

Final Report

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Project Title: Providing critical regional data in support of the development of an ecosystem model in the US South Atlantic region

Sub-recipient contract for a proposal submitted to the South Atlantic Landscape Conservation Cooperative project “Development of an eco-system model for the shelf waters of the US South Atlantic region and linking this marine model to existing terrestrial, freshwater, and estuarine ecosystem modeling efforts”

Overview

SC-DNR's MARMAP and SEAMAP-SA fishery independent monitoring programs have collected long-term abundance and life history data from Cape Hatteras, NC to the St. Lucie, FL, dating back to the 70's and 80's. Two types of surveys have been conducting standardized gear deployments since 1990, the Coastal Trawl Survey and the Reef Fish Survey. Since 2010, reef fish sampling efforts have been done in collaboration with SEFIS (SEFSC, Beaufort, NC), and the collaborative efforts are referred to as the Southeast Reef Fish Survey. Sampling has been conducted annually with a variety of gears (incl. trawls, fish traps, and long lines). Available data include detailed sampling location coordinates, oceanographic variables (incl. water column temperature and salinity), species composition, relative abundance or biomass by species, and information on age, growth, reproduction, diet, and genetic variability of a variety of selected species. Data and analysis have been used in many regional stock assessments and is published in numerous reports and publications. Key data (e.g. location, species abundance, lengths, bottom temperature, and some life history information) is stored in a comprehensive data- base. This database is housed at SC-DNR and managed by DNR personnel (reef fish data in closed collaboration with SEFIS staff). Additional information, such as diet data and age and reproductive information for certain species is not yet available in the central database. However, this data may be crucial for the proposed comprehensive ecosystem modeling effort that is relevant for regional fisheries management.

Making data available for use in modeling efforts involves extracting relevant information, summarizing data, and possible base-line analyses. A coordinated effort is needed to most effectively and efficiently provide the relevant fishery independent data and analyses to the ecosystem modeling lead(s). As this additional effort to support a regional ecosystem model is not included in any current SC-DNR funding source, and as such, it will require additional funds.

Work Done and Data Provided

Coastal Trawl Survey Biomass Data

The Coastal Trawl Survey utilizes near shore (< 20 m depth) trawls to collect biological samples. Biomass data was provided as total kilograms of a given species collected in a given year from 1990-2016. The sample size or the total number of tows sampled per year was also provided. The total effort as the total number of hectares swept by all tows in a given year was also included. Species were separated into trophic groups provided by the SALCC group. Atlantic menhaden, Bluefish, and Weakfish were species of interest provided not as a member of a higher trophic grouping. The fifteen trophic groupings provided were benthic coastal invertivores, benthic coastal piscivores, benthic oceanic invertivores, benthic oceanic piscivores, demersal coastal invertivores, demersal coastal omnivores, pelagic coastal piscivores, pelagic oceanic piscivores, pelagic oceanic planktivores, mackerels, mullets, penaeids, sciaenids, sharks, and skates and rays. The benthic coastal invertivores trophic group contained the following species: Big Eye, Blackcheek Tonguefish, Dusky Flounder, Fringed Flounder, Glasseye Snapper, Leopard Searobin, Naked Goby, Palefin Batfish, Roughback Batfish, Sandperch, Smoothhead Scorpionfish, Southern Hake, Spotted Hake, and Striped Cusk-eel. The benthic coastal piscivores included the Gulf Flounder, Inshore Lizardfish, Pale-spotted Eel, Shrimp Eel, Southern Flounder, and Summer Flounder. The Bandtail Searobin, Bighead Searobin, Blackwing Searobin, Northern Searobin, and Striped Searobin were included in the benthic oceanic invertivores trophic group. The Southern Stargazer was the only species included from the benthic oceanic piscivore trophic

group. The demersal coastal invertivores trophic group included the Atlantic Bumper, Florida Pompano, Gafftopsail Catfish, Leatherjacket, and Pigfish. The Northern Puffer, Orange Filefish, Oyster Toadfish, Pinfish, Planehead Filefish, Smooth Puffer, Spotfin Butterflyfish, and Spottail pinfish were included as species from the demersal coastal omnivores trophic group. The pelagic coastal piscivores contained the following species: Cobia, Guaguanche, Ladyfish, Scaled Sardine, Sharksucker, Tarpon, and Tripletail. The Atlantic Cutlassfish and Atlantic Needlefish were the only two species included in the pelagic oceanic piscivores trophic group. The pelagic oceanic planktivores trophic group contained the following species: Atlantic Silverside, Bay Anchovy, Bigeye Scad, Blueback Herring, Dusky Anchovy, Rough Scad, Rough Silverside, Round Herring, and Striped Anchovy. The three Mackerel species included were the Atlantic Mackerel, King Mackerel, and Spanish Mackerel, and the two mullet species included were the White Mullet and Striped Mullet. The penaeid shrimp included were the Brown Shrimp, Pink Shrimp, and White Shrimp. The following species were included in the sciaenid group: Atlantic Croaker, Banded Drum, Black Drum, Cubbyu, Gulf Kingfish, Northern Kingfish, Sand Drum, Silver Perch, Silver Seatrout, Southern Kingfish, Spot, Spotted Seatrout, and Star Drum. The shark species included were Atlantic Sharpnose Shark, Blacknose Shark, Bonnethead, Dusky Shark, Finetooth Shark, Nurse Shark, Sand Tiger, Sandbar Shark, Scalloped Hammerhead, Smooth Dogfish, Spinner Shark, Spiny Dogfish, and Thresher Shark. The following species were included in the skates and ray group: Atlantic Guitarfish, Atlantic Stingray, Bluntnose Stingray, Bullnose Ray, Clearnose Skate, Cownose Ray, Devil Ray, Lesser Electric Ray, Roughtail Stingray, Smooth Butterfly Ray, Southern Stingray, Spiny Butterfly Ray, and Spotted Eagle Ray.

Table 1. The trophic groups and the corresponding species for which biomass data was provided from the Coastal Trawl Survey.

Trophic Group	Species	
Species of Interest	Atlantic Menhaden Bluefish	Weakfish
Benthic Coastal Invertivores	Bigeye Blackcheek Tonguefish Dusky Flounder Fringed Flounder Glasseye Snapper Leopard Searobin Naked Goby	Palefin Batfish Roughback Batfish SandPerch Smoothhead Scorpionfish Southern Hake Spotted Hake Striped Cusk-eel
Benthic Coastal Piscivores	Gulf Flounder Inshore Lizardfish Pale-spotted Eel	Shrimp Eel Southern Flounder Summer Flounder
Benthic Oceanic Invertivores	Bandtail Searobin Bighead Searobin Blackwing Searobin	Northern Searobin Striped Searobin
Benthic Oceanic Piscivores	Southern Stargazer	
Demersal Coastal Invertivores	Atlantic Bumper Florida Pompano Gafftopsail Catfish	Leatherjacket Pigfish

Demersal Coastal Omnivores	Northern Puffer Orange Filefish Oyster Toadfish Pinfish	Planehead Filefish Smooth Puffer Spotfin Butterflyfish Spottail Pinfish
Pelagic Coastal Piscivores	Cobia Guaguanche Ladyfish Scaled Sardine	Sharksucker Tarpon Tripletail
Pelagic Oceanic Piscivores	Atlantic Cuttlassfish	Atlantic Needlefish
Pelagic Oceanic Planktivores	Atlantic Silverside Bay Anchovy Bigeye Scad Blueback Herring Dusky Anchovy	Rough Scad Rough Silverside Round Herring Striped Anchovy
Mackerels	Atlantic Mackerel King Mackerel	Spanish Mackerel
Mullets	White Mullet	Striped Mullet
Penaeids	Brown Shrimp Pink Shrimp	White Shrimp
Scieanids	Atlantic Croaker Banded Drum Black Drum Cubbyu Gulf Kingfish Northern Kingfish Sand Drum	Silver Perch Silver Seatrout Southern Kingfish Spot Spotted Seatrout Star Drum
Sharks	Atlantic Sharpnose Blacknose Shark Bonnethead Dusky Shark Finetooth Shark Nurse Shark Sand Tiger	Sandbard Shark Scalloped Hammerhead Smooth Dogfish Spinner Shark Spiny Dogfish Thresher Shark
Skates and Rays	Atlantic Guitarfish Atlantic Stingray Bluntnose Stingray Bullnose Ray Clearnose Skate Cownose Ray Devil Ray	Lesser Electric Ray Roughtail Stingray Smooth Butterfly Ray Southern Stingray Spiny Butterfly Ray Spotted Eagle Ray

Table 2. Number of tows and total effort (hectares swept) per year for the Coastal Trawl Survey.

Year	Number Tows	Total Effort
1990	462	924.6
1991	464	923.5
1992	467	897.8
1993	468	921.1
1994	468	913.5
1995	467	880.5
1996	468	887.2
1997	468	895.2
1998	468	835.7
1999	467	867.9
2000	468	918.2
2001	611	1178.4
2002	612	1131.0
2003	612	1133.8
2004	612	1119.0
2005	612	1141.4
2006	612	1119.4
2007	611	1078.8
2008	612	1107.6
2009	672	1231.8
2010	672	1226.9
2011	671	1238.4
2012	672	1222.9
2013	590	1090.7
2014	612	1153.8
2015	658	1196.5
2016	662	1226.4

Reef Fish Survey Biomass Data

The MARMAP Reef Fish Survey utilizes a variety of gears to collect biological samples from live bottom or reefs deeper than about 15 meters including traps, hook and line, and bottom longlines. The Southeast Reef Fish Survey partners use identical chevron traps. Annual estimates of biomass were provided for chevron traps (1990-2016), short bottom longlines (1996-2016) and long bottom longlines (1996-2016). Data provided was the total kilograms collected per species per year for a given gear, total hours of a given gear soaked on the bottom per year, and the total weight (kg) per hours per year for a given species and gear. For chevron traps biomass data was provided for Bank Sea Bass, Black Sea Bass, Sand Perch, Speckled Hind, Red Grouper, Snowy Grouper, Gag, Red Snapper, Vermilion Snapper, Tomtate, White Grunt, Knobbed Porgy, Spottail Pinfish, Pinfish, Red Porgy, Gray Triggerfish, *Stenotomus* spp., Blueline Tilefish, Greater Amberjack, Almaco Jack, and Scamp Grouper. Biomass data was provided for Blueline Tilefish, Snowy Grouper, Greater Amberjack, Almaco Jack, and Golden Tilefish from 1996-2016 for short bottom longline. Golden Tilefish biomass was also provided for Long bottom longline from 1996-2016.

Table 3. Number of deployments and total effort (hours) in a given year for chevron trap, short bottom longline, and long bottom longline.

Year	Chevron Trap (N)	Chevron Trap Effort	Short Bottom Longline (N)	Short Bottom Longline Effort	Long Bottom Longline (N)	Long Bottom Longline Effort
1990	349	593.78				
1991	295	452.97				
1992	320	529.27				
1993	392	640.67				
1994	437	738.88				
1995	427	777.23				
1996	374	623.70	15	23.78	17	29.03
1997	438	720.17	33	57.97	21	36
1998	441	719.43	33	59.9	8	12.33
1999	254	442.02	40	70.82	28	50.98
2000	312	527.58	36	69.58	8	15.33
2001	282	492.60	29	49.97	13	21.63
2002	251	421.15	19	34.22	20	36.95
2003	224	379.10	51	95.55	14	24.5
2004	304	502.53	34	54.35	5	8.72
2005	332	559.52	51	88.17	16	27.6
2006	316	510.92	82	135.08	7	12.87
2007	337	523.98	58	95.2	22	37.13
2008	303	471.33	43	71.38		
2009	404	641.77	59	97.43	36	58.3
2010	738	1209.43	95	164.18	39	62.03
2011	887	1438.20	117	202.42	30	64.95
2012	1216	1941.53	21	36.88		
2013	1389	2204.70	41	69.92		
2014	1473	2294.47	57	93.73		
2015	1507	2377.50	80	141.52	37	59.95
2016	1520	2394.95	62	105.73	27	42.18

Diet Data

Both the Coastal Trawl Survey and the Reef Fish Survey have collected stomachs for diet content analysis. Collections were often opportunistic or available for only a subset of years, depending on funding and management priorities. Stomachs typically are fixed in formalin and transferred to ethanol for storage and identification. Stomachs are weighed, contents are identified visually to the lowest taxon possible using a variety of identification guides, and individual taxa are weighed. Diet composition for the species listed in Tables 4 and 5 were provided in % weight and proportion of total.

Table 4. Coastal Trawl Survey species and sample availability for diet data.

Common Name	Scientific Name	Size Range (TL, cm)	Fish (n)	Remarks
Atlantic Croaker	<i>Micropogonias undulatus</i>	91-304	751	
Bluefish	<i>Pomatomus saltatrix</i>	54-491	400	juveniles
King Mackerel	<i>Scomberomus cavalla</i>	85-540	106	juveniles
Southern Kingfish	<i>Menticirrhus americanus</i>	68-380	1439	
Spanish Mackerel	<i>Scomberomus maculatus</i>	247-477	68	juveniles
Weakfish	<i>Cynoscion regalis</i>	100-442	764	

Table 5. Reef Fish Survey species and sample availability for diet data. All gears, traps, longlines, and hook and line, were combined for each species as available.

Common Name	Scientific name	Size Range (TL, mm)	Fish (n)
Black Sea Bass	<i>Centropristis striata</i>	40-845	554
Gag	<i>Mycteroperca microlepis</i>	287-1082	26
Gray Triggerfish	<i>Balistes capriscus</i>	304-595	82
Lionfish	<i>Pterois</i> sp.	276-358	20
Pinfish	<i>Lagodon rhomboides</i>	111-229	33
Red Porgy	<i>Pagrus pagrus</i>	274-508	140
Red Snapper	<i>Lutjanus campechanus</i>	213-911	219
Sand Perch	<i>Diplectrum formosum</i>	103-314	79
Scamp	<i>Mycteroperca phenax</i>	446-916	42
Scup	<i>Stenotomus</i> sp.	69-285	205
Spottail Pinfish	<i>Diplodus Holbrookii</i>	173-314	31
Squirrelfish	<i>Holocentrus adscensionis</i>	274-389	63
Tomtate	<i>Haemulon aurolineatum</i>	179-254	89
White Grunt	<i>Haemulon plumierii</i>	200-482	54
Vermilion Snapper	<i>Rhomboplites aurorubens</i>	257-557	81

Budget, Expenditures, and Adjustments of Scope of Work

The expected data provision outlined at the outset of the program required 2.25 mo. of time of an Associate Scientist level staff. During a 2017 SALCC meeting, the taxa to be included in the data request were updated and added to, which impacted the amount of staff time needed to prepare the data. Due to revisions in the requested data by SALCC, the workload of data preparation was divided between the Associate Scientist and an hourly employee, who became a Biologist I during the course of data preparation, which impacted the salary expenditures. A financial report will be submitted by our grants coordinator.