

SEDAR 18-Red Drum

NC Biological Data
Survey Descriptions and Background Information

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Program 123: North Carolina Red Drum Juvenile Seine Survey

Objectives: To determine the annual index of juvenile abundance for red drum in North Carolina.

Procedures:

A red drum seine survey was conducted at 21 fixed sampling sites throughout coastal North Carolina (Figure 1) during September through November for each year from 1991 through 2007. Each of these sites was sampled in approximately two week intervals for a total of six samples per site with an 18.3 m (60 ft) x 1.8 m (6 ft) beach seine with 3.2 mm (1/8 in) mesh in the 1.8 m x 1.8 m bag. One “quarter sweep” pull was made at each location. This was done by stationing one end of the net onshore and stretching it perpendicularly as far out as water depth allowed. The deep end was brought ashore in the direction of the tide or current, resulting in the sweep of a quarter circle quadrant. All species were counted and identified; red drum were counted and measured to the nearest mm FL. Salinity (ppt), water temperature (°C), tidal state or water level, and presence of aquatic vegetation were recorded. Locations of fixed stations were determined in 1990 based on previous catch rates and practicality for beach seining (Ross and Stevens 1991). The juvenile index, or CPUE, is the arithmetic mean catch/seine haul of young-of-the-year (YOY) individuals.

Data:

Data for the red drum juvenile seine survey are stored on the ASMFC FTP site as both an excel file (**ncrdseine.xls**) and a tab delimited file (**ncrdseine.txt**). A SAS program (**NCJUVRDCPUE.SAS**) has been provided that generates both an arithmetic and geometric CPUE by year, region and month.

Results:

As an example, the overall statewide arithmetic mean is presented in the following table.

Year	N	CPUE	lci	uci	SE	STDEV	CV	MIN	MAX	SUM	PSE
91	105	14.85	10.58	19.12	2.18	22.33	150.4	0	122	1559	15
92	116	3.72	1.49	5.94	1.13	12.22	329.0	0	125	431	31
93	117	12.65	8.3	17	2.22	23.98	189.6	0	130	1480	18
94	93	8.29	3.56	13.02	2.41	23.26	280.5	0	180	771	29
95	119	4.61	3.19	6.03	0.72	7.90	171.2	0	44	549	16
96	104	2.63	1.71	3.56	0.47	4.81	182.5	0	32	274	18
97	126	13.13	7.1	19.15	3.07	34.50	262.9	0	236	1654	23
98	124	8.23	6.04	10.43	1.12	12.48	151.6	0	85	1021	14
99	98	1.88	1.06	2.69	0.42	4.11	219.0	0	29	184	22
0	123	3.18	2.05	4.31	0.57	6.38	200.6	0	38	391	18
1	122	0.98	0.61	1.34	0.19	2.07	212.3	0	11	119	19
2	120	2.26	1.23	3.29	0.53	5.78	255.7	0	39	271	23
3	120	5.01	2.6	7.42	1.23	13.49	269.3	0	113	601	25
4	120	8.38	6.16	10.59	1.13	12.38	147.8	0	75	1005	13
5	120	9.02	6.26	11.77	1.40	15.39	170.6	0	80	1082	16
6	120	3.59	2.16	5.03	0.73	8.02	223.2	0	63	431	20
7	119	5.46	2.48	8.44	1.52	16.59	303.7	0	149	650	28

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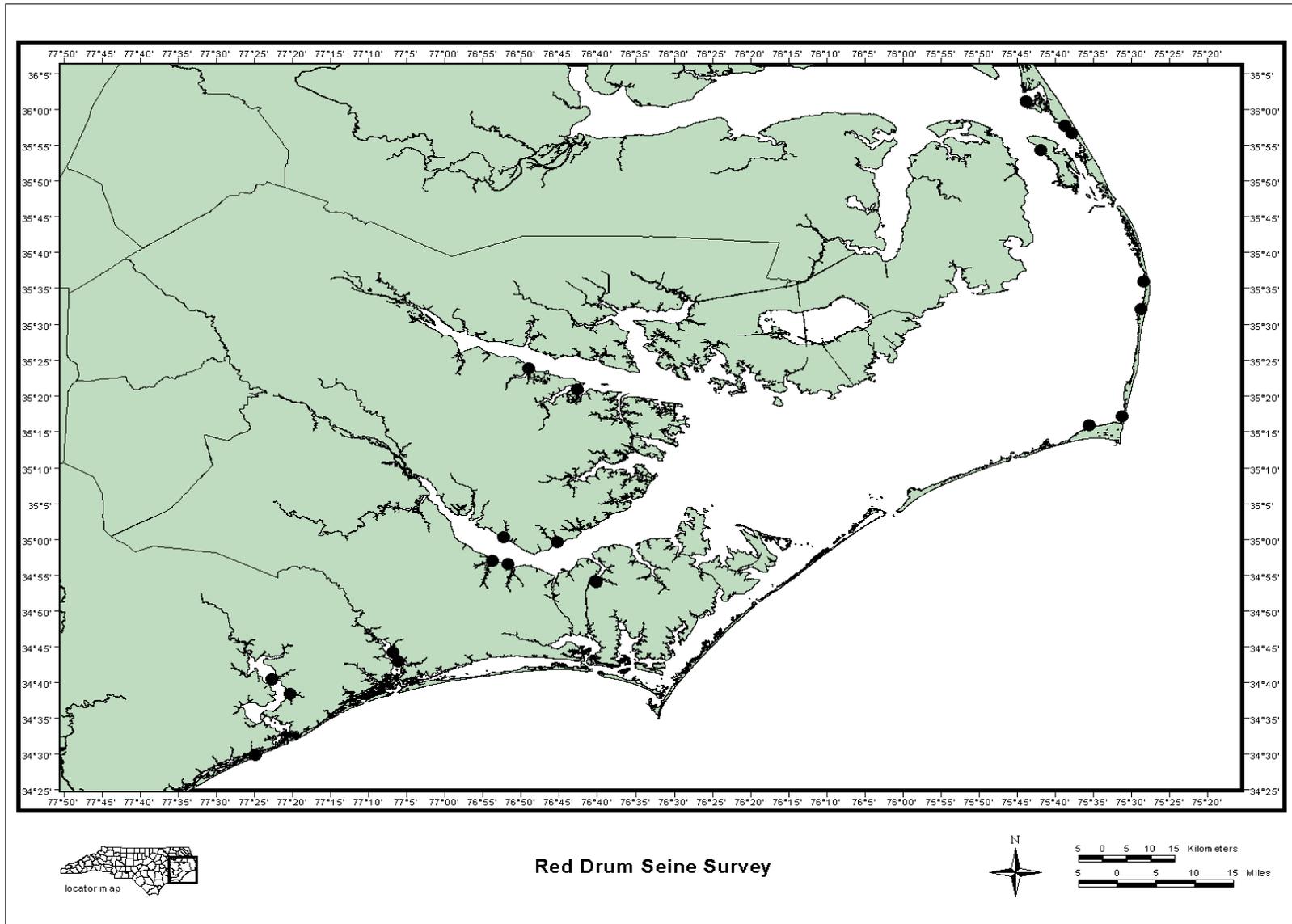


Figure 1. Sampling sites of the juvenile red drum survey in North Carolina.

A recent analysis of the North Carolina red drum seine survey is provided as a reference document (SEDAR 18-RD37):

Bacheler N.M., Paramore L.M., Buckel J.A., Scharf F.S. (2008b) Recruitment of juvenile red drum in North Carolina: spatiotemporal patterns of year-class strength and validation of a seine survey. N Am J Fish Manag 28:1086-1098.

For results of the preliminary data used to establish the current sampling methods and stations see (no electronic version available, will have hard copy at workshop):

Ross, J. L., and T. M. Stevens. 1992. Life history and population dynamics of red drum (*Sciaenops ocellatus*) in North Carolina waters. NC Division of Marine Fisheries, Marine Fisheries Research Completion Report Project F-29. 130 p.

METADATA

Documented changes in sampling and other notes of concern

DATES	Sampling Procedures
1987-1990	Preliminary sampling to establish productive and accessible stations and establish most appropriate gear type.
1991-present	Set stations and gear – time frame used for current CPUE index for red drum.
1996	Hurricanes during this year caused extreme high and low water conditions and may have altered survey results.

Program 915 – North Carolina Independent Gill Net Survey

Objectives:

- To provide an independent relative index of abundance for key species occurring in the estuarine waters of Pamlico Sound and its tributaries.
- To characterize habitat use in Pamlico Sound

Background:

The Divisions independent gill net study (Program 915) started as the presence and absence of disease sampling in 1998 on the Neuse, Pamlico and Pungo River systems (River Independent Gill Net Survey (RIGNS)). Sampling in Pamlico Sound (The Pamlico Sound Independent Gill Net Survey (PSIGNS)) was initiated in May of 2001. Sampling in the RIGNS was dropped after 2000 and resumed in 2003 to present. The PSIGNS has sampled continuously since 2001. A primary objective of both the PSIGNS and the RIGNS is to provide independent relative abundance indices for key estuarine species including red drum.

Sampling locations for the IGNS were selected using a stratified random sampling design based on area and water depth (Figure 2). The Sound was divided into eight areas: Hyde County 1 – 4 and Dare County 1 – 4. The Neuse River was divided into four areas (Upper, Upper-Middle, Middle-Lower, Lower) and the Pamlico River was divided into four areas (Upper, Middle, Lower and Pungo River). A one minute by one minute grid (i.e., one square nautical mile) was overlaid over all areas and each grid was classified as either shallow (< 6 ft), deep (\geq 6ft) or both based on bathymetric maps.

Each area was sampled twice a month. For each random grid selected, both a shallow and deep sample were collected. Each sample (both shallow and deep) consisted of eight 30 yard segments of 3, 3½, 4, 4½, 5, 5½, 6, 6½ inch stretched mesh gill net, for a total of 240 yards per sample. Nets were typically deployed within an hour of sunset and retrieved the next morning, so all soak times were approximately 12 h. This sampling design results in a total of approximately 64 gill net samples (32 deep and 32 shallow samples) being collected per month across both the Rivers and Sound.

Physical and environmental conditions, including surface and bottom water temperature ($^{\circ}$ C), salinity (ppt), dissolved oxygen (mg/L), bottom composition, as well as, a qualitative assessment of sediment size, were recorded upon retrieval of the nets on each sampling trip. All attached submerged aquatic vegetation (SAV) in the immediate sample area was identified to species and density of coverage was estimated visually when possible. Additional habitat data recorded included distance from shore, presence or absence of sea grass or shell, and substrate type.

Each collection of fish per mesh size (30-yard net) was sorted into individual species groups. All species groups were enumerated and an aggregate weight (nearest 0.01 kilogram (kg)) was obtained for most species, including damaged (partially eaten or decayed) fish. The condition of each individual was recorded as live, dead, spoiled, or parts. Individuals were measured to the nearest millimeter for either fork or total length according to the morphology of the species.

Data:

Data for the North Carolina Independent Gill Net Survey are stored on the ASMFC FTP site as both an excel file (**RDIGNSRAWDATA.xls**) and a tab delimited file (**RDIGNSRAWDATA.txt**). A SAS program (**IGNS CPUE.SAS**) will be provided to generate CPUE's by length, age and overall.

Prior Analysis:

For the reason that the time series in the rivers is inconsistent with the Pamlico Sound, results are typically analyzed for two areas: 1) Hyde and Dare counties (PSIGN) only, 2001-2007, and 2) Rivers (Pamlico, Pungo and Neuse), 1998-2000 and 2003-2007. The overall CPUE represents the number of red drum captured per sample. A sample was one array of nets (shallow and deep combined) fished for 12 hours. Due to disproportionate sizes of each stratum and region, the final CPUE estimate is weighted. The total area of each region by stratum was quantified using the one-minute by one-minute grid system and then used to weight the observed catches for calculating the abundance indices. CPUE data can be calculated by size, age (with ALK conversion) or overall.

Some results based on an overall CPUE calculation are provided below:

Sample areas and results for the period of 2001 to 2006 are provided in Figure 2.

Table 1 provides total catch by year and area for the PSIGN F-70. Also shown are the total samples (sets) and weighted CPUE. The time frame 2001-2007 demonstrates a decrease in catch and CPUE, with lowest catch rates in the time series occurring in 2007. Both regions show similar trends when evaluated independently. Table 2 represents the total catch by year and area, again including the weighted CPUE, for all areas (rivers and PSIGN), 2003-2007.

Table 1. PSIGN (Pamlico Sound only) total catch of red drum by year including weighted CPUE.

Year	Number of Red Drum	# Sets	Weighted CPUE	PSE	Mean Size (mm)	Min (mm)	Max (mm)
2001*	324	237	1.56	20	436	232	1155
2002	907	320	3.22	13	406	228	1194
2003	295	320	1.25	18	484	334	1206
2004	525	320	1.99	15	388	250	1200
2005	658	305	2.76	15	437	250	1227
2006	730	320	2.91	12	422	240	1257
2007	928	320	3.19	32	438	217	1172

* partial year (May-Dec)

Table 2. RIGN (Rivers only) total catch by year including weighted CPUE by year.

Year	Number of Red Drum	# Sets	Weighted CPUE	PSE	Mean Size (mm)	Min (mm)	Max (mm)
1998*	194	176	1.17	16	377	200	647
1999	861	542	1.68	12	355	142	661
2000*	555	239	2.16	19	396	109	633
2003*	161	156	1.03	34	423	285	1040
2004	853	320	2.77	16	372	146	487
2005	868	304	2.99	12	434	205	1156
2006	605	320	2.04	10	424	197	1240
2007	661	320	2.13	13	436	211	1207

* partial year for rivers

** all samples not currently in database

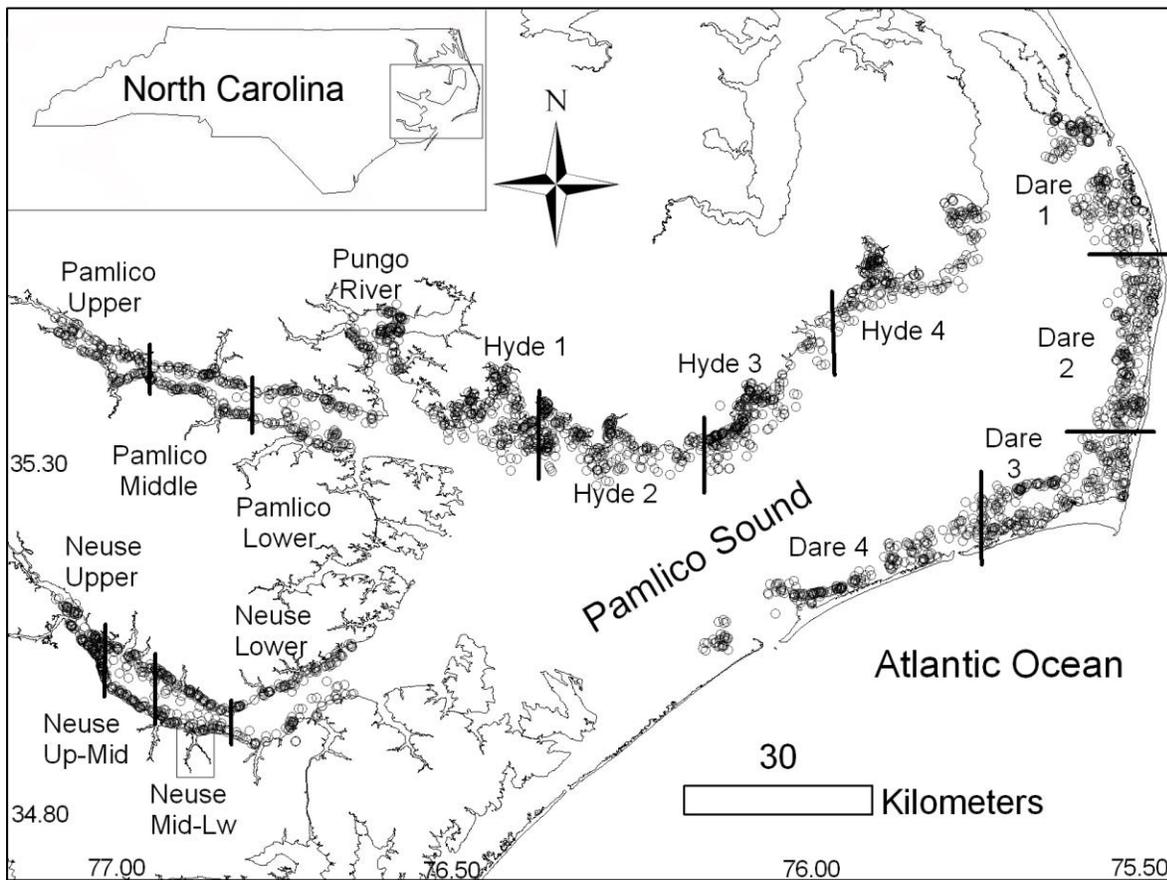


Figure 2. Map of Pamlico Sound and associated rivers showing the sample strata and locations of individual samples taken in the NCDMF independent gill net survey from 2001 to 2006.

Program 930: North Carolina Age and Growth Data**Procedures:**

Red drum (*Sciaenops ocellatus*) otoliths have been collected by NCDMF since 1987. Otoliths are collected monthly from commercial, recreational, and NCDMF fishery independent catches. Otoliths were removed from fish caught throughout state estuarine and coastal waters. The majority of fish sampled come from Pamlico Sound, its tributaries, and the coastal waters of the Outer Banks from Oregon Inlet to Cape Lookout. Fork length (FL) and total length (TL) in millimeters (mm) were recorded for most fish. When possible, whole weight to the nearest 0.1 kilogram (kg) and sex were obtained.

Otoliths (sagittae) were excised from all fish and stored dry. Dorso-ventral sections of the left sagitta were made through the core to the nucleus perpendicular to the anterior-posterior plane with a Hillquist thin-sectioning machine. Sections were mounted on slides with ultra-violet curing glue. All sections were read from a high resolution monitor coupled to a video camera mounted on a microscope. Age determination for red drum was based on the presence of annuli but had to be adjusted because the first annulus is not formed until 19-21 months after the hatching date. Additionally, a September 1 birthdate was used because this is the midpoint of the peak spawning season. Ages were incremented one year on this date. The system was calibrated with an ocular micrometer before each reading session. Validation of this technique is presented in Ross and Stevens (1992). Otolith sections were read independently by two readers. When disagreement occurred, ages were not assigned.

All individual length and weight data for North Carolina are contained within this data set. Maturity data when recorded is typically from macroscopic observation and should be interpreted with caution. Maturity data for North Carolina should be derived from the following reports:

Ross J.L., Stevens T.M. (1992) Life history and population dynamics of red drum (*Sciaenops ocellatus*) in North Carolina waters. Completion Report Project F-29, NC Div Mar Fish, Morehead City, NC.

Ross J.L., Stevens T.M., Vaughan D.S. (1995) Age, growth, mortality, and reproductive biology of red drums in North Carolina waters. Trans Am Fish Soc 124:37-54

Data:

North Carolina age and growth data are stored on the ASMFC FTP site as an excel file (**NC age-lth-wt data.xls**). Ages are reported in the data set for both a September 1 birthdate and for a January 1 birthdate as used in Vaughan and Carmichael (2000). A year class variable is also included that gives the year spawned for each fish aged.

North Carolina Commercial Fisheries Dependent Sampling Program

Procedures:

Commercial length frequency data were obtained by the NCDMF commercial fisheries dependent sampling program. Red drum lengths were collected at local fish houses by gear, market grade (not typical for red drum) and area fished. Individual fish were measured (mm, FL) and total weight (0.1 kg) of all fish measured in aggregate was obtained. Subsequent to sampling a portion of the catch, the total weight of the catch by species and market grade was obtained for each trip, either by using the trip ticket weights or some other reliable estimate. Length frequencies obtained from a sample were then expanded to the total catch using the total weights from the trip ticket. All expanded catches were then combined to describe a given commercial gear for a specified time period. Major commercial gears for North Carolina are gill net, long haul seine, and pound net. Commercial samples were taken throughout the year and from all areas where red drum were landed. Combined, gill nets, long haul seines and pound nets made up over 98% of all NC commercial landings of red drum for the period of 1999-2005. Of these, gill net landings dominated, accounting for >90%.

Dependent length frequency data for red drum in North Carolina began in the early 1980's. Data adequate to describe the major fisheries is available beginning in the late 1980's.

Data:

North Carolina commercial dependent data are stored on the ASMFC FTP site as an excel file (**NC COMM LF.xls**). The data are summarized by gear and month. The variable ONUM=the number of fish measured for a given size. The variable ENUM=the expanded number of fish in the total catch for a given size. Length frequencies to describe the fisheries should be based on the ENUM variable.

. Program 466: NC Commercial Gillnet Observer Program

Background:

Starting in October of 2000, the Pamlico Sound flounder gill net fishery has been restricted, operating under an Incidental Take Permit (ITP) issued by NMFS to reduce interactions with endangered and threatened sea turtles. The restrictions on this fishery are effective from September 15 through December 31. Stipulations of the permit include permitted entry, restricted areas, limited yardage of gill net and mandatory scientific observer coverage. This ITP initiated the availability of observer data for the estuarine gill net fishery in North Carolina. From 2001 to 2003, coverage was limited to the fall Pamlico Sound flounder gill net fishery. From 2004 to 2006, coverage was expanded by DMF to include other regions and estuarine gill net fisheries. Participation in this expanded coverage by commercial gill netters was voluntary. During 2007 coverage was once again limited to the fall Pamlico Sound flounder gill net fishery. Information gathered during observer trips includes data on effort and mesh sizes used, as well as, data on the size, aggregate weight and ultimate fate of captured species.

North Carolina observer data were used to estimate discards of dead red drum from the estuarine gill net fishery. Available observer coverage was for the period of 2001 to 2006 (Table 4). Data from 2001 to 2003 and 2007 were exclusively from the Pamlico Sound gill net fishery in the fall. Due to this limited coverage, annual coast wide estimates during these years may not be possible.

Table 4. Observed estuarine gill net trips by month and year from the North Carolina observer program.

Month	2001	2002	2003	2004	2005	2006
January	0	0	0	5	7	22
February	0	0	0	14	34	40
March	0	0	0	36	45	45
April	0	0	0	28	35	34
May	0	0	0	48	31	26
June	0	0	0	51	27	26
July	0	0	0	30	22	14
August	0	0	0	25	38	12
September	29	69	34	91	56	61
October	70	73	52	96	77	92
November	66	32	25	58	63	30
December	14	5	7	21	6	0
Total	179	179	118	503	441	402

Past estimates of discards from gill nets have been derived based on the generation of a CPUE from observed trips multiplied by the number of trips taken for a particular fishery (typically done by season and area). North Carolina trip tickets are used to provide the total number of trips.

The CPUE was defined as the number (or weight) of dead red drum discarded per trip. Estimates of discards were then calculated by multiplying the number of trips taken in a particular fishery by the corresponding CPUE from the observer data.

Data:

North Carolina commercial gill net observer program data are stored on the ASMFC FTP site as SAS data file (**observer01_07**). Additional programs to access this data set will be provided.