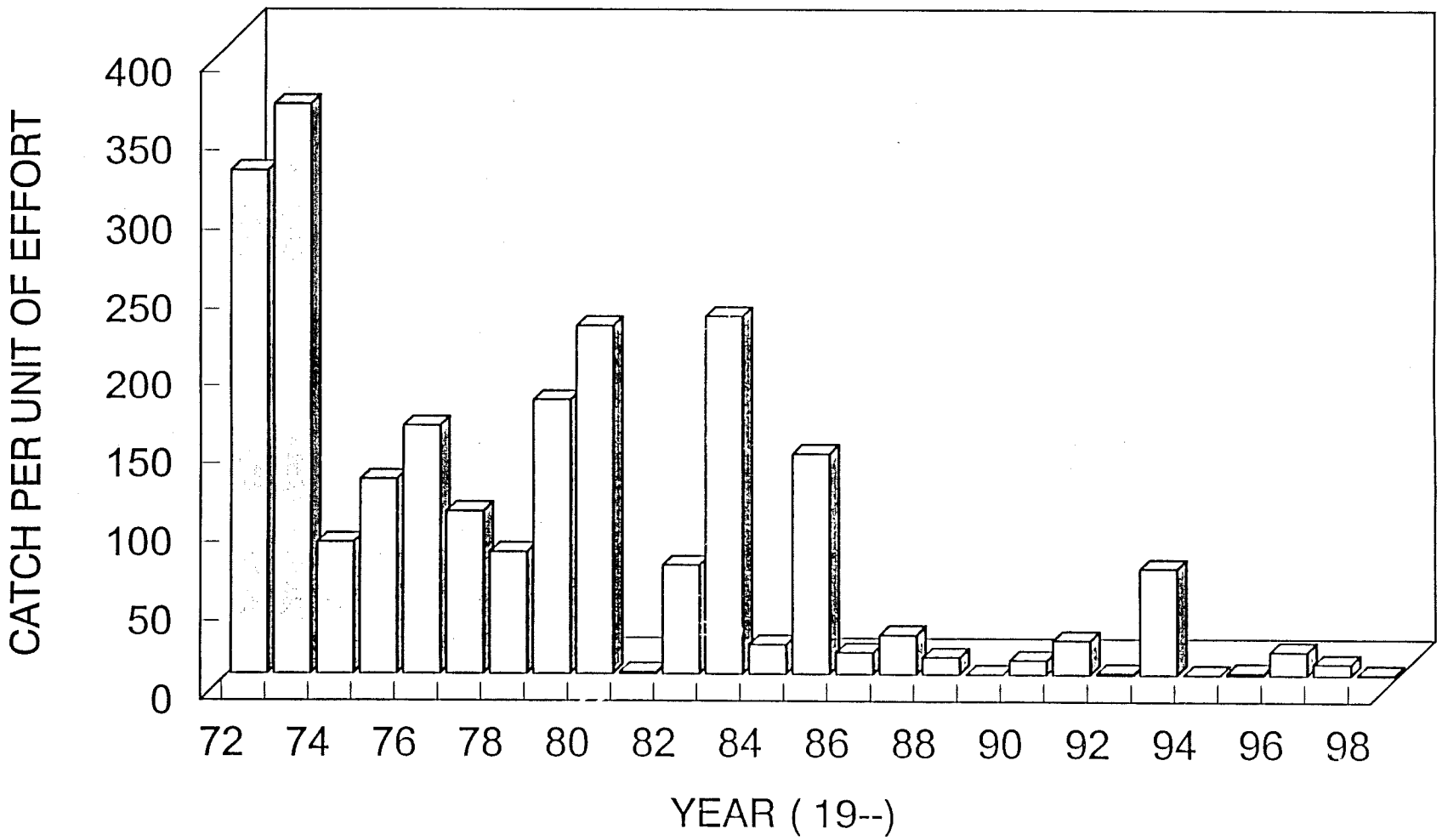


Figure 5. Blueback herring juvenile catch-per-unit-of-effort from the Albemarle Sound area seine survey, 1972-1998. (11 core stations)

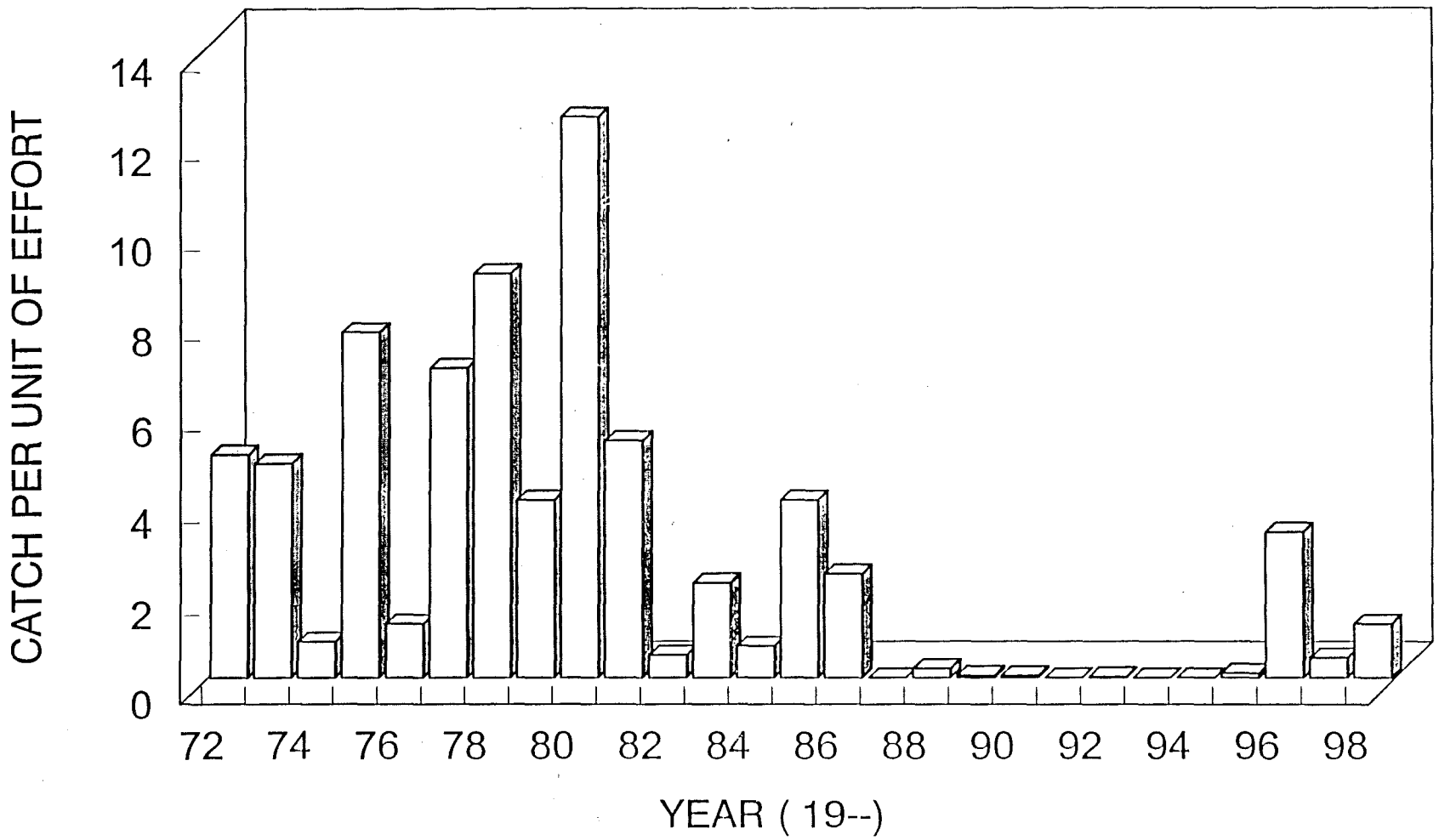


Figure 6. Alewife juvenile catch-per-unit-of-effort from the Albemarle Sound area seine survey, 1972-1998. (11 core stations)

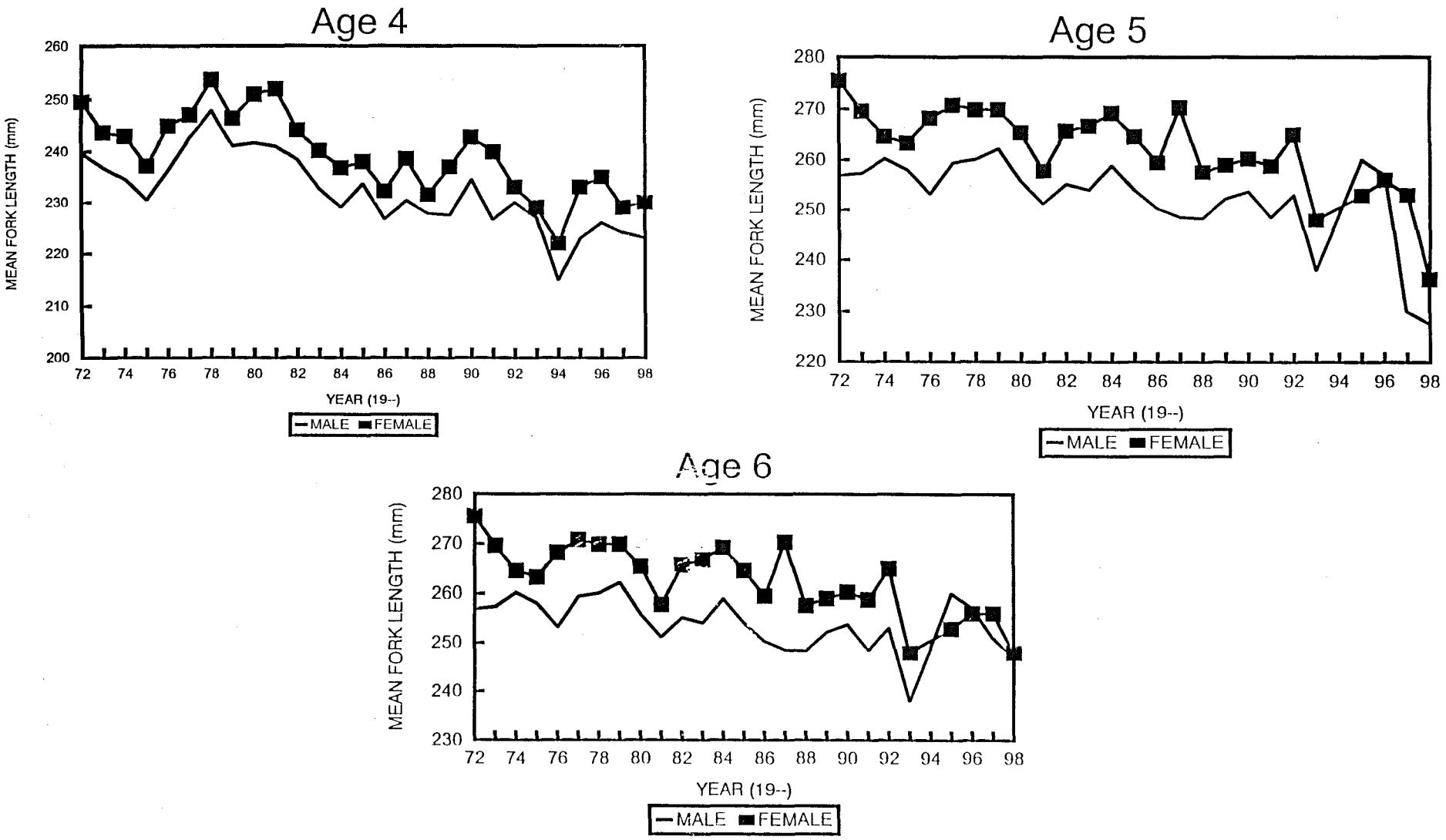


Figure 7. Mean length at age of blueback herring from the Chowan River pound net fishery, 1972-1998.

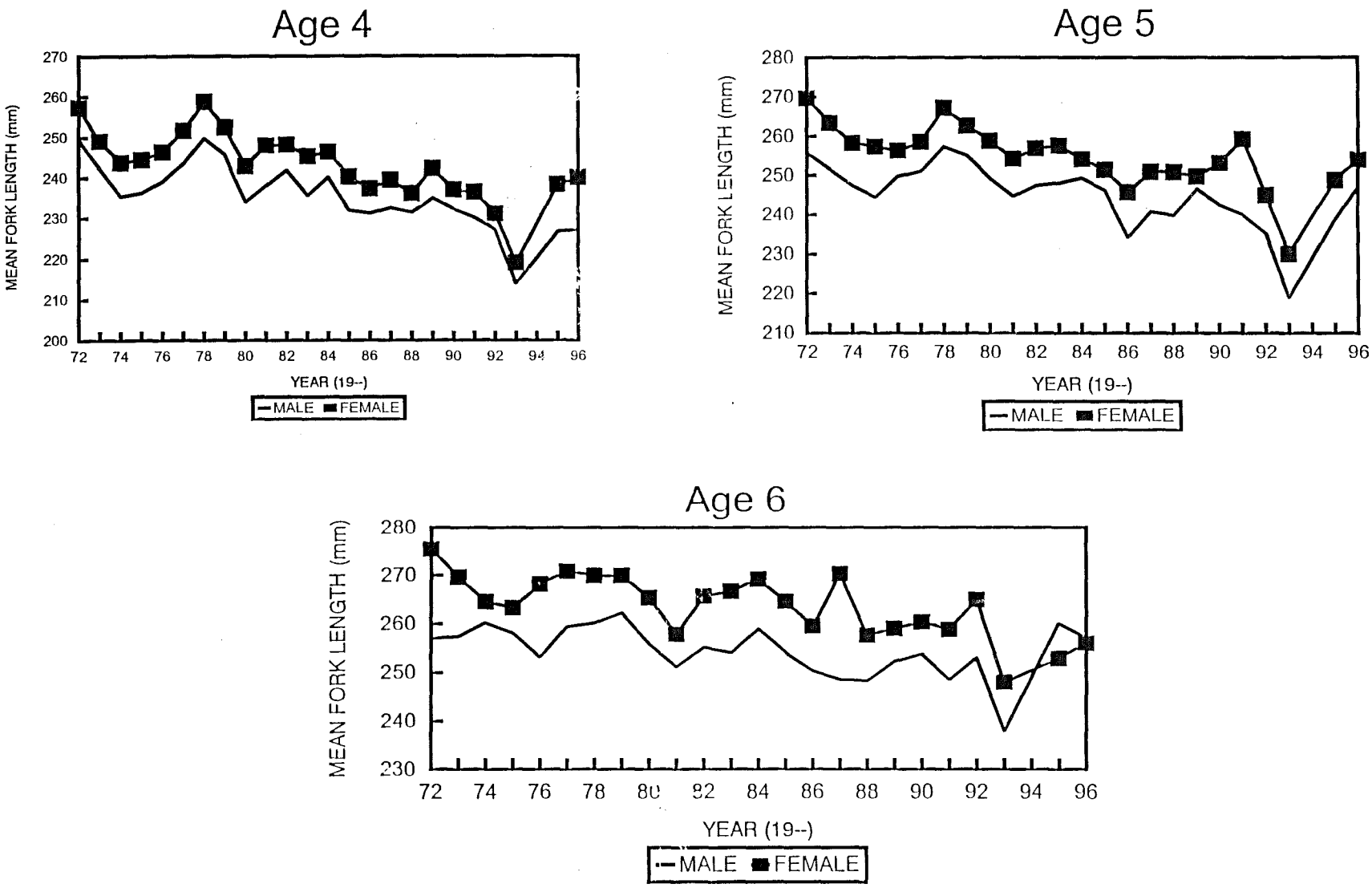


Figure 8. Mean length at age of alewife from the Chowan River pound net fishery, 1972-1996.

Johnson

Attachment E.2

UPDATED Status of Blueback Herring in the Chowan River, North Carolina, **1972-1998**
Draft Summary Results

John Carmichael
NC Division of Marine Fisheries
JANUARY 1998

Summary of Changes:
1. Correction of weight values. In some previous documents the measurement units "kilograms" and "pounds" were transposed in the figures and text. This does not affect the basic conclusions and results since the data in the model are expressed as numbers of fish, but for certain results the model output in numbers is converted to a weight measure for convenience. This document reflects proper expansion of model output to pounds and corrects the terminology and absolute values in both the text and figures.

2. Change in Stock-Recruitment assumption. Previous presentations and documents stressed both the importance of the stock-recruitment relationship to population projections and the difficulty in determining future recruitment. Stock-recruitment models and fixed recruitment series have both been considered in projection scenarios, but each approach imposes either assumptions that may not be supported or limitations that may not be realistic. After considering the pros and cons of the various methods of determining future recruitment, I decided to adopt a stochastic approach. This simply means that future recruitment values are selected randomly from past recruitment values according to spawning stock biomass levels. Or, in other words, the recruitment expected from a given future SSB is based on observed recruitment at similar historical levels of SSB.

I. Introduction

This update represents an initial attempt to capture the impact of recent regulatory changes and to guide management recommendations for the 1999 blueback herring fishery. The analysis is based on the Chowan River pound net fishery. Although blueback herring are landed in other areas of the Albemarle sound by a variety of gears, the largest fishery, both in the present and historically, is that of the Chowan River pound nets. Since there is no way to allocate landings from other areas and gears to the Chowan River stock, assessment efforts have focused on the Chowan pound net fishery alone. Moreover, the apparent decline of blueback herring populations in the Albemarle Sound since the mid-1980's has virtually eliminated landings from other tributaries to the extent that no catch sampling of these areas is feasible. Therefore, it is assumed that analysis of pound net landings provides the best available representation of the stock's status.

1998 pound net catch at age data were used to advance the stock synthesis based assessment of Chowan River blueback herring to include the 1998 fishing year. Results obtained for the 1972-1998 period include estimates of recruitment at age-3 plus numerical abundance for ages 4 to 7+, annual estimates of fishing mortality and associated confidence intervals, and annual estimates of spawning stock biomass (SSB). Also included are several simplified short term population projections for various fishing mortality rates. No further comparisons with past

CAGEAN assessments are provided. **This assessment is preliminary and subject to future editorial change, refinement, and peer review which may ultimately alter the results and conclusions presented at this time. A final document presenting the results in significantly greater detail will be prepared in accordance with the River Herring FMP.**

II. Landings and Survey Data

The NC DMF has tabulated blueback herring commercial landings and collected age and length samples from the Chowan River pound net fishery since 1972. Landings fluctuated substantially through the mid-1980's then dropped drastically, showing no evidence of recovery since (Figure 1). From 1972-1985, landings averaged 4.5 million pounds and ranged between 2 and 8 million pounds. Substantially lower landings between 1986 and 1994 resulted in an average for the period of only 1.2 million pounds. Since implementation of seasonal restrictions in 1995 landings have averaged only 0.31 million pounds, and ranged between 0.19 and 0.39 million pounds.

The only fishery-independent measure of stock abundance is the Albemarle Sound seine survey which is used to provide annual Juvenile Abundance Index (JAI) values. Declining JAI values during 1972-1998 provide the first indication that reduced landings are related to declining population abundance (Figure 2). From 1972-1985 the JAI averaged 149 and since 1986 it has only averaged 13. The 1998 JAI of 0.44 is the third lowest in the time series.

III. Estimation Procedure

Initial estimates of total mortality (Z, or fishing + natural mortality) were obtained through catch curve analysis. A catch curve is a basic approach to analyzing catch at age data wherein a linear regression is fit to declining catches at age. Catch curves may be applied to annual catches or to individual cohorts. Since annual catch curves assume constant recruitment, the catch curve analysis was also applied to individual cohorts. A cohort based catch curve allows for changes in recruitment and may therefore be more applicable to this stock. Catch curves are a proven method of estimating total mortality, but because they do not allow estimation of recruitment and abundance at age, more sophisticated models are also considered.

As noted in previous reports, the CAGEAN model is not used in current efforts to analyze blueback herring population dynamics. Since CAGEAN has several drawbacks that have lead to a decline in its use along the Atlantic Coast, this assessment uses a spreadsheet based catch at age analysis procedure incorporating a multinomial error distribution. This is a flexible approach to analyzing catch at age data that was initially developed in the late 1980's and has been used extensively for many analytical assessments. Unlike previous CAGEAN based assessments of Chowan River blueback herring model that incorporated both juvenile abundance and fishery effort data to generate parameter estimates, the only input data used in this approach are annual catches at age and annual numbers of fish aged. Removing the juvenile abundance data from the input dataset allows for potential verification of the JAI as a valid index of the juvenile population and spawning success. Similarly, avoiding the use of fishery effort data as a model input allows investigation of catch per unit effort trends in relation to population abundance.

Parameters estimated by the model include 1972-1994 average fishing mortality, 1995-1998 annual fishing mortality, selectivity for ages 3 and 4, and annual recruitment (estimated as abundance at age-3). Confidence intervals for fishing mortality estimates were obtained through both bootstrapping and likelihood profiling. Cohort and annual catch curve models were used to generate initial fishing mortality estimates and to provide a check on the model results.

Past assessments of this stock have assumed various natural mortality rates. Crecco used a value of 1.0 in an initial ASMFC assessment of Atlantic Coast stocks. A NC DMF assessment of the Chowan River stock, prepared by Schaaf, assumed natural mortality was 0.3. Application of the both the Hoenig and Pauly methods of estimating natural mortality yield estimates of 0.51. Since these analytical approaches provide an estimate between the previously assumed values, for this assessment the assumed instantaneous rate of natural mortality is 0.5.

One goal of this assessment is to provide estimates of future abundance and spawning stock biomass for various management targets. To do so requires either making an assumption of future recruitment or fitting a stock-recruitment relationship so that future recruitment may be estimated from the spawning stock biomass. Fitting a stock-recruitment relationship implies that recruitment is somehow influenced by spawning stock abundance, and the potential relationship can be observed by examining a plot of recruitment and spawning stock biomass. However, one drawback of a deterministic stock-recruitment relationship such as the Beverton-Holt model is that it imposes an average recruitment level when the population is projected in the future and fails to reflect the extreme variation that is typical of stock and recruitment values. Future recruitment values are also influenced by model choice. One way to avoid these difficulties is to generate recruitment from SSB according to the observed recruitment probability distribution. This was done by incorporating a stochastic stock-recruitment model, which randomly selects recruitment from past observed values with SSB thresholds set at 2.5 and 6.5 million pounds. Fifty trials of 50 years were conducted for each fishing mortality level. Yearly data points were averaged over the trials to generate 50 year trends in population parameters for each mortality level. Initial population abundance at age for 1999 was taken from the catch at age model.

IV. Results

Assessment results indicate the Chowan River stock of blueback herring is at an historic low and fishing mortality has exceeded any sustainable level over most of the last 27 years. Strong recruitment to age 3 during the 1970's and mid 1980's supported the population in spite of the high rates of fishing mortality, but apparent recruitment failure in the late 1980's allowed spawning stock biomass to decline sharply and it has never recovered. A slight drop in the average fishing mortality since 1995 has not yet provided any substantial gains in either population abundance or spawning stock biomass, and both recruitment and overall abundance continue to set new record lows.

Results from the annual catch curve analysis suggest that total mortality averaged 1.51 from 1972-1998 (Figure 3). A test of the slopes of the annual catch curves failed to indicate a significant difference, suggesting that fishing mortality varied without trend over the period. Average 1972-1998 total mortality from catch curves applied to cohorts was 1.55 with a 90%

confidence interval for the mean of 1.31 – 1.79. By subtraction of natural mortality, the estimated fishing mortality is 1.05.

Recruitment is estimated at age 3 since virtually no fish younger than this appear in the catch and there is no offshore survey data available to estimate the population of the sub-adults. Recruitment averaged around 30 million fish a year between 1972 and 1985, but since 1986 it has only averaged around 4.7 million fish (Figure 4). Strong year classes in the late 1960's sustained the stock through the mid-1970's, then poor 1975-1977 cohorts contributed to the decline in the late 1970's. Exceptional recruitment of the 1978 - 1981 cohorts, averaging 38 million fish, allowed the stock to rebuild in the early 1980's, but between 1983-1986 several poor year classes and high fishing mortality lead to a precipitous decline in overall stock abundance that continues through 1998. Recruitment has been extremely low since 1989, averaging slightly below 3 million fish a year. Moreover, any modest gains in recruitment since the early 1980's supported catches over the short term and were quickly removed by high fishing mortality. For example, at nearly 10 million fish, the 1987 and 1988 year classes were the best in the last 10 years. However, these two cohorts provided over 70% of the catch between 1990 and 1993. In more recent years, the 1993 year class supported nearly 10% of the catch in 1996, nearly 40% of the catch in 1997, and over 50% of the catch in 1998.

Fishing mortality varied without trend between 1972 and 1994; this conclusion is supported by the catch curve analyses. Fitting a constant F over this period greatly reduced the number of parameters estimated by the model and provides a more robust estimate of the long term average F than would be obtained from averaging values estimated annually. Although this is a slight deviation from the previous assessment, it should improve the estimation procedure. To account for the possibility that regulatory changes in 1995 and later had some impact on exploitation rates, F was estimated annually for 1995 - 1998 (Table 3). Estimated fishing mortality for 1972-1994 is 0.82, which is equivalent to an annual exploitation rate of 45%. Average fishing mortality has dropped slightly since 1994 to 0.66, although the 1996 estimate of 0.90 exceeds the long term average. 1998 fishing mortality is estimated at 0.82 with a 90% confidence interval of 0.4 - 1.2.

Spawning stock biomass (SSB) shows a general decreasing trend over the 1972-1998 period (Figure 5, Table 4). From 1972-1985 SSB varied between 3 and 13 million pounds and averaged just over 7 million pounds. It then dropped steeply to just 1.1 million pounds in 1990. A slight increase in 1991 and 1992 can be attributed to the 1987 and 1988 year classes reaching maturity, but continued poor recruitment further reduced SSB to a record low in 1997 of 0.68 million pounds. A slight increase to 0.77 million pounds is suggested for 1998, largely due to the 1993 year class being the best in the last 5 years. However, given that the 1994 and 1995 cohorts appear the lowest yet observed, it is unlikely that this slight increase in 1998 will be maintained.

It is apparent that strong year classes are much more likely when SSB is above 4 million pounds and poor year classes are to be expected when SSB is below 2 million pounds (Figure 6). Initially, a Beverton-Holt model was used to quantify the relationship between spawning stock and recruitment (Figure 7). For this stock, that means that when SSB reaches 4 million pounds the model would provide recruitment of around 10 million fish, but the range of observed recruitment at 4 million pounds is actually 10 to 60 million fish. The stochastic stock assessment

model was used to better account for the wide range of potential values. Results of this modeling approach are discussed in the stock projections section.

V. Stock projections

The goal of projections is to determine how a stock may respond to particular management changes by projecting population growth and catches in future years. This requires an estimate of abundance at age in the initial year and estimates of recruitment in future years. The abundance at age for the initial year is provided by the catch at age model and future recruitment must either be assumed or estimated. However, the level of future recruitment will greatly influence the results, especially in later years. As a general rule, short term projections are fairly reliable since the first few years are influenced heavily by the initial abundance at age, which, as stated earlier, is provided in the model output.

These basic tenets of stock projections are especially important for this stock. The catch is typically dominated by 4 and 5 year old fish, yet the first age that can be estimated is age 3. Virtually no fish older than 7 appear in the catch. The end result is that once a projection has been extended out 5 years the abundance of every age in the population is directly dependent on the assumed recruitment value. Also, once the projection is extended 3 years, the abundance of the dominant ages is directly dependent on the assumed recruitment value. Clearly, for this stock the accuracy of even relatively short term projections is heavily dependent on the accuracy of future recruitment assumptions. Unfortunately, one of the most difficult tasks in fisheries population dynamics is estimating future recruitment.

Two main approaches were taken to project future catches and stock conditions: fixed quotas under stochastic stock recruitment conditions and fixed fishing mortality under fixed recruitment. The first two series illustrate expected results for fixed fishing mortality rates for 10 years under fixed annual recruitment. Ten year trends in SSB are shown under two recruitment possibilities: (1) recruitment in future years is fixed at a low value, specifically the 1.5 million fish estimated as the recruits in 1998; and (2) recruitment is fixed at 3 million fish for 3 years and then at 5 million fish for the remaining 7 years.

For scenario 1, initial stock sizes are taken from the catch at age model. For the range of fishing mortalities examined, the spawning stock stabilizes between .5 and .3 million pounds in a few years (Figure 8). Under high recruitment, SSB may reach 2 million pounds in 10 years (Figure 9). Initial stock sizes were increased for scenario 2 by going back to 1996 and then doubling the 1997 and 1998 recruitment while holding fishing mortality at 0.5. Such conditions are not unreasonable given the uncertainty in terminal year estimates. However, this increased initial stock abundance does little to increase SSB and within a few years the impacts of future recruitment drive SSB to levels similar to those observed in the first scenario (Figures 10 and 11). Figure 12 combines the SSB estimates from scenarios 1 and 2 to illustrate the overall range of SSB's indicated by the two scenarios and the two possible initial population values.

The third series illustrates 10 year trends in SSB and fishing mortality under fixed quotas and assuming the stochastic stock recruitment relationship. Quota levels examined include 0, 150,000, 250,000, and 400,000 pounds. To maintain a 400,000 pound harvest, fishing mortality

would have to increase significantly in the initial years as the poor 1994 and 1995 year classes move through the population (Figure 13). Mortality then stabilizes in later years since the average recruitment predicted by the model is somewhat higher than that observed in recent years. Similarly, SSB initially declines due to the poor 1995 year class, then increases gradually (Figure 14). By 2008, SSB could be between .60 and 1.2 million pounds depending on harvest levels. Obviously, the 0 harvest scenario provides the greatest gains in SSB, but even such drastic measures are unlikely to build the spawning stock to the 2 to 4 million pounds that has historically produced strong recruitment. To give a long term perspective, figure 15 shows potential 50 year trends in SSB under a range of fishing mortalities. Even with no fishing mortality, the stock is unable to reach the threshold that would give strong recruitment. It is clear that regardless of harvest conditions, recruitment will need to improve significantly if the stock is to recover in the near future.

VI. Summary

Exceptionally strong recruitment through much of the 1970's and early 1980's sustained the Chowan River stock of blueback herring in spite of very high fishing mortality. Much of the variability in landings, population abundance, and spawning stock biomass over this period can be attributed to trends in recruitment. Several poor year classes in the mid-1980's could not support high fishing mortality and therefore the stock declined to historic low levels. Sustained high mortality through the mid-1990's has kept the stock at very low levels and prevented any gains in SSB from the few slightly stronger year classes of the early 1990's.

This analysis suggests that the long term decline in landings is related to a decline in population abundance and that a fishing mortality rate averaging 0.8 is not sustainable. It is apparent that sustained high exploitation has significantly reduced SSB over the last 25 years to the extent that current levels are insufficient to produce even moderate recruitment. The slight decrease in fishing mortality over the last 4 years has not changed the trend of declining SSB and poor recruitment. The stock is at such low abundance that any significant recovery seems unlikely in the next few years. Furthermore, stronger year classes such as that of 1993 are supporting current catch levels and therefore cannot make any real contribution to sustained population growth. While an analysis of data through 1997 suggested that current management measures were positively impacting the stock, the high mortality estimated in 1998 indicates minimal improvements. This is further supported by the comparison of exploitation on cohorts fished before and since the regulatory changes. Moreover, the 1994 and 1995 year classes are possibly the smallest in the time series and offer little potential for further stock improvement in the coming years. Stock-recruitment analyses suggest that the spawning stock biomass may need to increase to around 2.5 million pounds before any real gains in recruitment may be expected. This is nearly a 3-fold increase over current levels.

Projections of future fishing mortality and catch levels clearly indicate that little improvement in the stock can be expected until recruitment improves. It is possible that the current harvest rate will not be sustainable if recruitment continues to decline, and even if fishing mortality on this stock is eliminated completely, only modest gains in spawning stock biomass

and recruitment are expected. However, if recruitment begins to increase then the stock should be able to sustain current harvest levels and SSB should begin to increase slightly.

Results contained in this update are similar to those in the previous summary which included data through 1997. The most notable change is the estimation of a constant F from 1972-1994 and the stochastic stock-recruitment relationship. The constant F allows better estimation of recruitment over the period, as the model is forced to account for changes in catch through changes in population abundance, rather than through a combination of both mortality and abundance. Examination of model residuals indicates an improvement in fit over the annual F model. As expected, the recruitment series suggested by the current model is somewhat more variable than shown in previous estimates. Predicted recruitment is more closely tied to past observed values by the stochastic stock-recruitment relationship, resulting in greater variation in future recruitment levels. But even accounting for recruitment variability fails to quickly rebuild SSB to the threshold. It is likely that once SSB reaches the threshold, this approach provides a chance for extremely high recruitment that could support rapid stock rebuilding.

Table 1. Chowan River Blueback herring landings, 1972 -1998

Year	Total pounds	Pound net pounds	Mean Pounds	% Blueback sampled	Catch in Numbers
1972	8,231,629	8,032,839	0.4042	0.78	20363410
1973	5,792,255	5,759,159	0.4172	0.79	13884517
1974	4,819,000	4,735,300	0.3969	0.84	12142629
1975	2,666,831	2,633,461	0.3660	0.53	7285468
1976	4,817,212	4,791,389	0.3974	0.84	12120866
1977	7,121,489	7,001,059	0.4261	0.96	16714988
1978	4,323,637	4,050,767	0.4429	0.77	9763117
1979	2,194,868	2,118,907	0.4460	0.51	4921446
1980	3,498,920	3,388,983	0.4593	0.65	7617644
1981	2,088,102	2,041,319	0.4789	0.63	4359845
1982	5,445,777	5,388,115	0.4354	0.73	12507281
1983	2,423,253	2,380,262	0.4069	0.55	5956052
1984	3,247,790	3,205,420	0.3589	0.71	9049529
1985	6,830,971	6,757,805	0.3768	0.77	18130028
1986	4,487,406	4,344,802	0.3986	0.78	11257649
1987	1,774,386	1,773,684	0.3695	0.76	4801700
1988	1,310,735	1,296,041	0.3475	0.58	3772226
1989	581,213	580,844	0.3536	0.64	1643806
1990	489,064	488,746	0.3792	0.69	1289756
1991	1,031,775	870,348	0.3354	0.86	3075915
1992	804,956	804,956	0.3533	0.71	2278148
1993	567,991	567,282	0.3635	0.71	1562613
1994	390,852	385,437	0.2774	1.00	1408922
1995	280,681	268,534	0.3379	1.00	830611
1996	404,884	398,476	0.3843	1.00	1053595
1997	201,928	191,991	0.4264	1.00	473547
1998		368,667	0.3340	1.00	1103741

Table 2. Albemarle Sound Blueback herring juvenile abundance index, 1972-1998.

Year	JAI
1972	320.46
1973	362.93
1974	83.27
1975	123.36
1976	157.36
1977	103.20
1978	77.33
1979	174.12
1980	222.63
1981	1.00
1982	68.94
1983	228.67
1984	18.87
1985	139.69
1986	13.78
1987	25.05
1988	10.95
1989	0.02
1990	9.16
1991	21.75
1992	0.93
1993	67.30
1994	0.00
1995	1.18
1996	14.87
1997	7.24
1998	0.44

Table 3. Chowan River pound net fishery blueback herring catch at age.

	Age					
Year	3	4	5	6	7+	Sum (3-9)
1972	3463302	7728025	6517914	2352378	301791	20,363,410
1973	609732	4553269	4929395	3254753	537369	13,884,518
1974	125560	4886185	4330173	2538488	262223	12,142,629
1975	190280	4958701	1923176	198798	14513	7,285,468
1976	354726	6144407	4654402	805114	162217	12,120,866
1977	0	4384858	10078202	1816140	435789	16,714,989
1978	260665	3444138	5021707	763513	273094	9,763,117
1979	209628	1072062	2209701	1171851	258205	4,921,447
1980	40901	1697287	2861666	2018912	998878	7,617,644
1981	19580	920821	1671494	1030063	717885	4,359,843
1982	1027384	5918199	2801163	1573438	1187098	12,507,282
1983	448603	3035315	2080419	351876	39840	5,956,053
1984	1054265	4013551	3346091	635622	0	9,049,529
1985	573864	2511223	10317409	4554865	172667	18,130,028
1986	245195	2703555	5014043	2974390	320466	11,257,649
1987	261620	2583543	1303999	538213	114326	4,801,701
1988	529807	2259583	778316	156093	47205	3,771,004
1989	209553	924866	425759	83628	0	1,643,806
1990	407126	560133	252362	51261	6291	1,277,173
1991	786731	1371874	711753	166948	38610	3,075,916
1992	78672	1317041	691089	179035	12311	2,278,148
1993	66024	262210	898560	282730	53089	1,562,613
1994	254389	643723	393400	100637	16773	1,408,922
1995	23644	323960	446828	22888	13290	830,610
1996	103564	373949	387701	145665	42715	1,053,594
1997	65398	184069	138230	77543	8308	473,548
1998	38060	352055	580415	102286	28545	1,101,362

Table 4. Estimated fishing mortality and approximate confidence intervals.

Year	F	90% Confidence Interval	Exploitation Rate
1972	0.820	0.8 - 0.85	46%
1973	0.820		
1974	0.820		
1975	0.820		
1976	0.820		
1977	0.820		
1978	0.820		
1979	0.820		
1980	0.820		
1981	0.820		
1982	0.820		
1983	0.820		
1984	0.820		
1985	0.820		
1986	0.820		
1987	0.820		
1988	0.820		
1989	0.820		
1990	0.820		
1991	0.820		
1992	0.820		
1993	0.820		
1994	0.820		
1995	0.597	0.5 - 0.58	36%
1996	0.902	0.8 - 1.25	49%
1997	0.331	0.25 – 0.4	22%
1998	0.823	0.4 – 1.05	46%

Table 5. Chowan River Blueback herring spawning stock biomass and recruitment 1972-1998. Recruitment includes a 3 year lag, so 1972 recruitment represents the 1972 year class.

Year	SSB Pounds	Recruits, millions of fish
1969		38.007
1970		24.250
1971		22.970
1972	13,110,135	45.308
1973	10,268,791	48.027
1974	7,659,396	22.285
1975	6,647,660	14.527
1976	7,885,693	17.827
1977	8,844,114	8.130
1978	7,328,679	39.329
1979	5,136,393	15.746
1980	3,905,867	34.757
1981	3,837,390	62.692
1982	4,917,156	13.142
1983	5,618,020	9.789
1984	6,954,466	7.378
1985	8,803,910	2.731
1986	7,207,287	3.421
1987	4,078,943	11.524
1988	2,407,730	7.003
1989	1,424,125	2.260
1990	1,170,727	4.215
1991	1,560,647	2.995
1992	1,632,187	2.213
1993	1,186,217	3.943
1994	897,717	2.168
1995	770,788	1.505
1996	742,942	
1997	677,902	
1998	764,886	

Figure 1. Chowan River blueback herring pound net landings in pounds, 1972-1998.

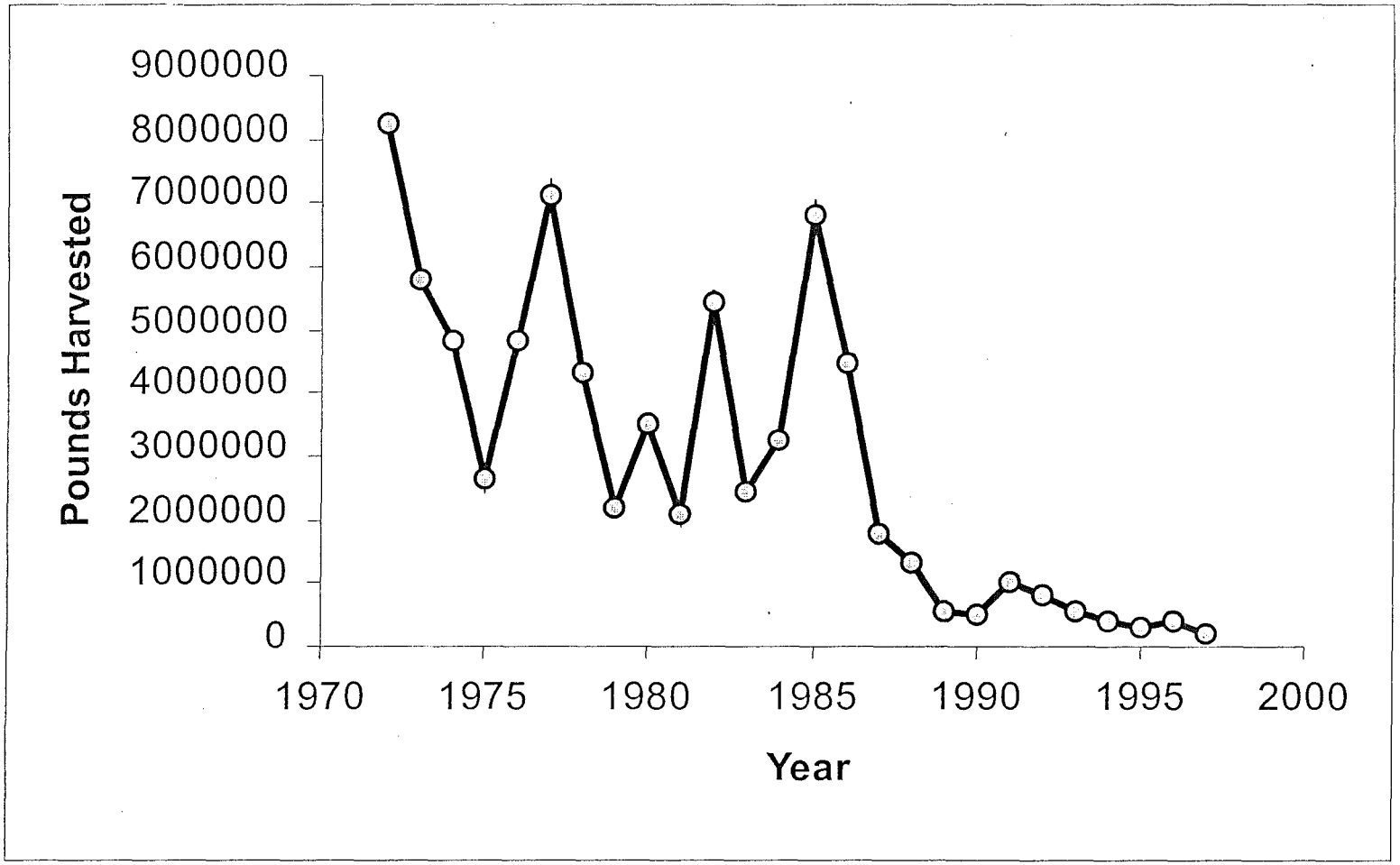


Figure 2. Albemarle Sound blueback herring juvenile abundance index, 1972 –1998.

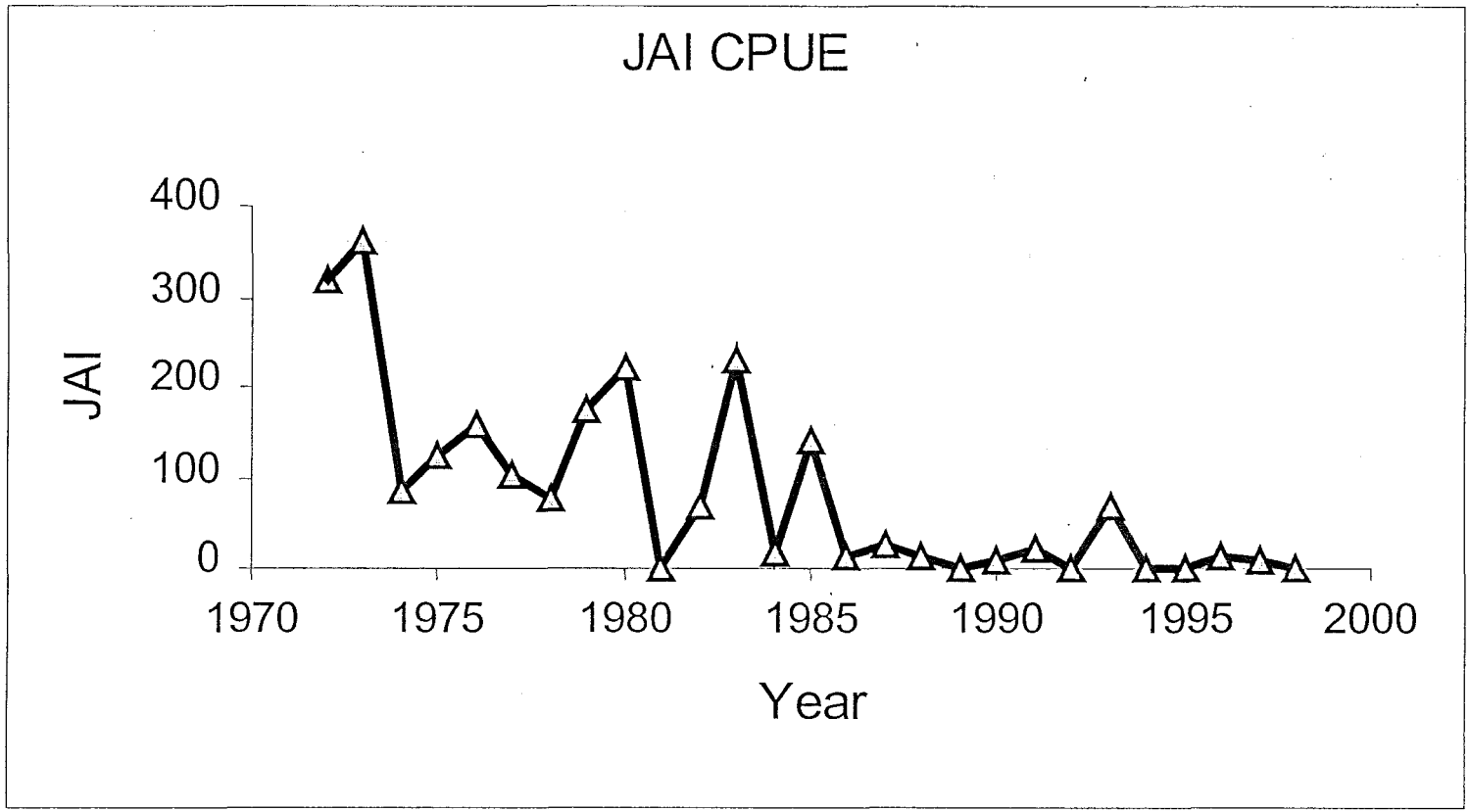
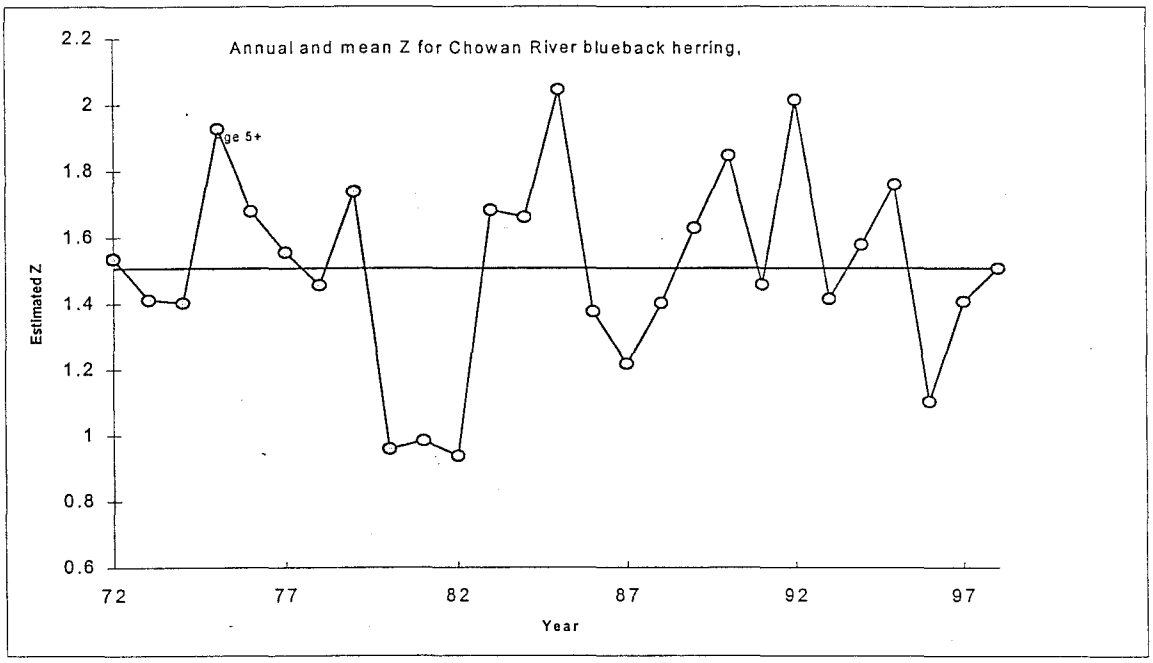


Figure 3. Annual and cohort catch curve estimates of total mortality.



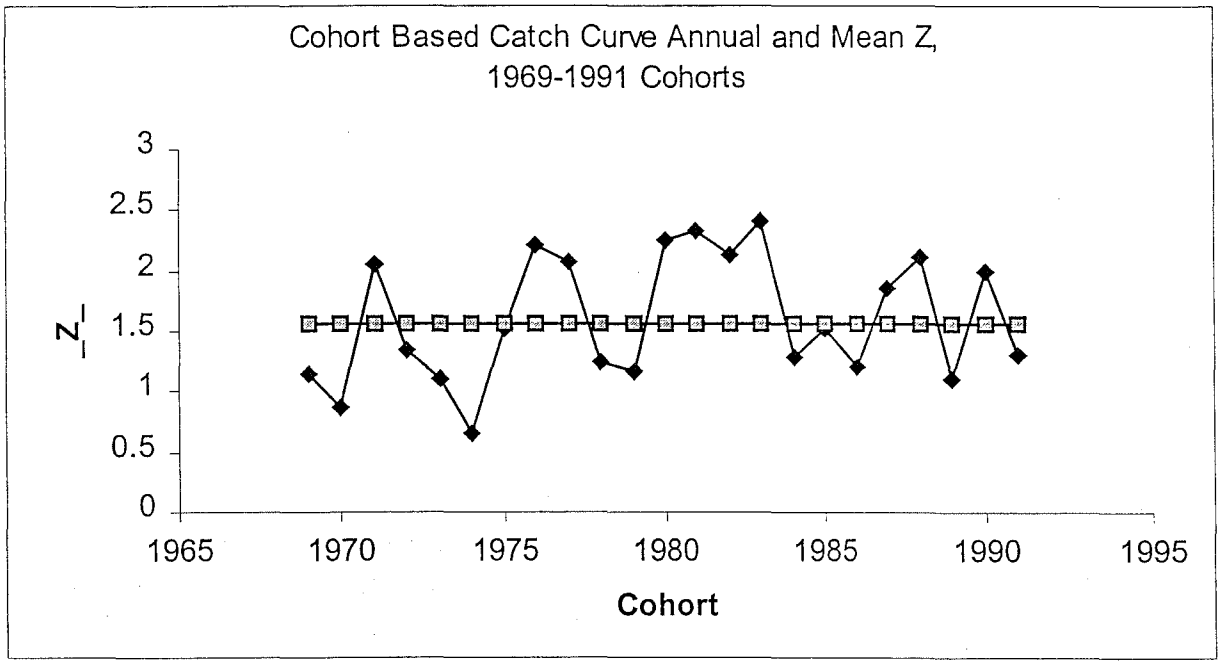


Figure 4. Blueback herring recruitment, 1972-1998.

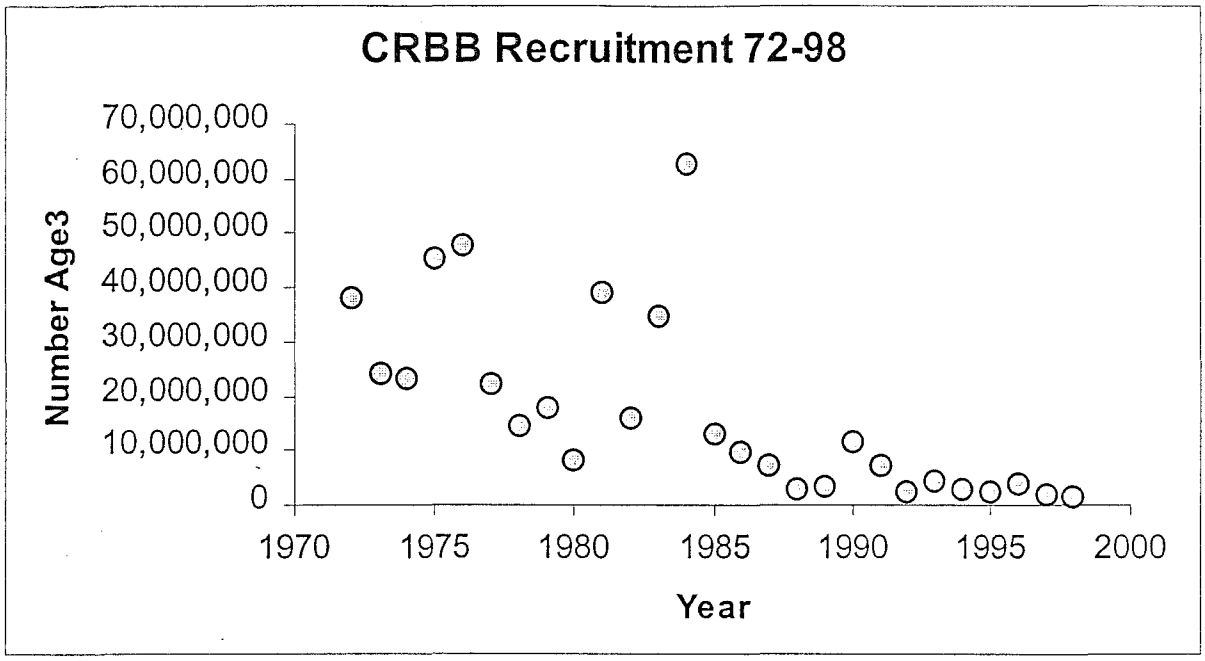


Figure 5. Blueback herring spawning stock biomass in 10k pounds, 1972-1998

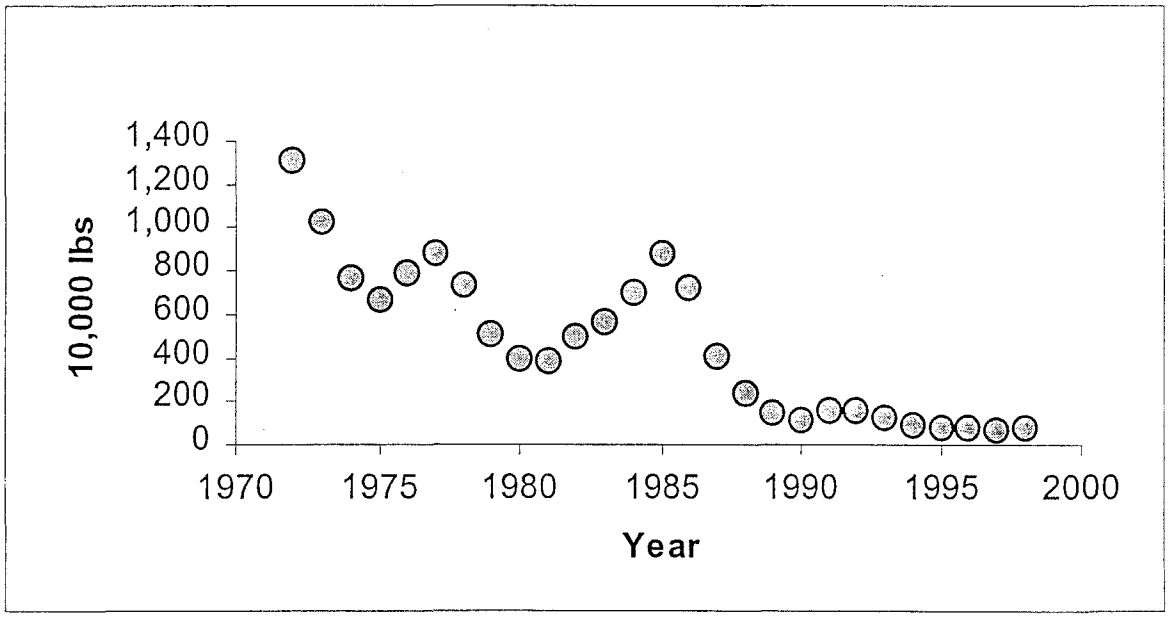


Figure 6. Blueback herring recruitment vs. spawning stock biomass, 1972-1998.

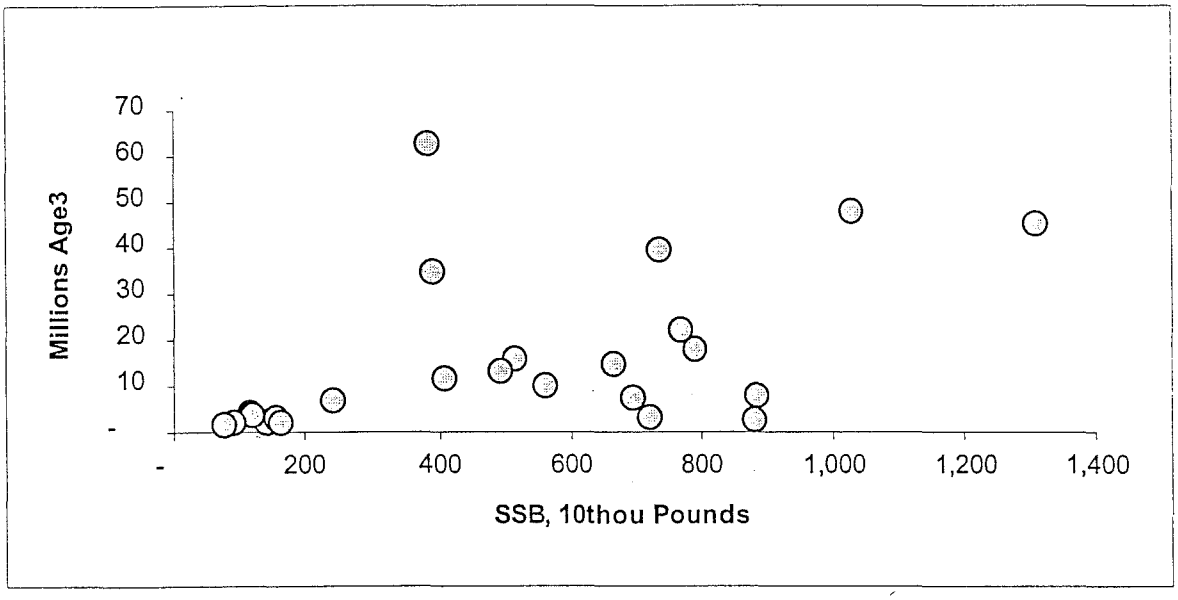


Figure 7. Blueback herring Beverton-Holt stock recruitment model results.

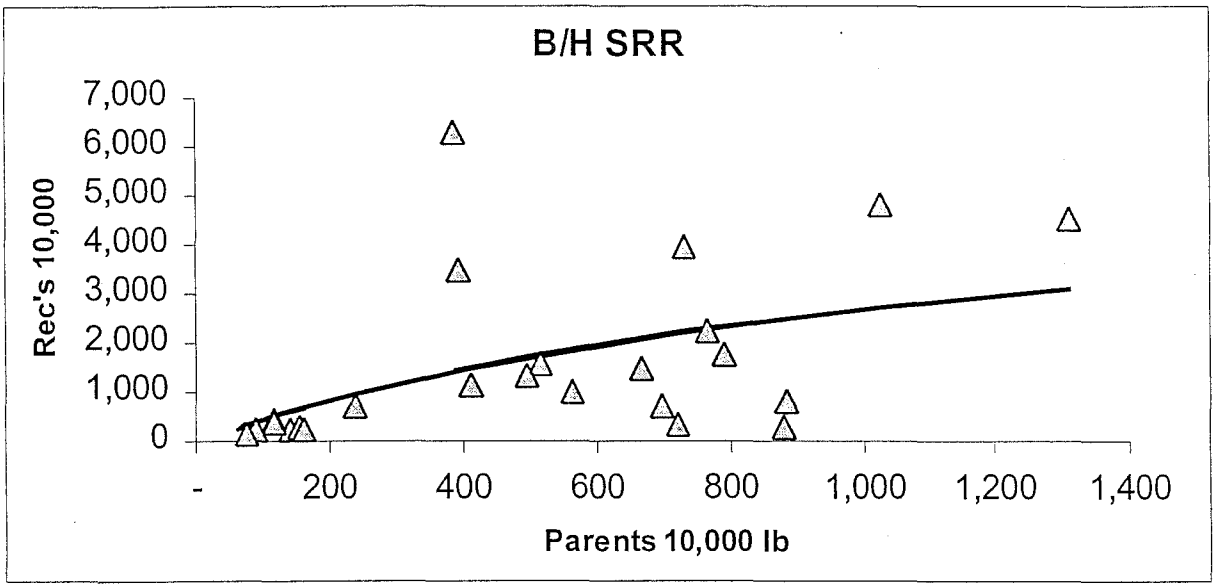


Figure 8. Range of SSB values from projection scenario 1: fixed mortality between 0 and 0.8, observed stock, and low recruitment.

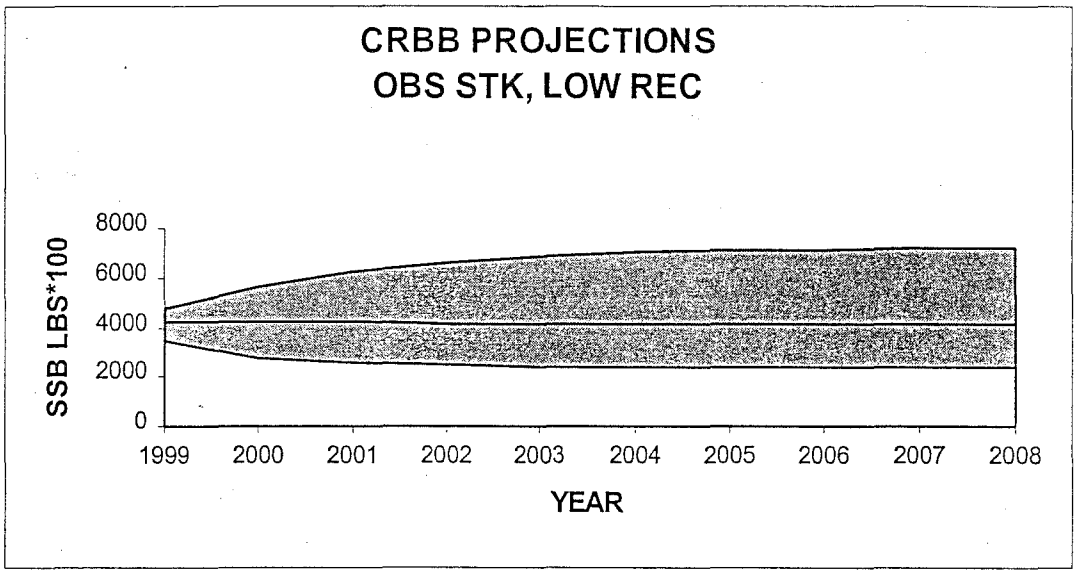


Figure 9. Range of SSB values from projection scenario 1: fixed mortality between 0 and 0.8, observed stock, and high recruitment.

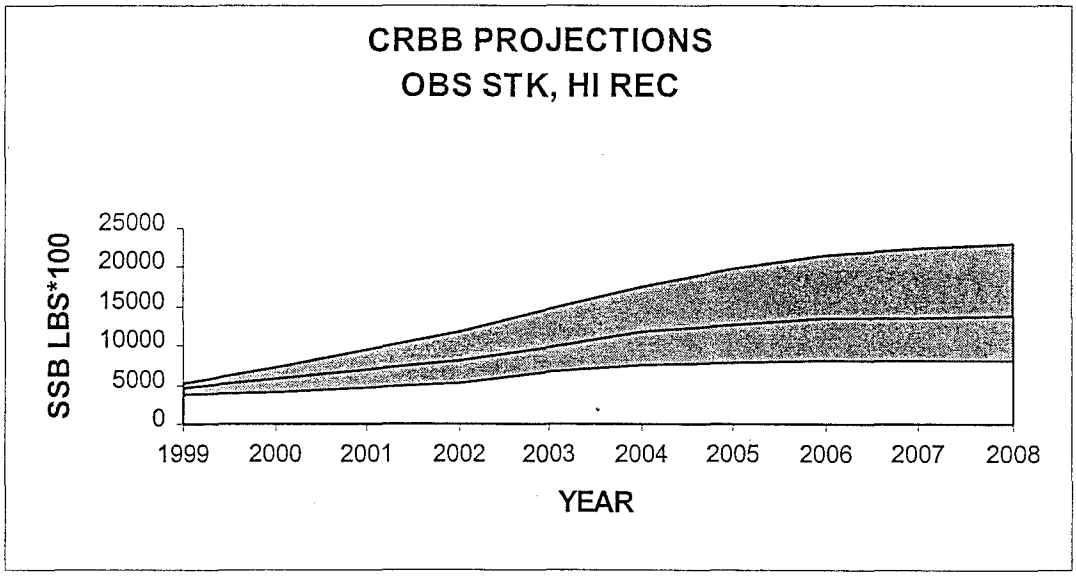


Figure 10. Range of SSB values from projection scenario 2: fixed mortality between 0 and 0.8, increased stock, and low recruitment.

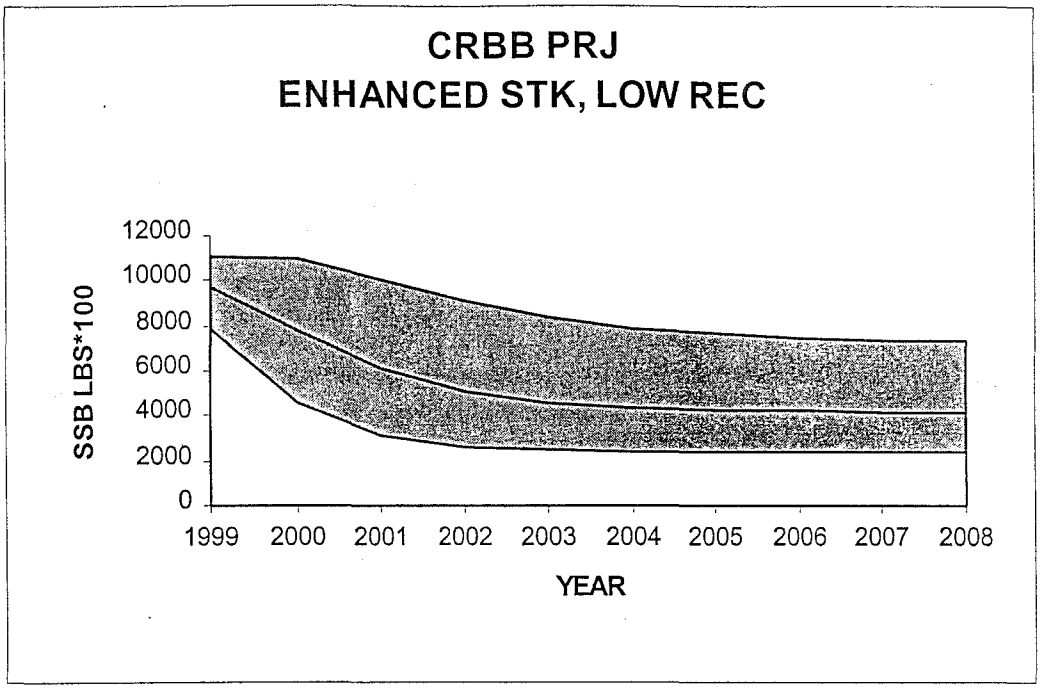


Figure 11. Range of SSB values from projection scenario 2: fixed mortality between 0 and 0.8, increased stock, and high recruitment.

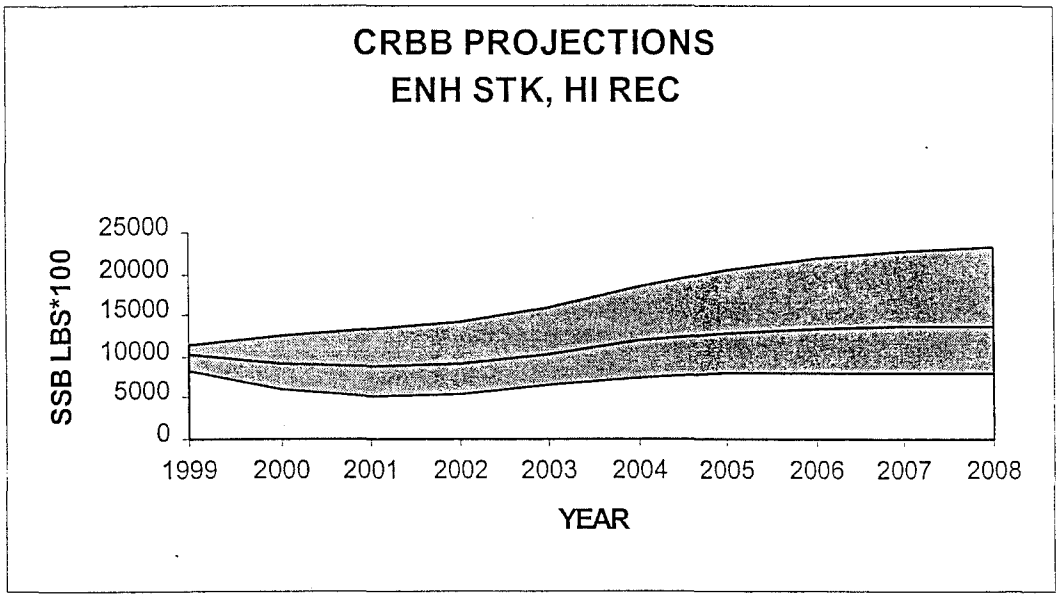


Figure 12. Overall range of predicted SSB values for fixed mortality scenarios 1 and 2.

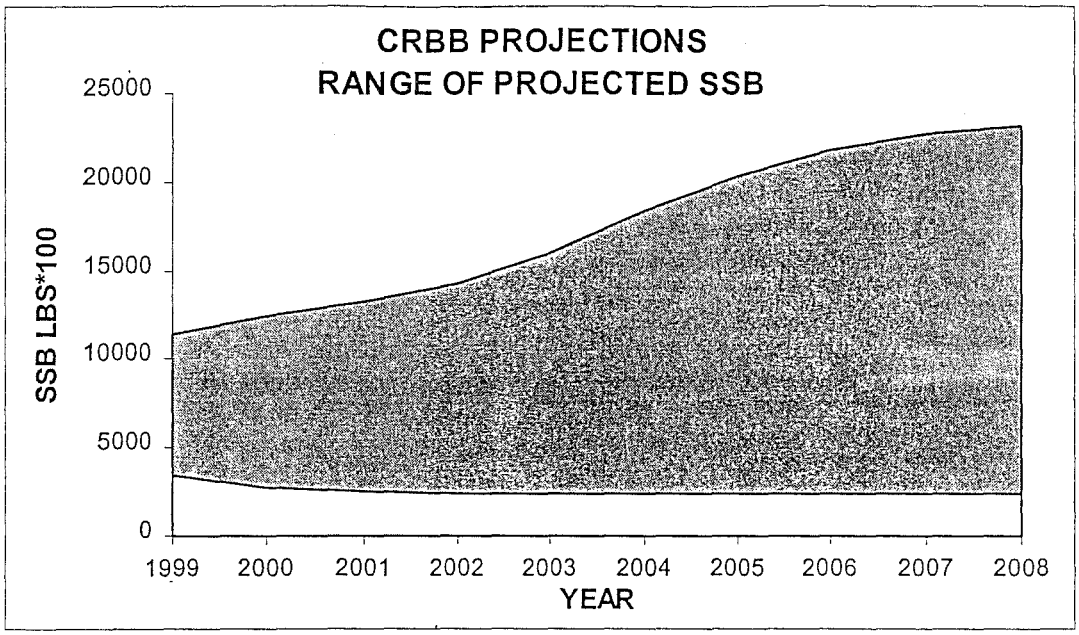


Figure 13. Ten year trends in fishing mortality for fixed harvest scenarios between 0 and 400,000 pounds, based on a stochastic stock recruitment relationship.

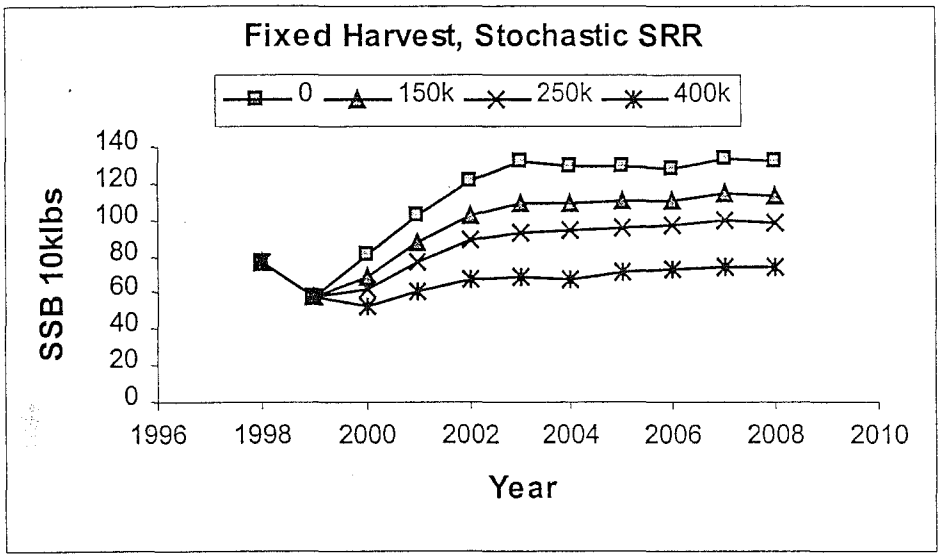


Figure 14. Ten year trends in spawning stock biomass for fixed harvest scenarios between 0 and 400,000 pounds, based on a stochastic stock recruitment relationship.

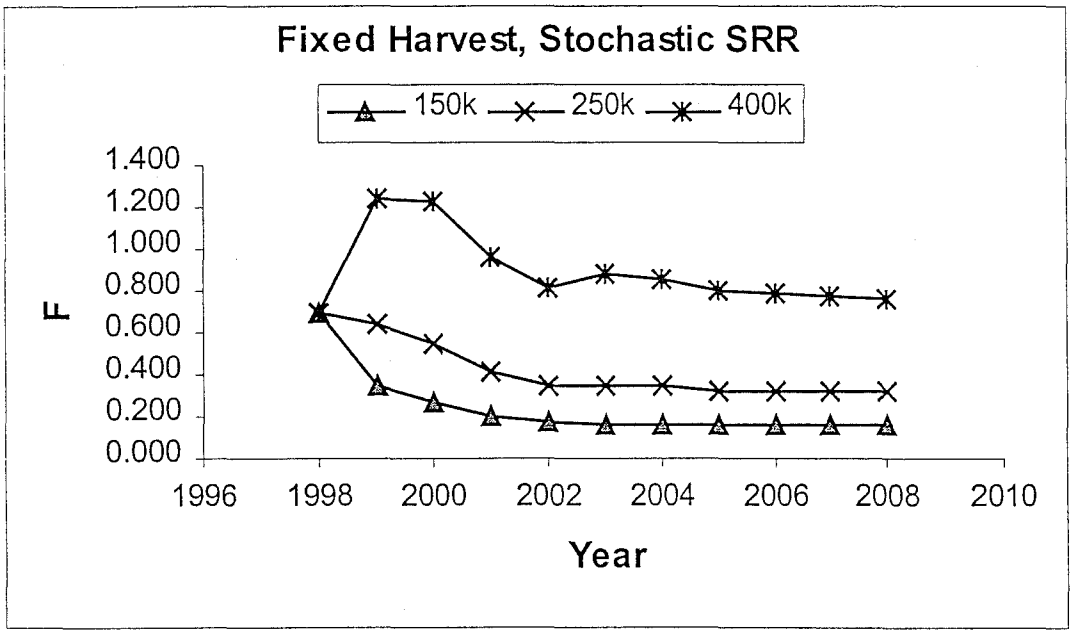
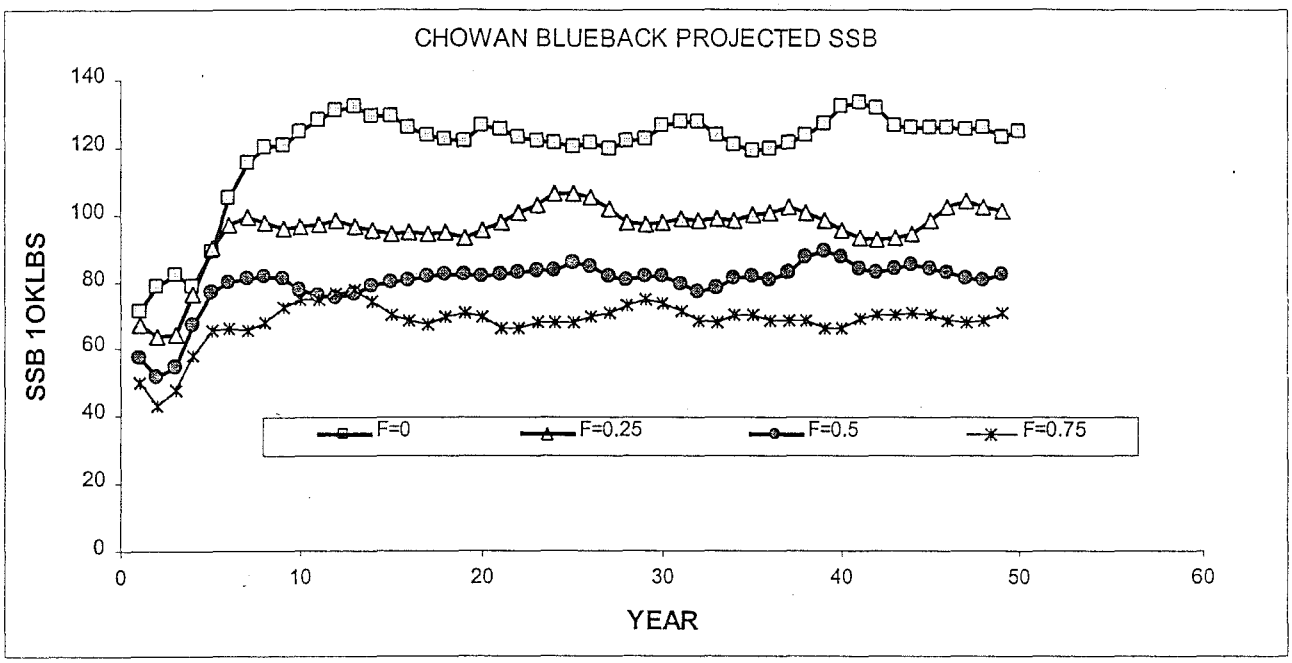


Figure 15. Fifty year trends in SSB for fixed mortality rates between F=0 and F=0.75 based on the average of 50 stochastic stock assessment trials.



Johnson

Attachment E.3

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Marine Fisheries

James B. Hunt, Jr., Governor
Wayne McDevitt, Secretary
Preston P. Pate, Jr., Director

Dear Interested Parties:

Over the last few years, Albemarle-Pamlico Estuarine Study's comprehensive Conservation and Management Plan, the Coastal Futures Committee final report, Governor Hunt's Coastal Agenda, and the Fisheries Moratorium Steering Committee Report have all recommended preparation of state coastal fishery management plans (FMPs). The North Carolina Division of Marine Fisheries (DMF) has developed a process for development of FMPs in response to these recommendations. Approved FMPs for anadromous fishes, such as river herring, will be implemented through adjustments in agency programs and recommendation of needed rules to the North Carolina Marine Fisheries Commission (MFC), which has jurisdiction over fisheries in Coastal Waters, and to the North Carolina Wildlife Resources Commission (WRC), which has jurisdiction over anadromous species in Inland Waters. Anadromous fishes are those which reside in the ocean for most of their adult lives, but return to fresh waters to spawn.

Restoration of anadromous species in North Carolina is conducted in part under a Cooperative Agreement between the DMF, WRC, and U.S. Fish and Wildlife Service (FWS). The agreement specifies that the three agencies will work together to restore anadromous fishes in river basins with historically significant anadromous fishery resources. Cooperation and action from the North Carolina Environmental Management Commission (EMC) and the North Carolina Coastal Resources Commission (CRC) and their supporting agencies- Division of Water Quality (DWQ) and the Division of Coastal Management (DCM)- will be necessary to restore sustainable environmental conditions in some areas.

The DMF recently initiated development of a FMP for river herring in North Carolina. The major emphasis of the plan will be the Albemarle Sound area, since approximately 98% of the state's total river herring landings have historically come from this area. A River Herring Advisory Committee, consisting of fishermen, dealers, and WRC and MFC commissioners has been appointed to provide input on all aspects of the FMP development. A Plan Development Team has been formed using personnel from the participating agencies to review past regulations, report historic and current status of the species, and identify issues, commercial and recreational interest, and socioeconomic factors affecting the fishery.

Public meetings will be held on the attached Public Information Document on October 27, 1997 at the North Carolina Aquarium-Roanoke Island, Manteo and October 28, 1997 at Swain Auditorium, Edenton. Both meetings will begin at 7:00 p.m. I encourage you to attend one of these meetings and provide your comments. If you cannot attend, written comments on the PID will be accepted through November 28, 1997. Please send your written comments to Sara E. Winslow, Biologist Supervisor, NCDMF, 1367 Hwy. 17 South, Elizabeth City, N.C. 27909.

I hope that you will be able to attend one of these meetings. Your input in the development of this FMP and others in the future is a vital part of making these plans successful.

Sincerely,

Preston P. Pate, Jr.
Director

Public Information Document

Fishery Management Plan for River Herring

Prepared by
River Herring Plan Development Team

North Carolina Division of Marine Fisheries
Department of Environment, Health, and Natural Resources
Morehead City, North Carolina 28557

September 1997

900 copies of this public document were printed at a cost of 7cents per copy.

River Herring Public Information Document

I. STATEMENT OF THE PROBLEM

A. Purpose Of This Document

Over the last few years, the Albemarle-Pamlico Estuarine Study's Comprehensive Conservation and Management Plan, the Coastal Futures Committee final report, Governor Hunt's Coastal Agenda, and the Fisheries Moratorium Steering Committee Report have all recommended preparation of state coastal fishery management plans (FMPs). The North Carolina Division of Marine Fisheries (DMF) has developed a process for development of FMPs in response to these recommendations. Approved FMPs for anadromous fishes will be implemented through adjustments in agency programs and recommendation of needed rules to the North Carolina Marine Fisheries Commission (MFC), which has jurisdiction over fisheries in Coastal Waters, and to the North Carolina Wildlife Resources Commission (WRC), which has jurisdiction over anadromous species in Inland Waters. Anadromous fishes are those which reside in the ocean for most of their adult lives, but return to freshwaters to spawn.

Restoration of anadromous species in North Carolina is conducted in part under a Cooperative Agreement between the DMF, WRC and U.S. Fish and Wildlife Service (FWS). The agreement specifies that the three agencies will collaboratively work to restore anadromous fishes in river basins with historically significant anadromous fishery resources through a combination of appropriate fishery management techniques. Cooperation and action from the North Carolina Environmental Management Commission (EMC) and the North Carolina Coastal Resources Commission (CRC) and their supporting agencies- Division of Water Quality (DWQ) and the Division of Coastal Management (DCM) - would be necessary to restore sustainable environmental conditions.

The DMF has recently initiated the development of a FMP for river herring in North Carolina. A Plan Development Team (PDT) has been formed using personnel from the participating agencies to review past regulations, report historic and current status of the species, and identify issues, commercial and recreational interests, and socioeconomic factors. In addition, a River Herring Advisory Committee (RHAC) has been named to work with the PDT in developing the FMP.

Through this Public Information Document (PID), DMF is actively seeking input from all interested parties including fishermen, dealers, managers, conservation interests, scientists, and the general public. The information included in the PID will be the focus of meetings at which the public will be invited to share their views, concerns and ideas on how best to manage this fishery.

The purpose of the FMP process, developed by DMF, is to produce a series of public documents which clearly state the goals, objectives, and strategies which will guide the agencies in managing fishery resources. Preparation of the FMPs will include significant public participation, principally through an Advisory Panel for each FMP. Approval of both Commissions will be required for implementation of FMPs for anadromous fishes. Preparation of this FMP for river herring (alewife and blueback herring) is required as specified by the MFC (NC Division of Marine Fisheries 1995).

Because environmental impacts affect the viability of many species, when appropriate, recommendations will also be made to the EMC and the CRC. These recommendations will be focused on the preservation and/or rehabilitation of water quality and habitat which will require actions relative to issues under the jurisdiction of these commissions. The recommendations will also be included in Habitat Protection Plans to be developed at a later date by the North Carolina Department of Environment, Health, and Natural Resources (DEHNR).

Overall management of river herring stocks on the East Coast of the United States is under the jurisdiction of the Atlantic States Marine Fisheries Commission (ASMFC), of which North Carolina is a member state. The Commission's responsibility rests on the federal Atlantic Coastal Fisheries Cooperative Management Act passed by Congress in 1993. North Carolina's rules for river herring are currently in compliance with the provisions of the existing ASMFC management plan (ASMFC 1985 and 1988). Under the ASMFC management structure, a revised management plan is being prepared by the Shad and River Herring Plan Development Team, working with the Shad and River Herring Advisory Panel, Shad and River Herring Technical Committee and Shad and River Herring Management Board (Board). Once approved by the Board, the plan will be approved by the Interstate Fishery Management Program Policy Board for implementation. Rules in North Carolina will then be revised to comply with the

new ASMFC plan.

Available data along the East Coast indicate a decline in river herring populations. The ASMFC FMP for shad and river herrings cites several reasons for the decline, including dam construction; foreign overfishing in the ocean during the late 1960s and early 1970s; degradation of water quality through eutrophication, blue-green algae blooms, and anoxic conditions; channelization of swamps and creeks which serve as spawning areas; and loss of spawning and nursery areas. The overall decline in North Carolina, as well along the East Coast, is probably caused by a combination of these factors. Abundance along the Atlantic Coast has fallen by 90% or more in many areas; including North Carolina.

B. Life Histories

River herring is a term commonly applied to blueback herring (*Alosa aestivalis*) and alewife (*Alosa pseudoharengus*). The coastal range of blueback herring is from Nova Scotia to Florida. The coastal range of the alewife is farther north, from Newfoundland to South Carolina. River herring feed on zooplankton (amphipods, copepods, isopods, mysids, and decapod larvae). Blueback herring and alewife are pelagic schooling species which live as adults in the ocean and undertake spawning migrations to freshwater to spawn.

In North Carolina, the spawning season for alewife occurs from mid-February through April, with the peak occurring in late March - early April. Optimum water temperatures for alewife spawning range from 10.5 to 20.0°C. Blueback herring spawning occurs from the end of March through mid-May, with the peak normally during mid-April. Optimum water temperatures for blueback herring spawning range from 16 to 20°C.

The historical average size at sexual maturity for both species is approximately 9.8 inches. Mean size- at- age data for the Albemarle Sound area (1972-1996) show a decrease in the overall size of 1-2 inches since the mid-1970s (Figure 1 and Figure 2). Most male blueback herring are mature at age 3 or 4, while most females mature at age 4 or 5. Virtually all blueback herring are sexually mature by age 5. Most male alewife first spawn at age 3 or 4, and females mature at 4 or 5 years of age. Both species exhibit repeat spawning; that is, once a fish has

spawned, it will return during following years to spawn again. Spawning areas have been documented throughout the Albemarle Sound area, including the sound and its tributaries. A female river herring can lay several hundred thousand eggs. After external fertilization, the semi-sticky eggs (measuring about 1 millimeter in diameter) adhere to the bottom or submerged debris. Eggs hatch in about 2-7 days, depending on the water temperature.

Juvenile alewife and blueback herring spend their first growing season in fresh to brackish waters, migrating to more saline waters as the water temperatures decrease in the fall. At this time juvenile alewife measure approximately 3.5 inches, while blueback herring are approximately 2 inches in length. Some juveniles may spend their first winter in the sounds close to the ocean. Both species then remain in the ocean until reaching sexual maturity.

Both species make extensive migrations along the Atlantic Coast, spending the summer and fall in the waters offshore Cape Cod to eastern Canada until returning to coastal spawning areas during the late winter/spring.

C. Stock and Fishery Status

River herring have been subjected to intensive exploitation along the Atlantic coast since Colonial times; however, landings have declined greatly in most of the coastal states in the past twenty years. With the implementation of the Magnuson Fishery Conservation and Management Act of 1976, foreign catches, which grew to equal domestic catches in the late 1960s and early 1970s, declined to near zero, but domestic landings have yet to recover.

Landings peaked in North Carolina during 1887 at 23.7 million pounds (mlb). The landings and values have fluctuated significantly over the years. The most recent peak occurred in 1985 at 11.5 mlb, which was higher than any of the 13 previous years (Figure 3). The trend since 1985 has continued down with 1994 landings being the lowest recorded (608,503 lb) up to that time.

In 1995, a fishing season was implemented by MFC rule (DEHNR 1996, 15 NCAC 3M.0513), which prohibited taking blueback herring, alewife, American shad and hickory shad by any method from April 15 through January 1. This rule

has reduced harvest greatly since 1995.

River herring landings during the 1995 season totaled 434,869 pounds. In 1996, the rule was suspended, extending the season for ten days. Once the season was extended, the Chowan River pound net fishery operated on a 250,000 pound total allowable catch (TAC). The total harvest in 1996 was 529,503 pounds from all gears and all areas. It should be noted that river herring landings during some years do not necessarily reflect the amount of fish available, but may reflect to some degree, environmental and market conditions. Since 1988, regulations enacted for striped bass conservation (gill net mesh size restrictions, yardage restrictions, area closures) have impacted river herring harvest in the Albemarle Sound area.

Fishing effort (i.e. number of nets) in the Chowan River pound net fishery has continuously declined each year since 1987 (Figure 4). The average number of pound nets set each week in 1977 was 539, compared to 451 in 1987. Prior to the season being implemented in 1995, effort had decreased to 147 nets in 1994. Aerial flights were made weekly during spring 1995, 1996, and 1997 to determine the number of pound nets set. Based on the flights, the average number of nets set during the 1995 season was 60 nets, 79 nets were set in 1996, and during 1997, 92 nets were set.

Several members of the River Herring Advisory Committee (RHAC) feel that, since the season has been implemented, some nets (8-10) may have been set only to satisfy the Pound Net Permit requirements (DEHNR 1996, 15 NCAC 3J.0107). These nets were not actively fished and probably were not a factor in the harvest or economic value. However, this anecdotal evidence can not be refuted or substantiated due to the historic inability of determining whether the nets were actively fishing. Therefore, determination of Pound Net Weeks (PNW) and subsequent Catch-Per-Unit-of-Effort (CPUE) may not be precise. (PNW is the number of pound net sets times the number of weeks fished.)

Although the CPUE measured by PNW has also fluctuated, the CPUE for pound nets has increased during two of the last three seasons. In 1977, the CPUE was 14,895 pounds per net, declining to 5,189 pounds in 1987, to only 2,632 pounds per net in 1994, an all time low (Figure 5). In 1994, DMF began a new harvest data collection system through the trip ticket program which may affect comparisons with former years. Although CPUE for pound nets in the Chowan

River has increased since 1995, there are no data on CPUE for gill nets or other methods of harvest although DMF trip ticket data show that gill nets and other gear account for 25-43 % of the river herring harvest.

The juvenile abundance indices for blueback herring and alewife have fluctuated over the years in the Albemarle Sound area. Eleven seine stations have been consistently sampled monthly during June-October of each year since 1972. The highest CPUE recorded for blueback herring was in 1973 (362.9 fish/seine); the lowest was in 1994 (0 fish/seine), part of a very low CPUE trend covering 1986-1996 (Figure 6). The twenty- five year average CPUE for blueback herring is 78.9. In 1980, a CPUE of 12.4 fish/seine was recorded for alewife; other years were much below that level (Figure 7). The average CPUE for alewife during the 25 year period is 2.7 fish/seine.

The age structure of the commercial river herring harvest in the Albemarle Sound area has been characterized since 1972, with 3-5 year-old fish dominating both species. The percentage of repeat spawners has decreased from 25% in the early 1970s to less than 3% in the 1990s. The DMF has always targeted for unculled catches, but obtaining unculled catches has not always been possible in recent years. Reduction of research efforts due to lack of funding has resulted in some smaller data sets.

Data for the Albemarle Sound area (1972-1996) for both species and sexes show a general decline in the mean size at age (1-2 inches). However in 1995 and 1996, an increase in the mean size was observed in most ages (Figure 1 and 2). Research conducted by Kornegay (1978) indicated an overlap of size for river herring ages 4 to 6 , which is the expected natural variation in size.

In order to rebuild the spawning population and stabilize recruitment in the blueback herring and alewife stocks, conservation actions may be necessary to reduce fishing mortality rates. Due to the current low stock status, even low harvest poundage can present significant impediments to stock recovery.

All of these factors combined indicate that blueback herring and alewife are depressed. The ASMFC report, "Stock Assessment of River Herring from Selected Atlantic Coast Rivers" (Crecco and Gibson 1990) determined that the status of alewife was "overfished," and blueback herring "fully exploited" in the Chowan

River based on data from the 1980s. An updated stock assessment analysis utilizing 1972-1994 data (Schaaf 1996) shows the Chowan River blueback herring fishery operated for 16 years at levels (population size and landings) above what might be expected for an average maximum sustainable yield (spawners); recruitment has averaged only 31% of the maximum. The fishing mortality rate has averaged 63% above the F_{msy} ; consequently, yields have averaged only 34% of maximum sustainable yield (MSY). (Fishing mortality is a measurement of the rate of removal of fish from a population by fishing. MSY is the largest catch that can be taken continuously from a stock under average environmental conditions.) An update of the blueback herring assessment utilizing the 1995-1997 data and an analysis for alewife from the Chowan River pound net fishery will occur later in 1997.

River herring assessments (spawning area surveys, juvenile abundance sampling, size, age, and sex composition of the harvest) were conducted in the Tar-Pamlico, Neuse, and Cape Fear systems in the 1970s. However, all sampling the these areas ceased 1980 due to a reduction in federal funds and loss of staff. Data collection, although reduced, has continued only in the Albemarle Sound area. Recent sampling of the recreational fishery or commercial gears other than pound nets has not occurred.

D. Habitat/ Water Quality

Changes in river herring spawning and nursery habitat, coupled with water quality degradation, have contributed to the stock declines. However, due to lack of adequate environmental data, the extent of these impacts can not be quantified. Some areas that once supported significant spawning runs now support only a remnant run.

Factors probably contributing to the decline of blueback herring and alewife include stream channelization, dredge and fill of wetlands, dams and impoundments, industrial water intakes, location of industrial discharges, chemical pollution, replacement of bridges with culverts, turbidity, low oxygen levels, sewerage discharges, inadequate fishway facilities, inadequate control of water release from dams, reduction in spawning habitats, reduction in nursery areas, poor food availability, and spawning areas too easily accessible to fishermen.

Spawning area surveys have been conducted throughout the tributaries of

Albemarle Sound, and use of these areas is documented. The MFC has adopted the following definitions by rules: "Anadromous fish spawning areas are defined as those areas where evidence of spawning of anadromous fish has been documented by direct observation of spawning, capture of running ripe females, or capture of eggs or early larvae" (DEHNR 1996, 15NCAC 3I.0001, (b) 20 (C)). "Anadromous fish nursery areas are defined as those areas in the riverine and estuarine systems utilized by post-larval and later juvenile anadromous fish" (DEHNR 1996, 15NCAC 3I.0001, (b)20(D)).

In conjunction with harvest restrictions, improving water quality, removing impediments to migration, and restoring spawning habitat would have positive impacts on the river herring stocks.

II. DESCRIPTION OF THE FISHERIES

A. Commercial

More than 90% of the total East Coast landings of river herring between 1978 and 1987 were taken from rivers in North Carolina, Virginia and Maine, with 54% of the total coming from the North Carolina pound net fishery. The river herring gill net fishery has grown relatively more important to the overall river herring harvest, in recent years. North Carolina landings between 1978 and 1987 were about 10 times greater than the total Atlantic Ocean harvest of river herring. From 1988 to 1994, North Carolina accounted for 41-75% of the total Atlantic Coast harvest (Figure 3).

Blueback herring and alewife have been important to North Carolina for many generations, with fisheries in the Albemarle Sound area predating the American Revolution. There are some fisheries for these species in all of the major coastal rivers in North Carolina, but the Albemarle Sound and its tributaries are the center of the fishery, accounting for approximately 99% of the state total.

River herring have historically, and continue to be, utilized for human consumption. The filets are generally processed and salted, while the roe is utilized, either fresh or canned. During 1995-1997, the percentage of the river herring harvest utilized for bait ranged from 10.7 to 38.8%.

Historically, haul seines, gill nets, and pound nets have been the predominant capture gears. Approximately 70-85% of the state's total landings of river herring have historically come from the Chowan River pound nets, even though fishing effort has declined almost continuously since the late 1980s. During 1995- 1997, pound nets contributed 62%, 75%, and 57%, respectively, to the total harvest.

B. Recreational

Recreational fisheries for river herring exist throughout coastal North Carolina, again with the Albemarle Sound area being the center. When pursued recreationally, many of the gears employed are the same as commercial gears: drift gill nets, anchor gill nets, bow nets and dip nets. Only a small portion of the recreational harvest is sold through finfish dealers and recorded on trip tickets; thus, the total harvest of this fishery in unknown. It is thought that the majority of river herring captured by recreational fishermen are retained for personal consumption, with some being peddled at the landings. There are no data or sampling programs to substantiate this assumption, and the impact of the recreational fishery on the fishery on the river herring stocks is unknown at this time.

C. Socioeconomic Considerations

Historically, river herring fisheries were economically and socially important, providing substantial direct and indirect employment through harvesting, processing, and shipping. Presently, however, river herring fisheries have a minor impact on area economies and provide minimal seasonal employment. Preliminary data indicate that the processing sector has remained constant, at three operations, for the past five years, compared to a range of 3-7 processors during 1970-1989. The annual processed value peaked at about $1.5 million in 1984. Employment has generally decreased since the late 1980s as the amount of product available and the demand for processing has fallen.

Ex-vessel values varied annually during 1965-1985. In general, total value increased while quantity decreased. After peaking at approximately $846,000 in 1985, the ex-vessel value fell sharply in recent years due to lower landings. However, a rise in the average price per pound was reported in 1994. This increase may be due to improved data collection through the trip ticket program that went into effect in that year, as well as the fact that for the first time ever, the price of roe,

which is often 10 to 15 times or more higher than the per pound fish price, was added into the value. Hence, the total value of North Carolina river herring landings prior to 1994 may have been under-reported as processing decreased and individual fishermen removed roe prior to selling the fish to dealers.

Although, in 1995 river herring landings accounted for less than 1% of the state's total commercial fisheries landings, the fishery ranks in the top two harvests by poundage in three counties that border the Chowan River. In Hertford County, the river herring fishery account for 93% of the county's landings, with a dockside value of $9,332- the highest species value for the county. About 10% of the state's total river herring landings are in Hertford County.

Chowan County's river herring landings make up 15% of that county's landings by pounds and account for about 46% of the state's total river herring landings. The dockside value of $44,185 is the highest in the county.

Bertie County landed about 26% of the state's river herring with a value of $25,191. River herring accounted for 52% of the landings in Bertie County and ranked highest in dockside value.

Chowan River pound net fishermen landed river herring valued at $70,050 and $76,507 in 1995 and 1996, respectively. The average full-time income from herring for these fishermen is probably in the $8,700 to $9,600 annual income range. This is a significant portion of pound net fishermen's annual income given that the mean annual wages for those counties was approximately $17,100 based on North Carolina Labor Market Employment Section statistics (Terry Trexler, Labor Market Information Specialist, North Carolina Employment Security Commission, personal communication). According to DMF data on the average income of North Carolina's commercial fishermen, this income may represent as much a 50% of annual income.

III. STATUS OF THE FISHERY MANAGEMENT PLAN

A. Actions

The Department of Environment, Heath and Natural Resources has

appointed a River Herring Advisory Panel (consisting of fishermen and dealers) to provide input on all aspects of the North Carolina River Herring Fishery Management Plan. The MFC and WRC will schedule public informational meetings on this document. Public comment on the PID will help form the goal and objectives for the plan, which the two Commissions expect to consider for approval in 1998.

IV. MANAGEMENT ISSUES, OPTIONS AND RECOMMENDATIONS

A. Management

Management of these species will be based on scientific data, and advice provided by state and federal biologists, as well as input from the public and the River Herring Advisory Panel. In general, management will strive for long-term sustainable populations supporting viable fisheries.

Some potential fishery management measures which could be included in the final plan include further research, limited entry, quotas, creel limits for the recreational fishery; gear restrictions (mesh sizes, yardage, escape panels, etc.), area restrictions, proclamation authority for seasons, and spawning area closures.

The MFC has the authority to designate spawning and nursery areas, which can influence the actions/rules of the EMC and the CRC. Habitat and water quality concerns would be directed to the EMC and CRC, and their supporting agencies, DWQ and DCM, for action.

B. Identification of Issues

The PID process is being used to identify the issues affecting river herring populations and the fisheries they support. The various user groups, as well as the non-fishing public, will be provided the opportunity to present their concerns over the use and conservation of the species.

C. Research Needs

Reevaluation of spawning areas.

Repeat the 1960s stream survey of coastal streams to determine the present location and extent of river herring populations.
Fecundity study
Quantify and sample commercial gill net fishery
Quantify and sample recreational fishery
Validate juvenile index with harvest
Assess current sampling programs and improve where necessary
Design an adult fishery-dependent data collection program using commercial pound net/gill net fishermen
Design an adult fishery-independent data collection program

D. Draft Fisheries Management Plan Goal

To manage the Albemarle Sound area river herring stocks in a manner that is biologically, economically, and socially sound while protecting the resource, the habitat, and its users. The management plan for river herring will be adaptive and involve regular reviews and responses to new information about the current state of the resource, the habitat, and its users.

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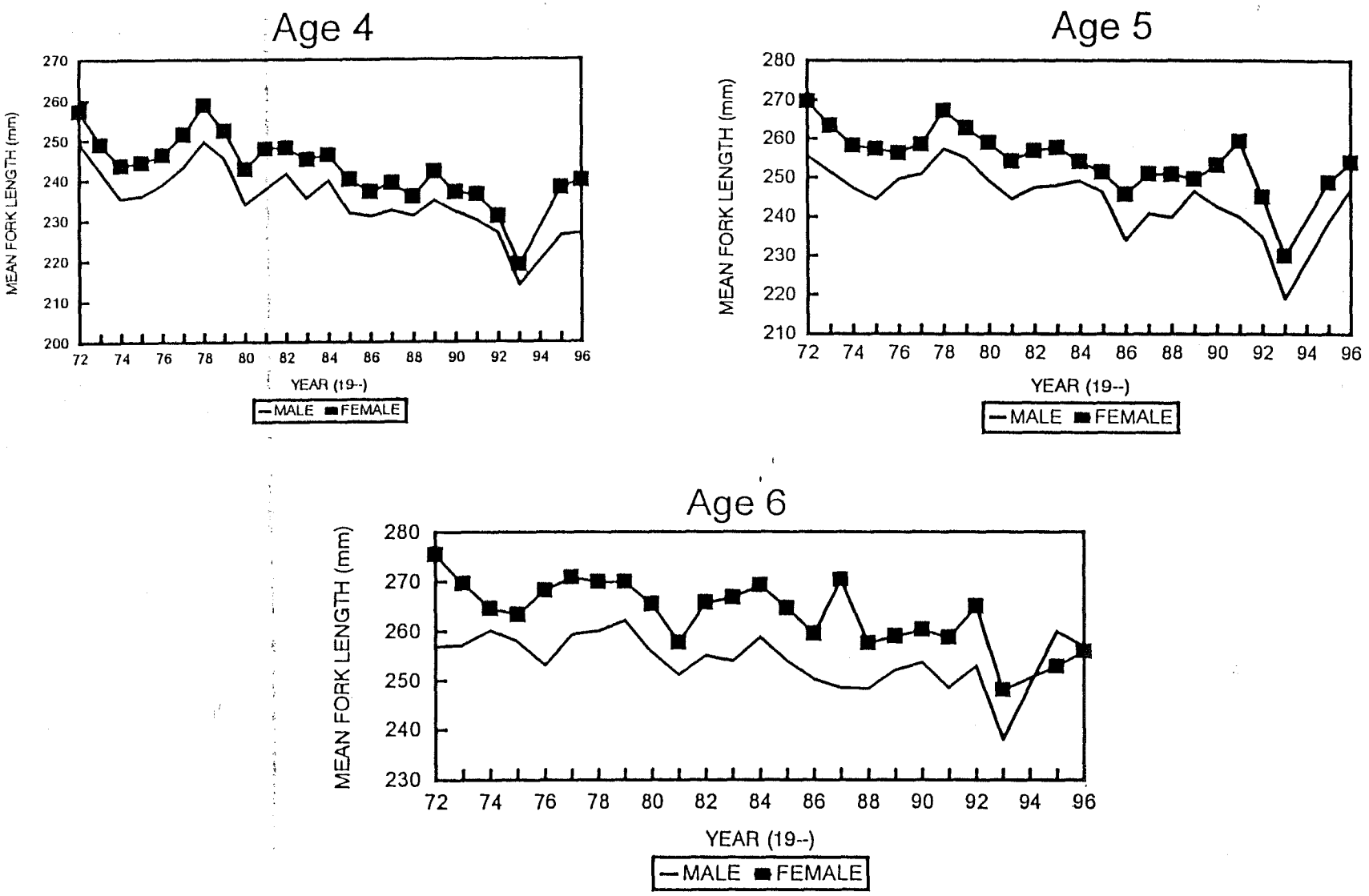


Figure 1. Mean length at age of alewife from the Chowan River pound net fishery, 1972-1996.

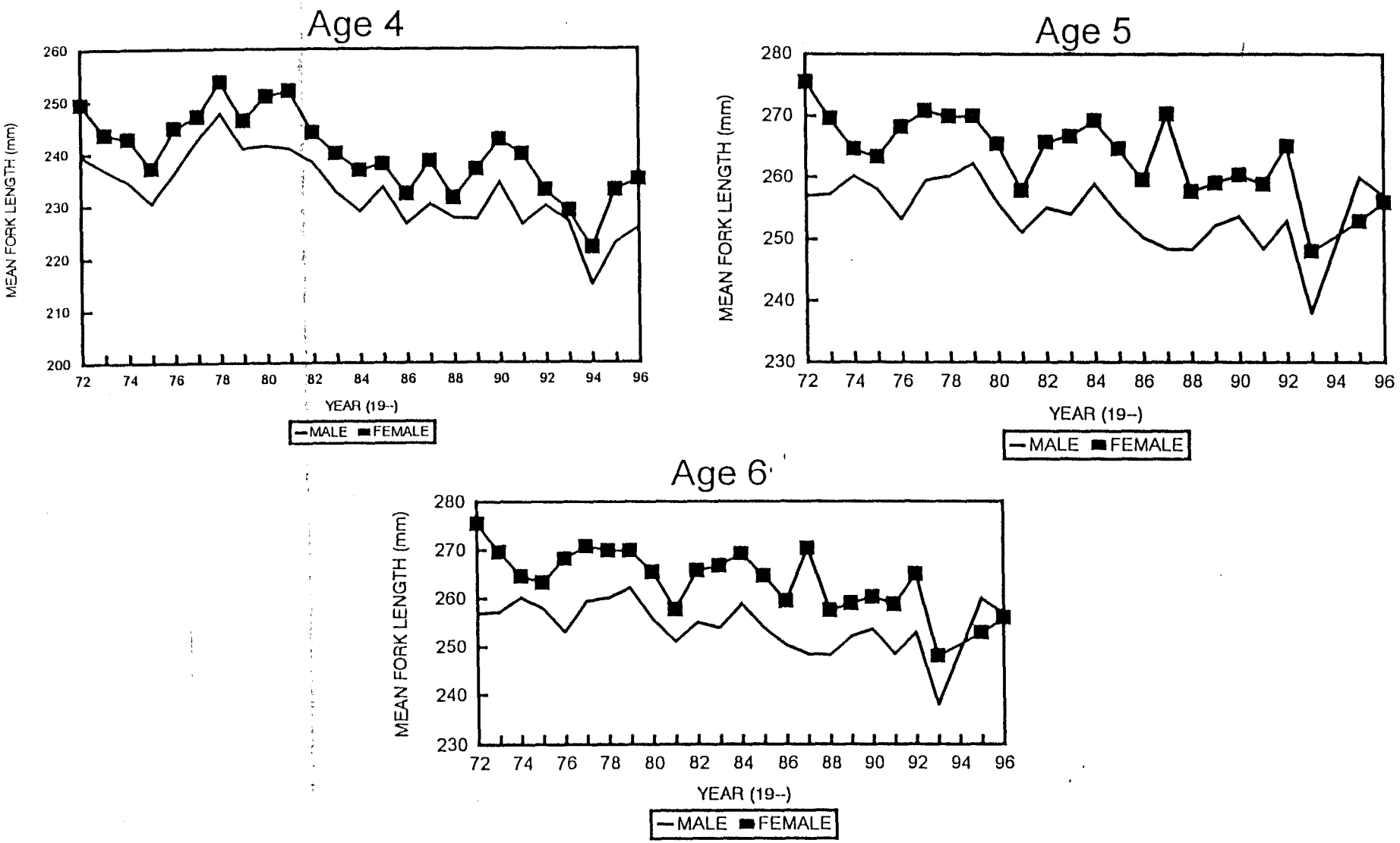


Figure 2. Mean length at age of blueback herring from the Chowan River pound net fishery, 1972-1996.

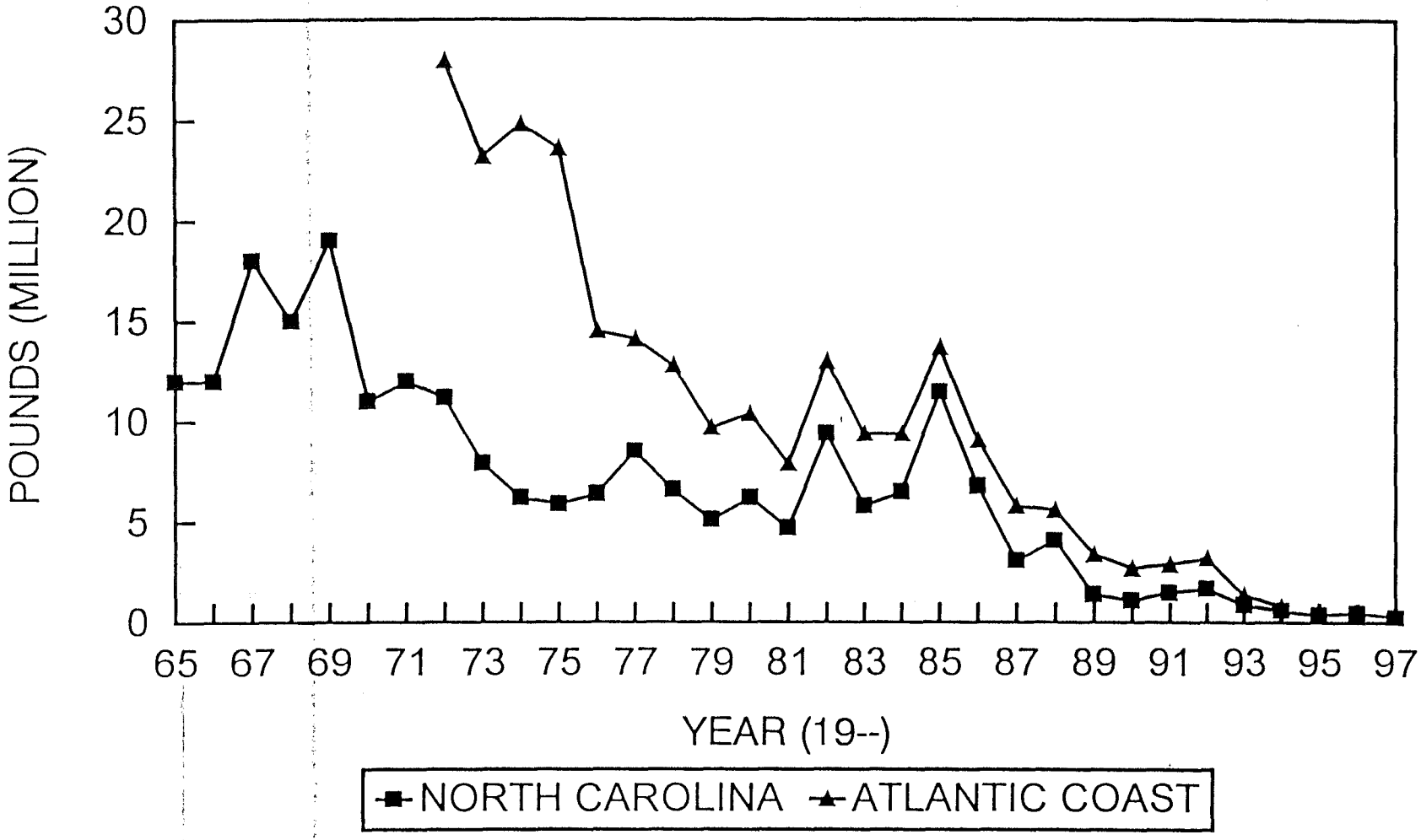


Figure 3. River herring landings, North Carolina and Atlantic Coast, 1965-1997.

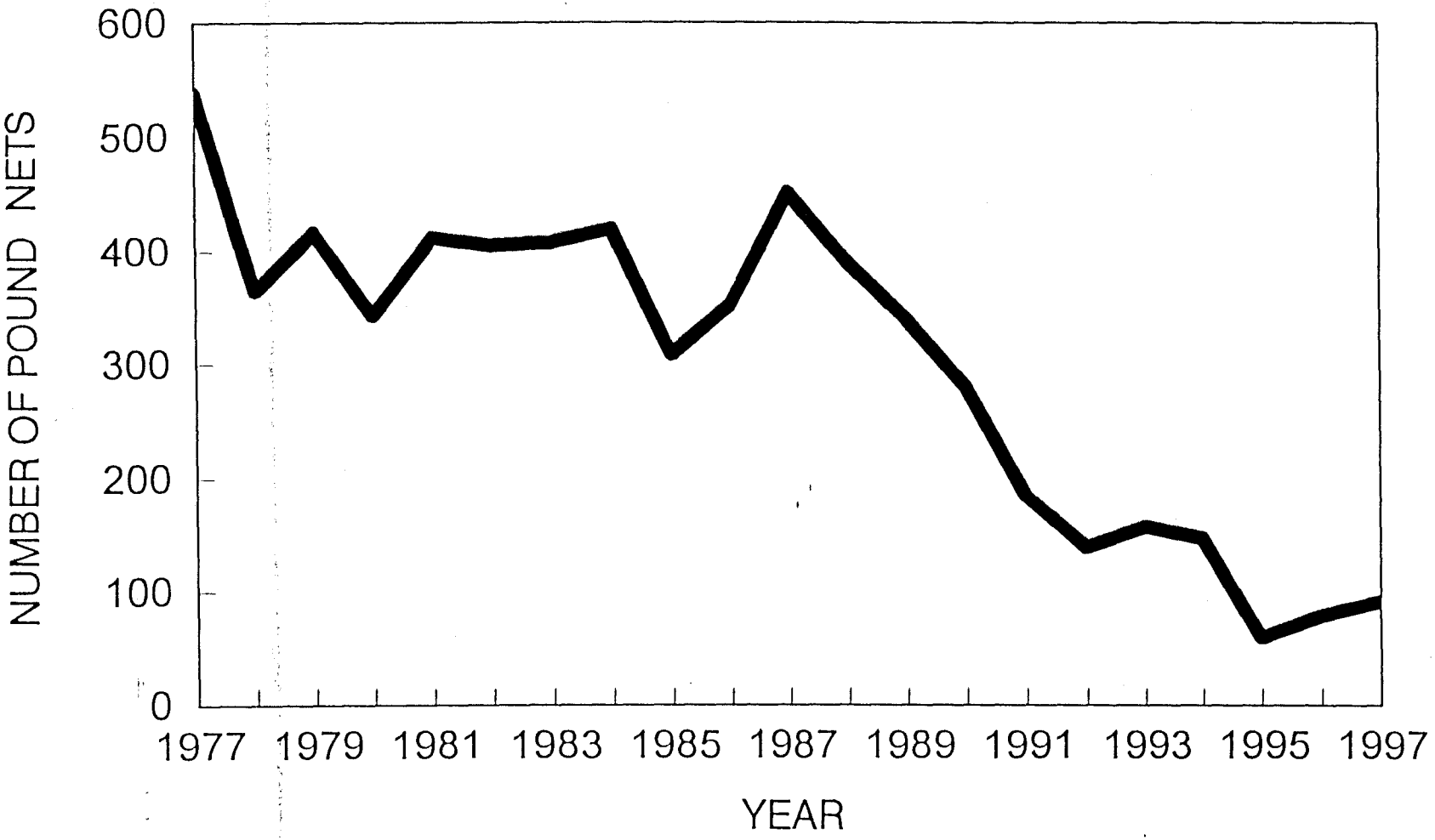


Figure 4. Mean number of pound nets set in the Chowan River, 1977-1997. (RHAC feels that since season implemented in 1995 that some nets (8-10) set to only satisfy Pound Net Permis requirements, but not actively fished.)

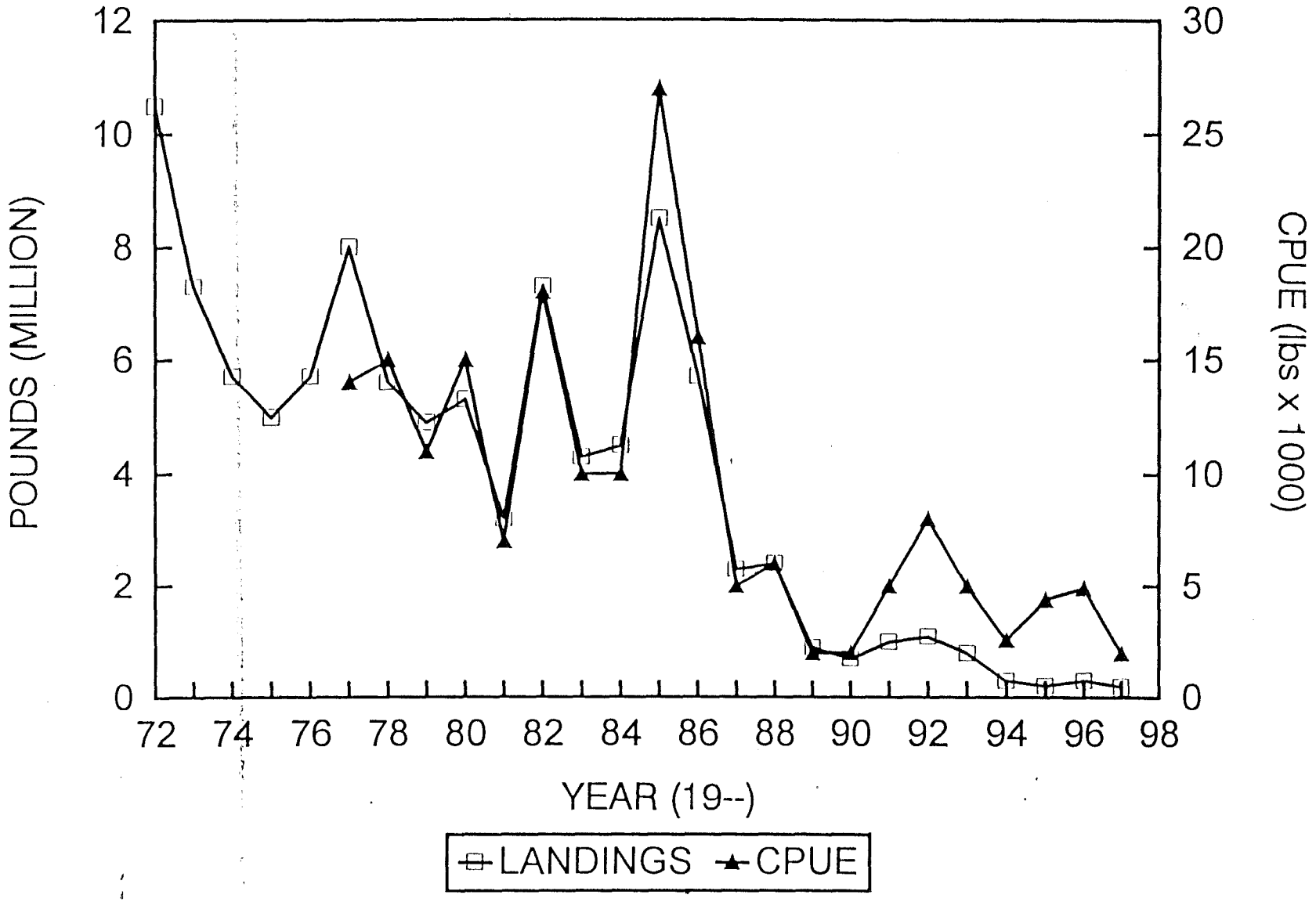


Figure 5. Chowan River pound net landings and catch-per-unit-of-effort, 1972-1997.

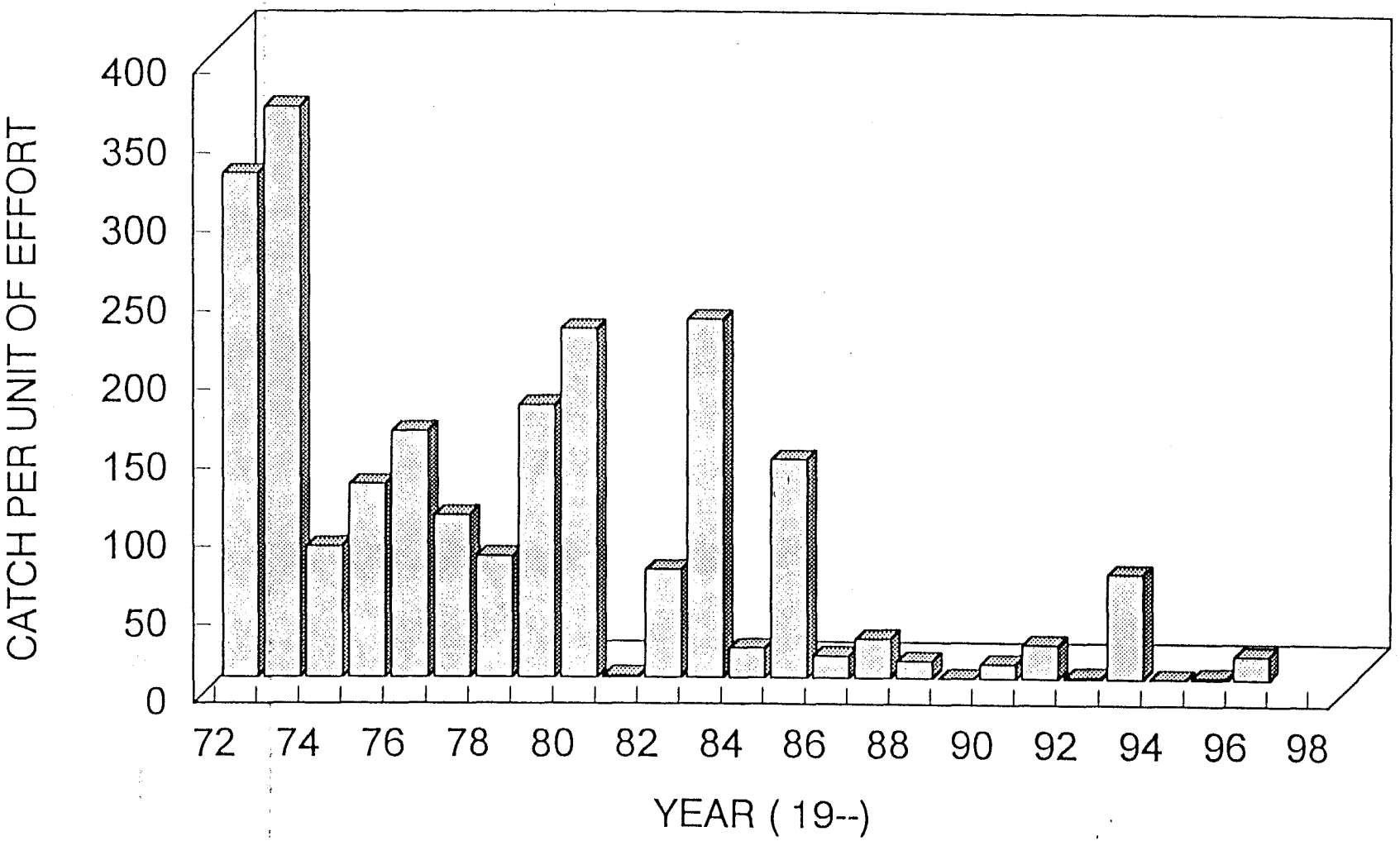


Figure 6. Blueback herring juvenile catch-per-unit-of-effort from the Albemarle Sound area seine survey, 1972-1996. (11core stations)

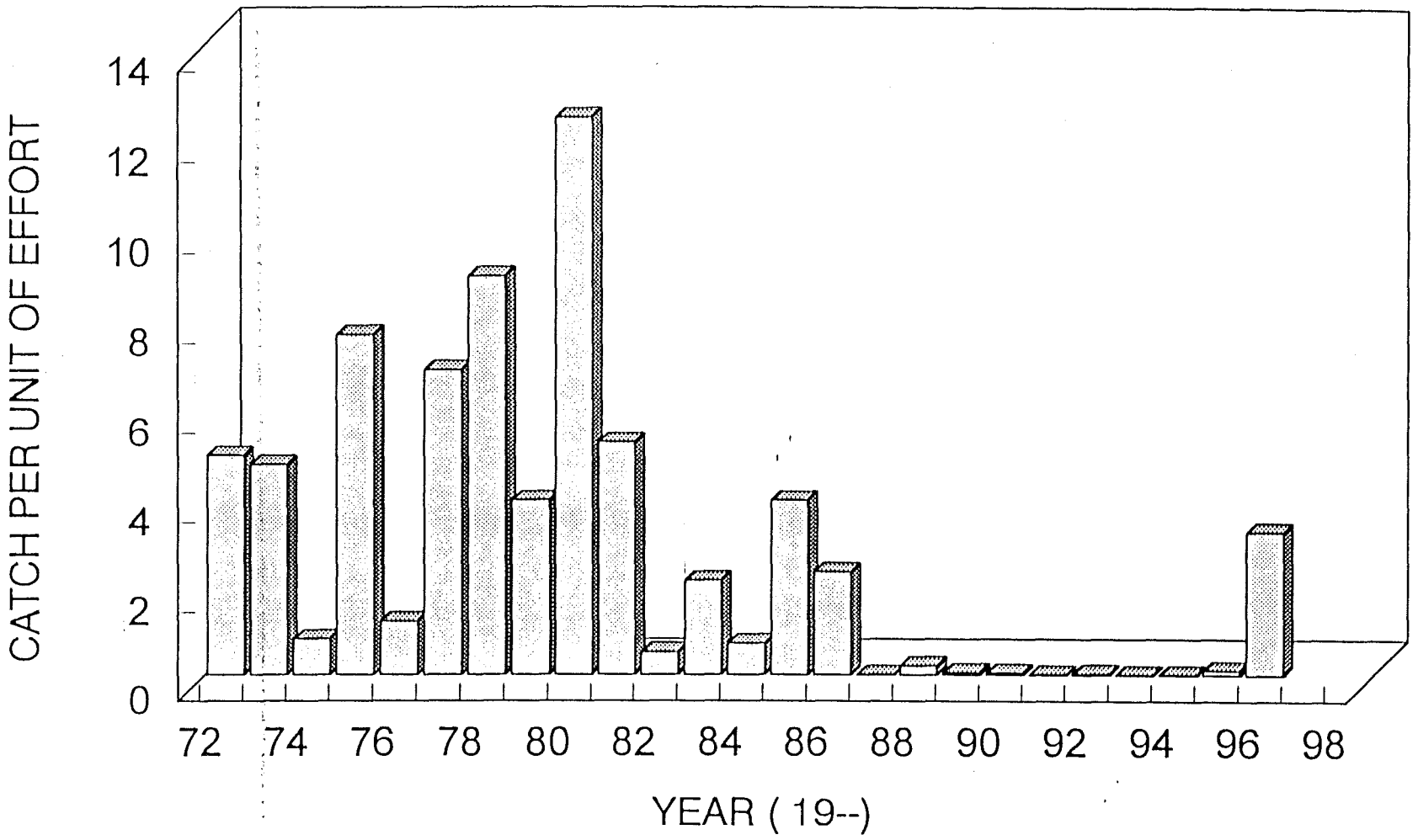


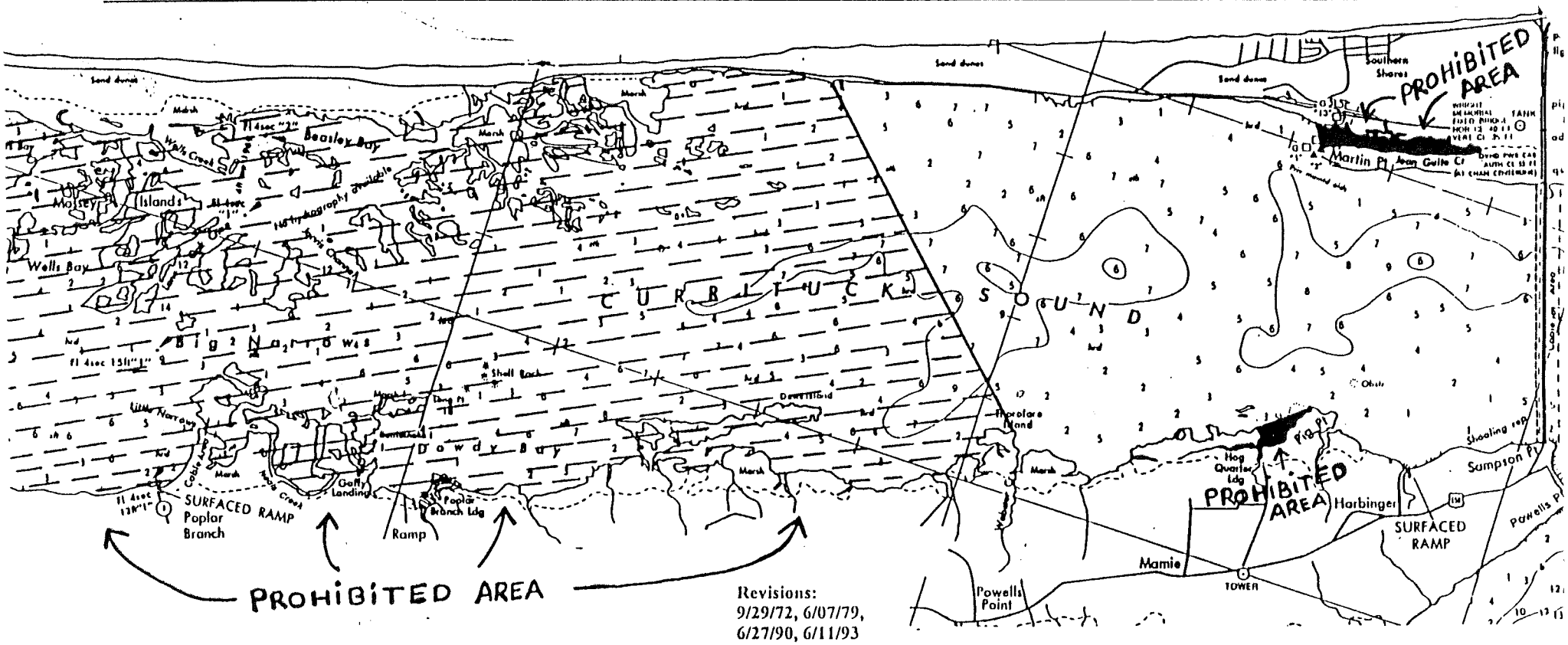
Figure 7. Alewife juvenile catch-per-unit-of-effort from the Albemarle Sound area seine survey, 1972-1996. (11 core stations)

Hardy

PROHIBIT TERRITORY

CURRITUCK SOUND AREA
Area 1-16 (Map 1)

CURRITUCK COUNTY
(Prohibited areas are shaded)



NO PERSON SHALL TAKE OR ATTEMPT TO TAKE ANY OYSTERS, CLAMS OR MUSSELS OR POSSESS, SELL, OR OFFER FOR SALE ANY OYSTERS, CLAMS OR MUSSELS TAKEN FROM THE FOLLOWING AREAS, AT ANY TIME: (SEE BACK OF MAP FOR CONTINUED AREA DESCRIPTIONS.)

(1) CURRITUCK SOUND AREA

(a) Currituck Sound - All those waters in Currituck Sound upstream of a line across the sound beginning at a point on the east shore at 36° 09' 36" N - 75° 49' 15" W; thence in a straight line to a point on the west shore at 36° 12' 25" N - 75° 46' 05" W; to include all creeks and tributaries.

(b) Jean Guite Creek - All those waters upstream of a straight line across the mouth of Jean Guite Creek.

(c) Hog Quarter Landing Area - All those waters upstream of a straight line beginning at a point on the marsh near Hog Quarter Landing at 36° 07' 24" N - 75° 48' 20" W; thence to a point near Pig Point at 36° 07' 00" N - 75° 47' 57" W.

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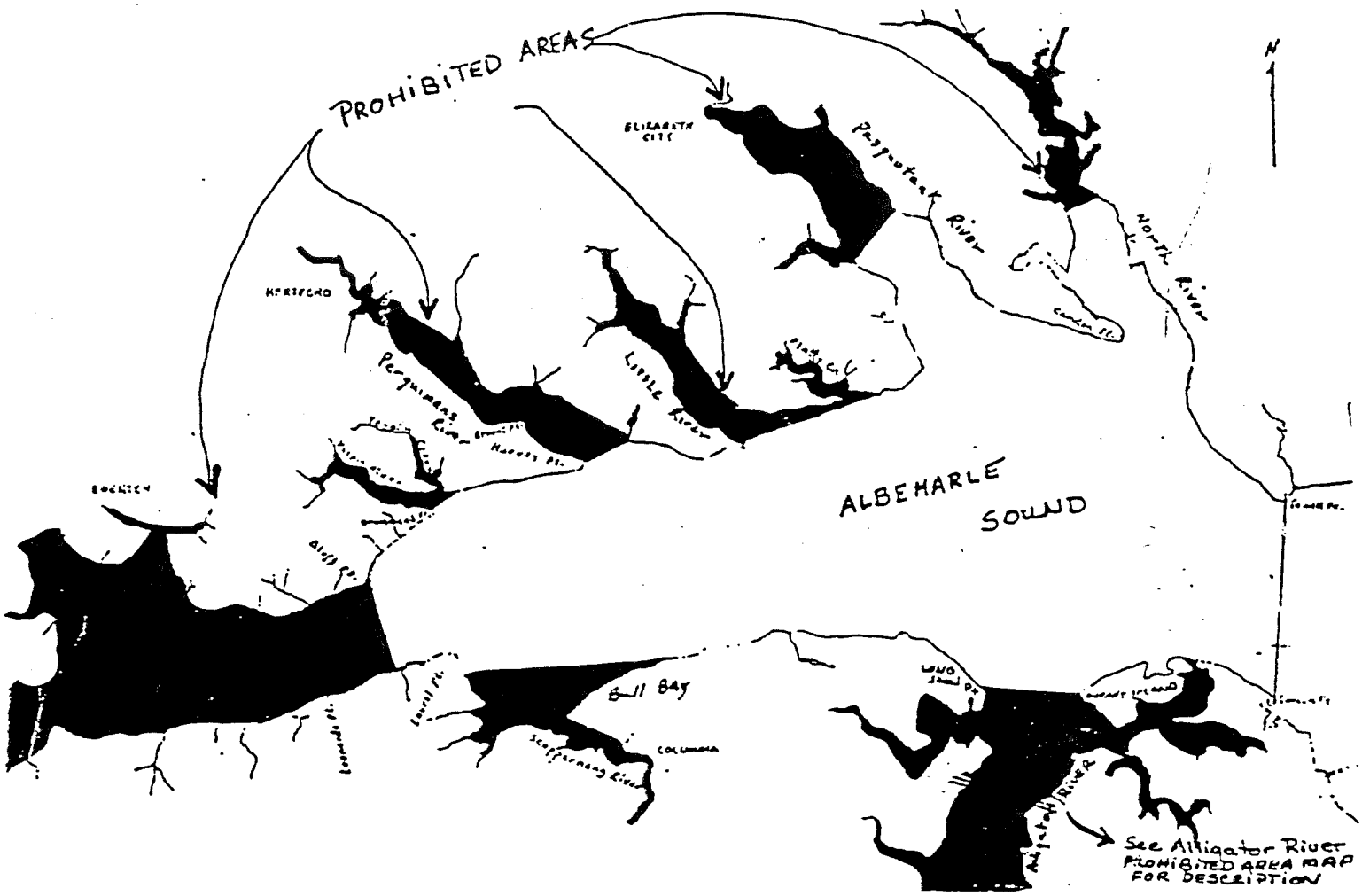
PROHIBITED TERRITORY

ALBEMARLE SOUND AREA
Area I-1 Thru I-16 (Map 2)

(Prohibited areas are shaded)

COUNTIES:
BERTIE, CAMDEN,
CHOWAN, CURRITUCK,
PASQUOTANK, PERQUIMANS,
TYRRELL, WASHINGTON



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(2) ALBEMARLE SOUND AREA

(a) North River - All waters upstream of a line drawn from a point on the west shore of North River at 36° 14' 06" N - 75° 57' 03" W; thence across the River through ICWW Beacon #159 to a point on the east shore at 36° 14' 50" N - 75° 55' 42" W, to include all tributaries upstream from said line.

(b) Pasquotank River - All waters upstream of a line beginning on the southwest shore at 36° 12' 42" N - 76° 06' 39" W; thence to the northeast shore at 36° 14' 15" N - 76° 04' 54" W at Miller Point.

(c) Little River and Flatty Creek - All waters upstream from a line beginning on Stevenson Point at 36° 06' 15" N - 76° 11' 42" W; thence to a point on the east shore of Flatty Creek at 36° 08' 13" N - 76° 06' 16" W.

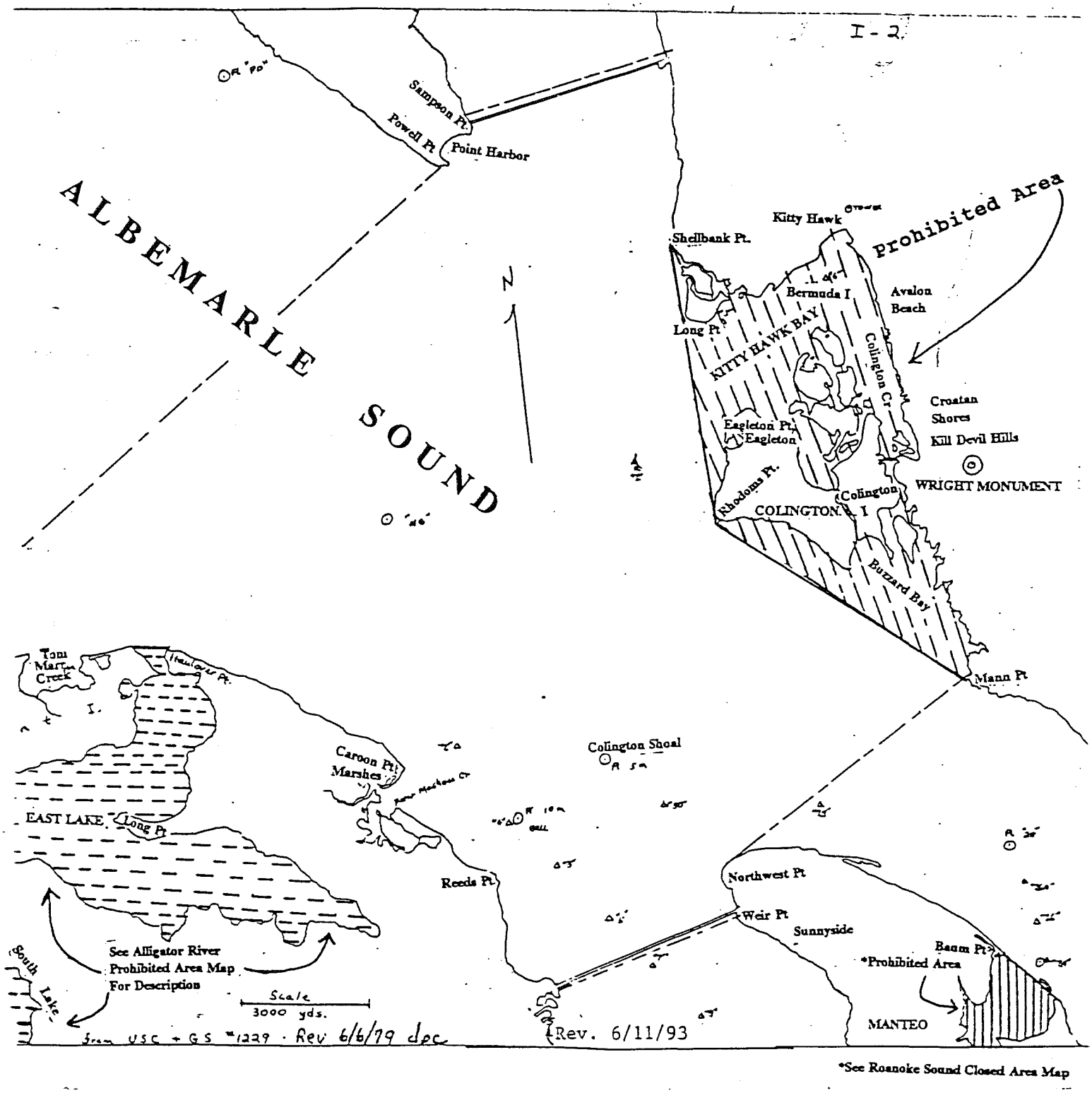
(d) **Albemarle Sound** - All waters upstream from a straight line across the Sound beginning at a point on the north shore at 36° 01' 22" N - 76° 27' 47" W; thence to the south shore at 35° 58' 26" N - 76° 26' 09" W.

(e) **Perquimans River** - All those waters in Perquimans River upstream of a straight line drawn from Harvey Point on the west shore to the south shore of Muddy Creek on the east shore.

(f) **Yeopim River** - All waters upstream of a straight line beginning at a point on Drummond Point at 36° 04' 07" N - 76° 24' 26" W; thence to the east shore at 36° 05' 00" N - 76° 22' 40" W.

(g) **Bull Bay** - All waters upstream of a straight line beginning at a point on the west shore of Bull Bay at 35° 58' 18" N - 76° 23' 00" W; thence to a point on the east shore at 35° 58' 42" N - 76° 14' 41" W.

(Prohibited areas are hatched)



No person shall take or attempt to take any oysters or clams or possess, sell or offer for sale any oysters or clams taken from the following areas, at any time:

ALBEMARLE SOUND:

Colington Area - All those waters east of a line beginning on Shellbank Point at 36° 03' 22" N - 75° 44' 30" W; thence in a straight line to a point on the western most point of Colington Island at 36° 00' 30" N - 75° 43' 50" W; thence southerly along the shore to Rhodoms Point at 36° 00' 12" N - 75° 43' 42" W; thence in a straight line to Mann Point at 35° 58' 18" N - 75° 40' 10" W.

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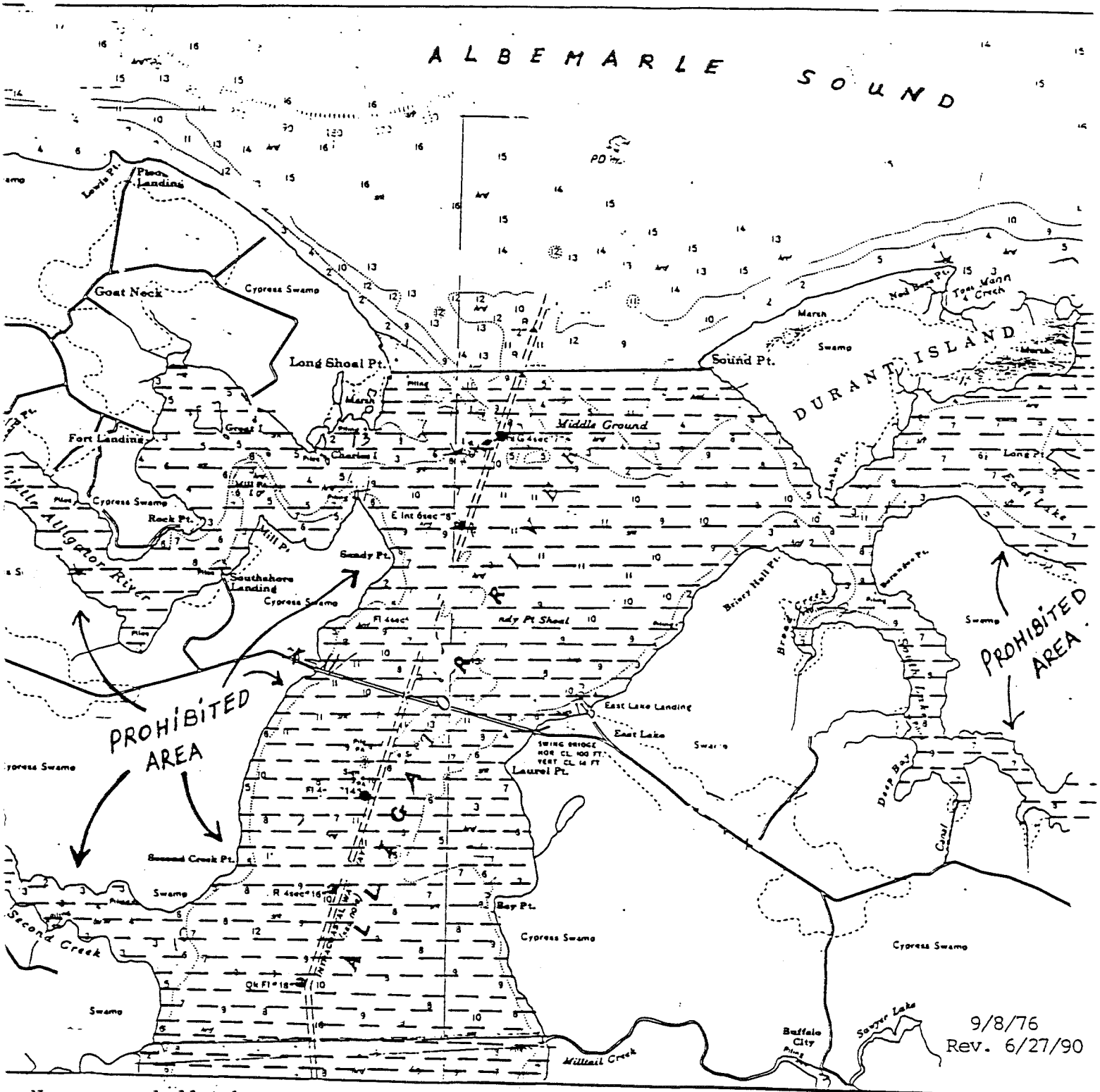
ALLIGATOR RIVER (MAP 4) PROHIBITED AREA DARE COUNTY and TYRRELL COUNTY

Area I-4 (PROHIBITED AREAS ARE HATCHED AND SHADED)



No person shall take or attempt to take any oysters or clams or possess, sell, or offer for sale any oysters or clams taken from the following areas, at any time:

ALLIGATOR RIVER:

All those waters in Alligator River upstream of a straight line drawn from Long Shoal Point on the west shore through Fl. Beacon "3" to Sound Point, to include all of East Lake and South Lake.

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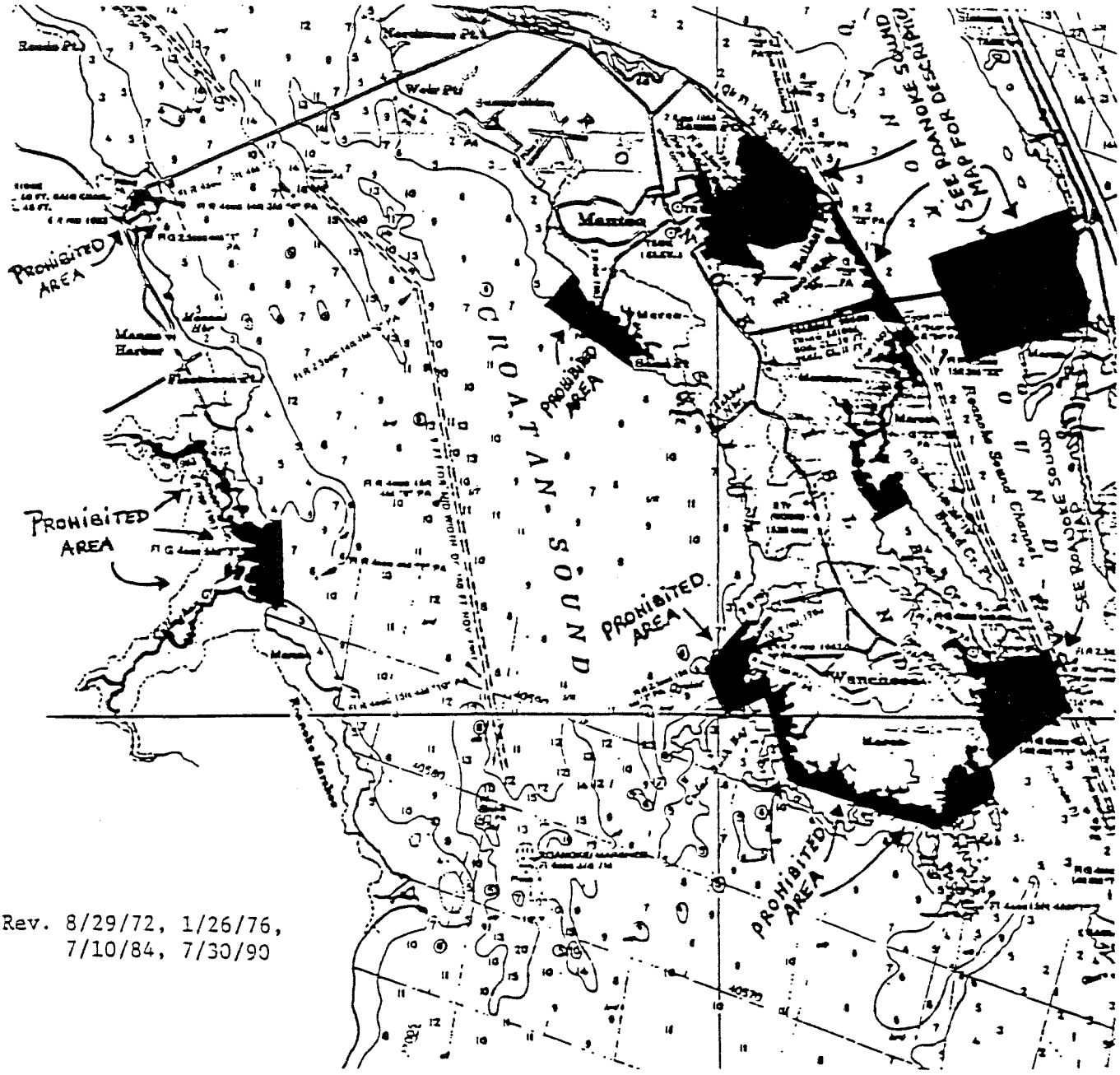
PROHIBITED TERRITORY

CROATAN SOUND AREA — DARE COUNTY

Area H-2 (Map 5) — (Prohibited areas are shaded)



Rev. 8/29/72, 1/26/76, 7/10/84, 7/30/90

NO PERSON SHALL TAKE OR ATTEMPT TO TAKE ANY OYSTERS, CLAMS OR MUSSELS OR POSSESS, SELL, OR OFFER FOR SALE ANY OYSTERS, CLAMS OR MUSSELS TAKEN FROM THE FOLLOWING AREAS, AT ANY TIME:

CROATAN SOUND AREA

All waters within a line beginning at a point on the shore at 35° 53' 56" N - 75° 41' 36" W; thence WSW 800 yards to a point in the sound at 35° 53' 38" N - 75° 41' 53 W; thence 1975 yards to a point on Sand Point at 35° 53' 03" N - 75° 40' 54" W, to include all tributaries

(Description continued on back of sheet)

All those waters within a line beginning at a point on the north shore of Baum Creek on Roanoke Island at 35° 50' 46" N - 75° 39' 43" W; thence in a straight line to Fl. Beacon #2 at 35° 50' 27" N - 75° 40' 06" W; thence in a straight line to a point on an island at 35° 50' 05" N - 75° 39' 56" W; thence in a straight line to a point on the shore at 35° 50' 16" N - 75° 39' 26" W; to include all creeks and tributaries within said boundary.

Upstream of a line beginning at a point near north shore of Spencer Creek at 35° 51' 45" N - 75° 44' 53" W; and thence 250 yards in an easterly direction to a point at 35° 51' 45" N - 75° 44' 43" W; thence south 1500 yards to a point 35° 50' 58" N - 75° 44' 43" W; thence 250 yards west to a point on shore at 35° 50' 58" N - 75° 44' 53" W.

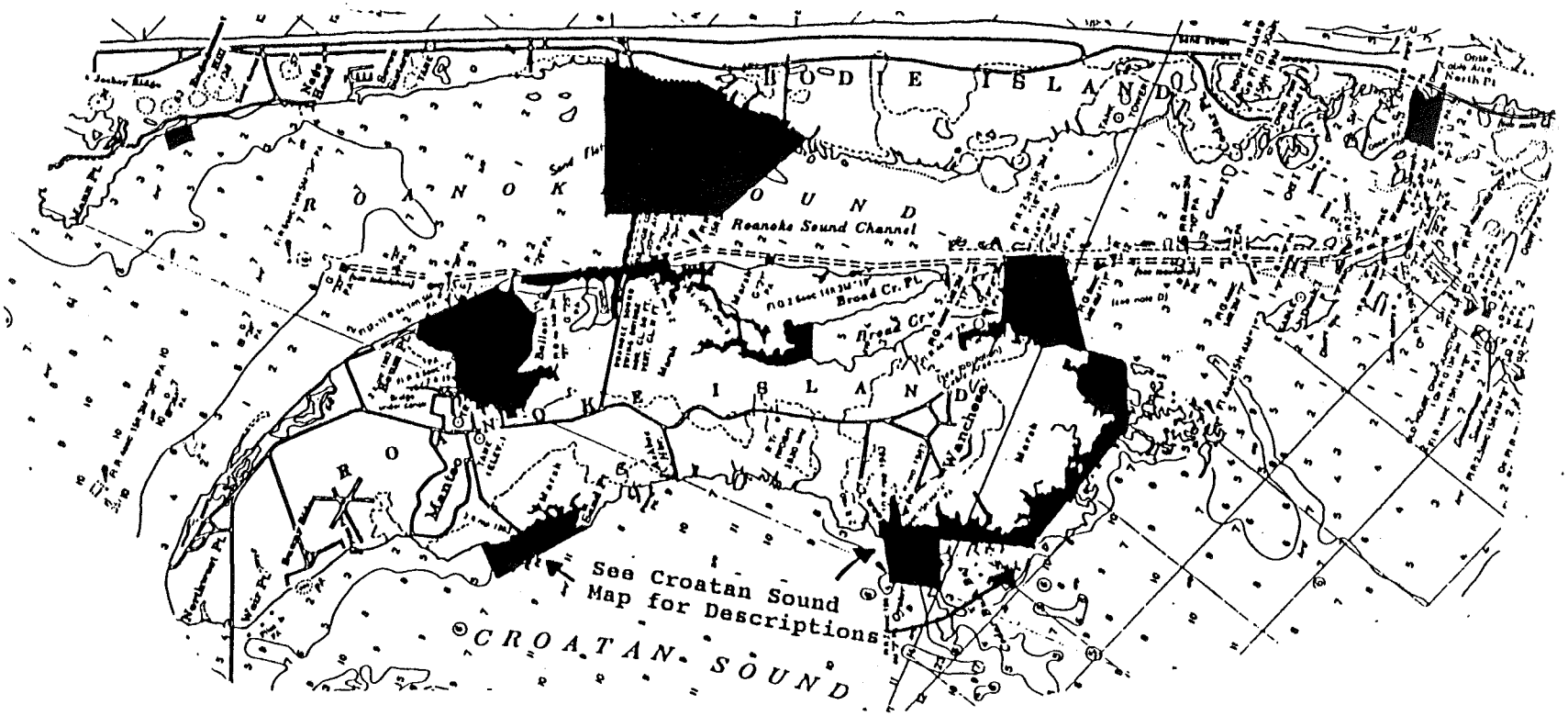
Manns Harbor - All those waters upstream of a line across the mouth of Manns Harbor beginning at a point on the north shore at 35° 54' 36" N - 75° 46' 02" W; thence in a straight line to a point on the south shore at 35° 54' 28" N - 75° 46' 06" W.

Wanchese - All those waters near the south end of Roanoke Island north and east of a line beginning at a point at 35° 49' 36" N - 75° 37' 00" W; thence in a southerly direction to a point at 35° 49' 20" N - 75° 37' 00" W, on marsh island; thence in a southwesterly direction to a point at 35° 49' 03" N - 75° 37' 33" W; thence northwesterly to a point on marsh at 35° 49' 24" N - 75° 39' 12" W; thence northerly to a point at 35° 50' 14" N - 75° 39' 28" W, to connect with the Baum Creek closure.

PROHIBITED TERRITORY

ROANOKE SOUND AREA
Area H-1 (Map 6)

DARE COUNTY
(Prohibited areas are shaded)



Revised: 12/30/81, 11/10/82, 2/14/84, 7/12/84, 7/3/89, 8/13/96, 1/98

NO PERSON SHALL TAKE OR ATTEMPT TO TAKE ANY OYSTERS, CLAMS OR MUSSELS OR POSSESS, SELL, OR OFFER FOR SALE ANY OYSTERS, CLAMS OR MUSSELS TAKEN FROM THE FOLLOWING AREAS, AT ANY TIME:

(Description continued on back of map)

(6) ROANOKE SOUND AREA

(a) All waters in Shallowbag Bay and its tributaries southwest of a straight line from Baum Point to Ballast Point.

(b) All the waters within a line beginning at the south side of the mouth of Broad Creek and running to Channel Marker Fl R "10"; thence to Channel Marker R "8"; thence due southwest to a point on the shore; thence along the shore in a northerly direction to the point of beginning, to include Mills Creek and its tributaries.

(c) Those waters around the Villa Condominium STP Outfall beginning at a point 35° 57' 54" N - 75° 38' 46" W; thence 200 yards in a southwesterly direction to a point in the sound at 35° 57' 48" N - 75° 38' 50" W; thence 400 yards in a southeasterly direction to a point in the sound at 35° 57' 38" N - 75° 38' 39" W; thence in a northeasterly direction to a point on shore at 35° 57' 45" N - 75° 38' 36" W.

(d) All those waters in Roanoke Sound bounded by a line beginning at a point on the east shore near Whalebone at 35° 54' 30" N - 75° 36' 10" W; thence in a westerly direction 2700 yards to a point in the Sound at 35° 54' 02" N - 75° 37' 40" W; thence in a southerly direction 2150 yards to a point at 35° 53' 04" N - 75° 37' 04" W; thence in a southeasterly direction 2000 yards to a point on shore at 35° 52' 36" N - 75° 36' 02" W, to include all creeks and tributaries.

(e) All those waters beginning at a point near Oregon Inlet Fishing Center at 35° 47' 44" N - 75° 33' 08" W; thence in a westerly direction to a point at 35° 47' 45" N - 75° 33' 26" W; thence in a southerly direction to Channel Marker #9 at 35° 47' 36" N - 75° 33' 26" W; thence in an easterly direction to a point on shore at 35° 47' 36" N - 75° 33' 52" W.

(f) All those waters bounded by a line beginning at a point on Ballast Point at 35° 54' 33" N - 75° 38' 40" W; thence in a straight line to the east side of the causeway draw bridge at 35° 53' 40" N - 75° 38' 07" W; thence to Channel Marker #24 at 35° 53' 22" N - 75° 37' 50" W; thence across channel to marsh at 35° 53' 20" N - 75° 37' 55" W; thence across Johns Creek in a northerly direction along shore back to the point of beginning. This will close Pirates Cove and all other tributaries within said boundary.

(g) **Broad Creek** - All those waters in Broad Creek north of a straight line beginning at a point on the west shore at 35° 51' 47" N - 75° 38' 15" W; thence across the creek to a point on the east shore at 35° 51' 57" N - 75° 37' 54" W; to include all of Johns Creek.