Biological Program Documentation: Juvenile Shrimp Sampling

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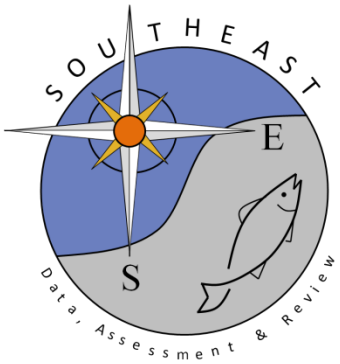

Biological Program Documentation

Program 510

Juvenile Shrimp Sampling

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Independent Fishery

Biologist

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Program 510

Juvenile Shrimp Sampling

General Description

November 11, 2013

This is a fishery-independent monitoring program to provide information on shrimp sizes, abundances and finfish bycatch for use of opening and closing shrimping areas not closed by primary or secondary nursery regulations or through implementation of the Shrimp Fishery Management Plan (FMP). This also includes monitoring of special secondary nursery areas for opening after August 15th of each year. These areas automatically close May 15th. A number of areas, especially in the southern area are monitored for information concerning the location and timing of shrimping openings and closures to harvest by proclamation. Often sampling is conducted in response to public concerns of undersize shrimp being harvest in a particular area. Thus, these areas are sampled with varying frequency and intensity and thereby preclude simple statistical evaluation. This sampling does, however, provide essential biological and environmental information for immediate management action.

The penaeid shrimp represents North Carolina's second most valuable marine fishery in terms of dockside revenue. The N.C. shrimp crop is comprised of three species including the brown shrimp, *Farfantepenaeus aztecus*, the pink shrimp, *F. duorarum*, and the white shrimp, *Litopenaeus setiferus*. Brown shrimp are generally responsible for most of the poundage landed and represent, on average, 58% of the total crop, pink shrimp contribute an average of 4% to the total, and white shrimp provide the remaining 38%.

The division has been responsible for management of shrimp resources since 1964. Intense penaeid shrimp research was initiated during the late 1960s and provides the basis for today's present management. This research included tagging studies which were employed to determine growth, migration and mortality of N.C. shrimp (Purvis and McCoy 1972; Purvis and McCoy 1974). Other research was conducted during the 1970s by the division to identify and survey areas which served as nursery habitats for shrimp and other commercially important species. For purposes of management, nursery areas were classified as primary and secondary types. Primary nursery areas, which provide refuge and food for post larval shrimp, are usually low salinity, shallow tributaries located in the upper section of a system. Secondary nursery areas, in which juvenile shrimp development occurs, are located in the mid-portion of an estuarine system and are characterized by moderate depth and salinities. Please refer to Program 120 documentation for in-depth information on this program.

Before the implementation of the 2006 Shrimp Fishery Management Plan (FMP), generally the ocean, sound, and major rivers remained open to shrimping year round unless extreme environmental conditions such as hurricanes lead to significant percentages of pre-commercial size shrimp into that area. Tributaries and small river systems that were not designated as

secondary nursery areas and may empty directly into unfishable bottom were also opened to trawling prior to any significant immigration of pre-commercial size shrimp. Tributaries and small river systems designated as special secondary nursery areas (SSNAs) that empty into an open shrimp area were closed to all trawling from May 15 through August 31. Tributaries and small river systems designated as permanent secondary nursery areas remained closed to all trawling year round as were primary nursery areas. A final type of area that was considered for management purposes within some of the sound systems were generally titled "an area of resource concern". This final area type was closed to trawling for varying periods of time to protect juvenile pink shrimp in grass bed/shoal habitat and functioned as a secondary nursery area.

Monitoring of shrimp varied accordingly with the type of area and prevailing environmental conditions. Areas which were usually open (e.g., the Atlantic Ocean, Pamlico Sound, and the major rivers) required minimal sampling effort except during times of extreme environmental conditions. Areas which were always closed also required little monitoring (with the exception of spring sampling for assessment of juvenile brown shrimp stock). But, those areas where closure lines were subject to movement demanded considerable sampling effort.

Before the implementation of the 2006 Shrimp FMP, attempts were made to limit the frequent movement of shrimp lines by meeting with the fishermen, discussing the problems, and seeking answers acceptable to the majority, while offering reasonable protection for the small shrimp.

Shrimp management since the implementation of the Shrimp FMP varies from the southern portion of the state to the northern part because of species specific behavior, and the differences among geographic areas. In the Roanoke Island area, which is the northernmost range for NC shrimp, the management of SSNAs is based more on the protection of juvenile finfish than on the harvest of shrimp. Sampling is conducted to insure that the small fish have left the bays and if shrimp are present, the area is opened. Abundant shrimp in the northern part of the state is such a rare occurrence that nearly any size is considered harvestable, and by August 16, they are usually of sufficient size.

The present shrimp sampling program is the result of years of research and monitoring and is currently designed to provide size and abundance information for shrimp management and the minimization of bycatch decisions and is an ongoing responsibility of the Division.

Objectives (Present)

1. To examine the distribution, length frequency, and movement of shrimp species for the establishment of openings and closing of shrimping areas via proclamation.

2. To determine the species composition and abundance of trawl bycatch in consideration of openings and closings of shrimping areas via proclamation.

Background Information

2012-Present

Shrimp sampling occurs in the southern district beginning in July of each year or earlier if public concern deems it necessary. Brown shrimp management (Record Type I, VAR1=4) employs a 10.5 ft. trawl (gear 556) with ¼" mesh in the body and 1/8" mesh tailbag. White shrimp management (Record Type I, VAR1=3) employs a 25' trawl (gear 536) with ¾" bar mesh body ¼" mesh tailbag four seam trawl. Choice of trawl will be based on a number of factors including: size, number, and species of shrimp expected; habitat type; and the exact nature of the management issue question. Sampling will employ one to ten minute tows and will be based on the abundance of shrimp and finfish in each area. Longer tow times may be employed to obtain two pounds of shrimp (desired minimum sample size to calculate the count size of shrimp). Data collected include abundances, modal size, and count size by shrimp species, and weight of the subset and a total weight of shrimp per pound. Shrimp lengths will be recorded (Record Type IV) as modal groups of 10 mm starting, for example, at 15 mm, then 25 mm, etc. Length will be measured as distance from the tip of the rostrum to the tip of the telson. Finfish data are also collected on economically important finfish species including abundances and sizes. A subsample of 30 individuals will be measured for all economically important finfish species. Environmental and habitat data are also collected. Additional bycatch weight information is collected for shrimp, economically important finfish, non-economically important finfish, and invertebrates. Areas monitored for openings and closings are typically located either in or landward of the Intracoastal Waterway (IWW) which runs the entire length of the Onslow, Pender, New Hanover and Brunswick counties coastline.

Shrimp sampling also occurs in the central district between August and October of each year. Special Secondary Nursery Areas (SSNAs) are monitored as needed and include: West Bay/Long Bay, Thorofare Bay, and Jarrett Bay. Data collected include individual lengths of shrimp by species, a weight of the subset and a total weight of shrimp per tow. A total weight of all bycatch (finfish, invertebrates and trash) is recorded per tow. Data from the central district are not entered in the BDB.

No shrimp sampling has occurred in the Pamlico and Northern Districts since 2008.

2009-2011

Shrimp sampling occurred in the southern district beginning in in June or July, depending on recruitment of each year. Data collected include abundances, modal size, and count size by shrimp species. Environmental data were also collected. No bycatch information was collected. Areas monitored for openings and closings were typically located either in or landward of the Intracoastal Waterway (IWW) which runs the entire length of the Onslow, Pender, New Hanover and Brunswick counties coastline.

Shrimp sampling also occurs in the central district between August and October of each year. SSNAs are monitored as needed and include: West Bay/Long Bay, Thorofare Bay, and Jarrett Bay. Data collected include individual lengths of shrimp by species, a weight of the subset and a total weight of shrimp per tow. A total weight of all bycatch (finfish, invertebrates and trash) is recorded per tow. Data from the central district has not been entered since the termination of the spring brown shrimp sampling in 2008

Shrimp sampling was minimal to no sampling, dependent on the shrimp year in the Pamlico and Northern District but did occasionally occur in the Bay River and Stumpy Point Bay.

XXXX-2008

Objectives

1. To estimate recruitment of juvenile brown shrimp in primary nursery areas in the spring for inclusion and comparison with the historical juvenile brown shrimp data set.

2. To monitor recruitment trends in the movement of brown shrimp and the recruitment and movement of white and pink shrimp to establish closure lines beyond those associated with primary and secondary nursery regulations.

Background

Estimates of juvenile brown shrimp recruitment was determined and related to environmental data for an estimate of total population size based on a comprehensive sampling of the state's primary nursery areas. This sampling employed a 10.5 ft. trawl (gear 556) with 1/4" mesh in the body and 1/8" mesh in the cod end. One minute tows will be used for this daytime sampling. Sampling was conducted once during the last week of May and/or the first week of June.

1989-XXXX

Objectives

1. To examine distribution and length frequency of pink shrimp in the spring for management of harvest areas (Central and Southern Districts only).

2. To estimate recruitment of juvenile brown shrimp in primary nursery areas in the spring for inclusion and comparison with the historical juvenile brown shrimp data set.

3. To monitor general trends in the movement of brown shrimp and the recruitment and movement of white and pink shrimp to establish closure lines beyond those associated with the primary and secondary nursery regulations.

4. To evaluate additional areas that may serve as habitat for juvenile shrimp, for designation as secondary or special secondary nursery areas (Central District only).

<u>Spring pink shrimp management:</u>

Pink shrimp will be examined biweekly in the spring using a small boat and a 20 ft trawl with ¾" mesh in the body and 1/4" mesh in the cod end (gear code 556, 558). Pink shrimp distribution and length=frequency will be specifically examined from approximately mid-March (i.e., when water temperatures reach 16^{O} C) until mid-May, by which time substantial emigration appears to occur. The spring pink shrimp sampling will employ 5 minute tows, and will be conducted at

night due to the nocturnal behavior of this species. In the Central District, sampling will be conducted at 6 stations each in Core, Back, and Bogue Sounds; three of the six stations in each sound will exist in shoal habitat and the other three will be located in sloughs. All shrimp will be sorted by species and, if numerous, will be sub-sampled to include a minimum of 30 shrimp. All subsequent catch data will be derived from this group of individuals. Record type I data to be recorded includes date, station number, time gear began fishing, time gear ended fishing, length of headrope (i.e., gear parameter #3), surface temperature, bottom temperature, surface salinity, bottom salinity and bottom composition. Additional Record Type I information will consist of a qualifier describing purpose of sampling:

1=spring pink shrimp management
2=brown shrimp recruitment
3=white shrimp management
4=brown shrimp management

Record type III data will include the shrimp species code, and subsample number. Shrimp lengths will be recorded (Record Type IV) as modal groups of 10 mm starting, for example, at 15 mm, then 25 mm, etc. Length will be measured as distance from the tip of the rostrum to the tip of the telson. Weights will not be measured in the field since an approximate length to weight relationship has been established. Number of shrimp per pound will sometimes be determined for a catch brought in from the field and may be indicated in the comments.

Recruitment of juvenile brown shrimp assessment:

Estimates of juvenile brown shrimp recruitment will be determined and related to environmental data. A number of models have been developed (Hunt et Al., 1980; Matylewich and Mundy, 1985) which correlate brown shrimp landing with salinity and/or water temperature. These models have been used with varying degrees of success to predict the outcome of a year's harvest. Of somewhat more immediate application are estimates of total population size based on a comprehensive sampling of the state's primary nursery areas. This sampling employs a 10.5 ft. trawl (gear 556) with ¼" mesh in the body and 1/8" mesh in the cod end. One minute tows will be used for this daytime sampling. Sampling is conducted once during the last week of May and/or the first week of June. All other data will be collected and coded as described for the spring pink shrimp monitoring.

Multi-species shrimp fishery management (summer and fall):

Areas not closed by primary or secondary nursery regulations will have closure lines proclamated based primarily on biological and physio-chemical information. Generally trawl sample data will be collected using either the 10.5' trawl and 5 minutes with the 20' trawl. In the Central District white shrimp – specific sampling employs a 20' ¾" mesh body ¼" mesh tailbag four seam trawl while in the Southern District, a 12' ¼" bar mesh four seam trawl is used in recruitment areas and a 25" ¾" bar mesh body ¼" mesh tailbag four seam trawl is used in secondary areas and adjacent migration routes. Choice of trawl will be based on a number of factors including: size, number, and species of shrimp expected; habitat type; and the exact nature of the management issue question. A list of shrimp sampling stations is provided (Appendices A-D) which differentiates stations based on whether they are primarily examined for the following: 1) recruiting brown shrimp , 2) pink shrimp, 3) white shrimp, and 3) migratory brown shrimp. White shrimp data can be collected through day time sampling, whereas pink and brown shrimp management data is generally collected at night (although brown shrimp data

may be collected during the day in more turbid areas). All data is coded as described for the spring pink shrimp sampling. Subsequent to brown shrimp recruitment sampling (i.e., objective 2), waters are monitored for areas to be closed to harvest of small brown shrimp By July, areas must be examined again for the purpose of reopening areas to harvest of the now larger shrimp. Sampling of areas to prevent or permit harvest of brown shrimp continues through September. By August, recruiting pink and white shrimp must also receive management consideration. Traditional areas for occurrence of recruiting pink and white shrimp may be sampled for general abundance and location information (e.g., White Oak River for white shrimp), but most investigative effort will be directed toward monitoring presence of undersize shrimp in opened areas. More intensive sampling of white shrimp is conducted in the Southern District, where initial sampling or core and optional stations in nursery areas are completed during August. An additional consideration for the summer and fall multi-species shrimp management is the August sampling of special secondary nursery areas. These areas, which close by regulation May 15 and may open as early as September 1, are examined to determine the date for proclamating their opening to harvest.

Secondary nursery area determination:

Special and permanent secondary nursery area regulations have been valuable management tools for preventing excessive fishing activity on and./or physical disturbance of pre-commercial –size shrimp, juvenile finfish, and fisheries habitat. Although most water bodies which appear suited to implementation of secondary nursery area status are covered by regulations made effective in August 1986, and occasional review of potential secondarys is needed. Currently, general review suggests that Turnagian Bay, Carteret County, may be an appropriate location for a special or permanent secondary nursery area. In conjunction with other shrimp sampling (i.e., from objectives 2 and 3) additional samples will be collected from South River, Turnagain Bay and Long Bay. South River typically does not function as secondary nursery area, whereas Long Bay has already been established as a special secondary. Samples will be collected monthly from 3 stations in each of the 3 systems from June through August thereby permitting a comparison between Turnagain Bay and secondary and non-secondary areas. The uppermost of each of the set of three stations were sampled for one minute using the 10.5' trawl and the other two stations will be sampled for five minutes with the 20' trawl. All other data will be collected and coded as described for the spring pink shrimp sampling (i.e. objective #1)

1969-1989

Objectives

1. To estimate abundance, growth, and distribution of penaeid shrimp
2. To forecast annual shrimp crops

Sampling of penaeid shrimp began in 1969. Areas sampled by Morehead City field personnel included Pamlico Sound, bays and tributaries associated with Pamlico Sound, Neuse River and its tributaries, Core Sound and its bays and tributaries, North River ,Newport River, Bogue Sound and its tributaries and white oak River. Exact stations were assigned where feasible although several water bodies were sampled where no stations could be assigned. Many times for example, samples were taken at the mouth of bays, rivers, or creeks and tributaries and in

Pamlico Sound, Core Sound, and Bogue Sound, where no stations were located. Later, stations were assigned to some of these areas and identifies as approximate location rather than as an exact location.

Funding Source and/or Federal Aid Project Titles

State appropriations

Program Lead and Time Span

- Trish Murphey 2013-Present
- Sean Mckenna 1989-2013
- ???????????? 1969-1989

General Approach

Overview of Sampling Design

Areas not designated as primary or secondary nursery areas are sampled by trawl to open and/or close based on shrimp size and abundance information as well as the occurrence of bycatch species and abundance. Starting in June, areas in the southern district must be examined for the purpose of opening or closing areas to harvest of shrimp. Starting in July, white shrimp must also receive management consideration based on shrimp size, abundance and bycatch. Most sampling of white shrimp is conducted in the Southern District, while sampling in the central district only occurs for monitoring of special secondary nursery areas and are usually sampled in late September. These areas, which close by regulation May 15 and may open as early as September 1, based on sampling results.

Study Specific Detailed Sampling Design and Protocols

Trawl sample data are collected using either the 10.5' or 20' net (gear 556 and/or 558) and tow times of 1 minute with the 10.5' trawl and 5 minutes with the 20' trawl. In the Central District white shrimp - specific sampling, use a 20' 3/4" mesh body 1/4" mesh tailbag four seam trawl while in the Southern District, a 12' 1/4" bar mesh four seam trawl is used in recruitment areas and a 25' 2/4" bar mesh body 1/4" mesh tailbag four seam trawl is used in special secondary areas and adjacent migration routes of New River and Chadwick Bay. Choice of trawl is based on a number of factors including: size, number, and species of shrimp expected; habitat type; and the exact nature of the management issue in question. White shrimp data are collected through day time sampling, while brown shrimp management data are collected at night (although brown shrimp data may be collected during the day in more turbid areas.

Timeframe (starts/stop dates)

Sampling occurs yearly beginning as early as June and can go as late as November and is dependent on the recruitment of the shrimp crop for that year.

Study Site

Sample sites are dependent on historic locations and occur mostly in the southern and central districts. Occasional sampling may occur in the Pamlico and Northern districts and is dependent on the abundance of shrimp for that year.

Seasonality

Sampling season is a late spring through late fall of each year

Sampling Intensity/Sample Numbers

Dependent of area sampled

Gear

- 10.5' ¼" mesh standard trawl
- 12' ¼" mesh four seam trawl
- 20' ¾" mesh standard trawl
- 20' ¾" mesh four seam trawl
- 25' ¾" mesh four seam trawl

Sample Workup

Record type I information to be recorded include date, station number, time gear began fishing, time gear ended fishing, length of headrope, size of body mesh, surface and bottom temperature, and surface and bottom salinity. In addition, habitat and water quality data as required in the habitat and water quality monitoring documentation are also recorded. Target species are all penaeid shrimp. Individual total lengths (tip of rostrum to tip of telson) are recorded in record type IV. Sub-sampling of 50 shrimp/per species may be taken in the case of large amounts of shrimp are caught. Total number of shrimp per species is recorded in record type III along with subsample number.

Total finfish bycatch weight is recorded in record type III with individual lengths of commercially and recreationally important species recorded in record type IV.

Fields and Codes Clarifications to the Program

N/A

Attachments and Tables

N/A