Nothing Compares
NORTH CAROLINA

Blue Crab Traffic Light Update and Adaptive Management Measures

North Carolina Marine Fisheries Commission

May 19, 2016

Department of Environmental Quality

Blue Crab Traffic Light Overview

- Implemented in Amendment 2 (November 2013)
- Replaced a single point estimate for stock status
  - Pamlico Sound Survey
  - September data
  - Spawning stock index
- Synthesizes a range of information to provide a description of the stock condition

Blue Crab Traffic Light Overview

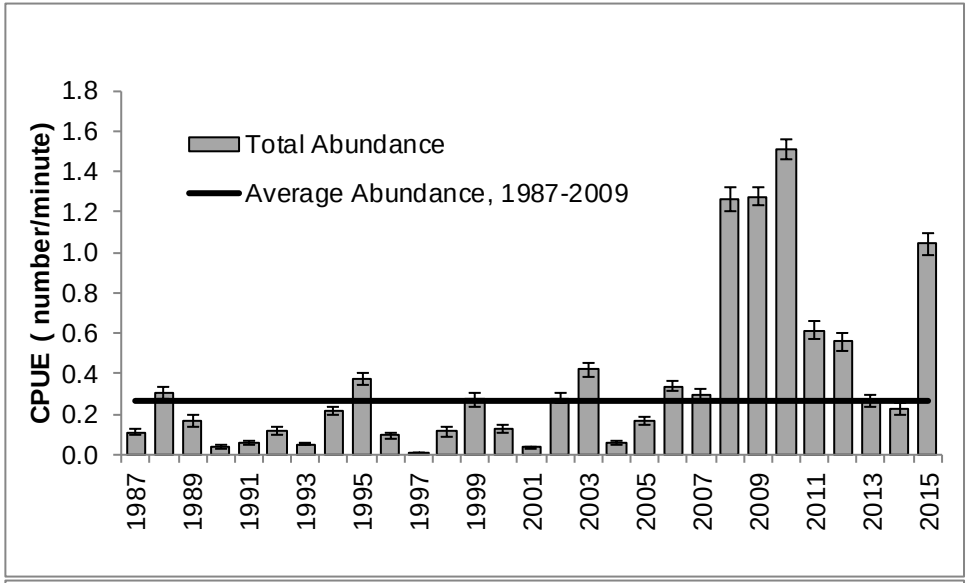
- Evaluates 19 qualitative and quantitative indicators of stock condition
- Four fishery-independent and one fishery-dependent survey
- Indicators are evaluated against a set of base years set by Amendment 2 (1987-2009).
- Indicator values are assigned a green, yellow, or red “signal.”
  - Green = favorable stock condition
  - Yellow = neutral or transition stock condition
  - Red = unfavorable stock condition

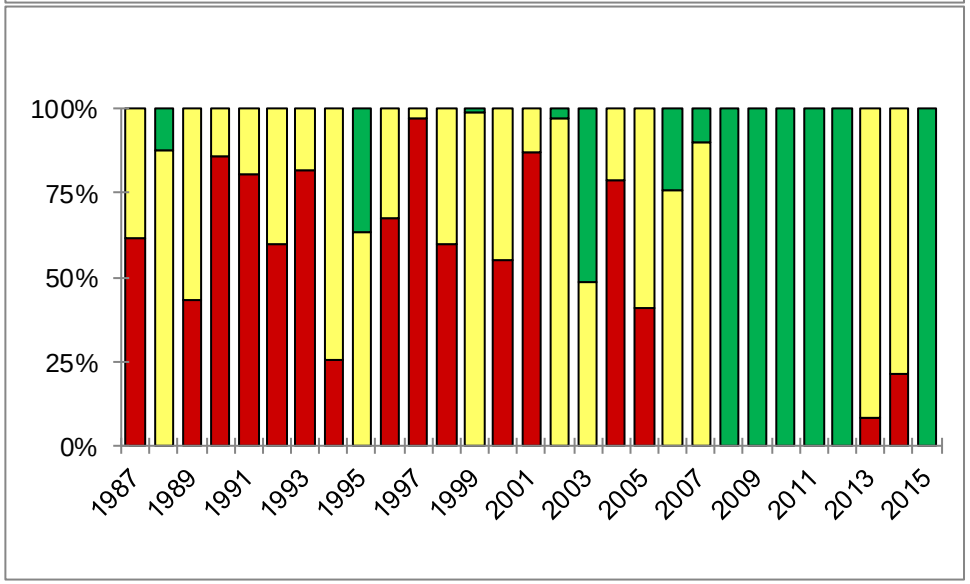
Blue Crab Traffic Light Overview

- Fishery-independent survey characteristics
  - Sample in a consistent manner to provide unbiased indices of abundance
  - Sampling not always done where a species is most abundant
  - Objective is to collect information on a population throughout its range
  - Not influenced by socioeconomics or management measures
  - Conducted over long time period to track population trends
- Fishery-dependent survey characteristics
  - Collected directly from commercial or recreational harvesters
  - Influenced by socioeconomics and management measures

Blue Crab Traffic Light Overview

Example of an indicator

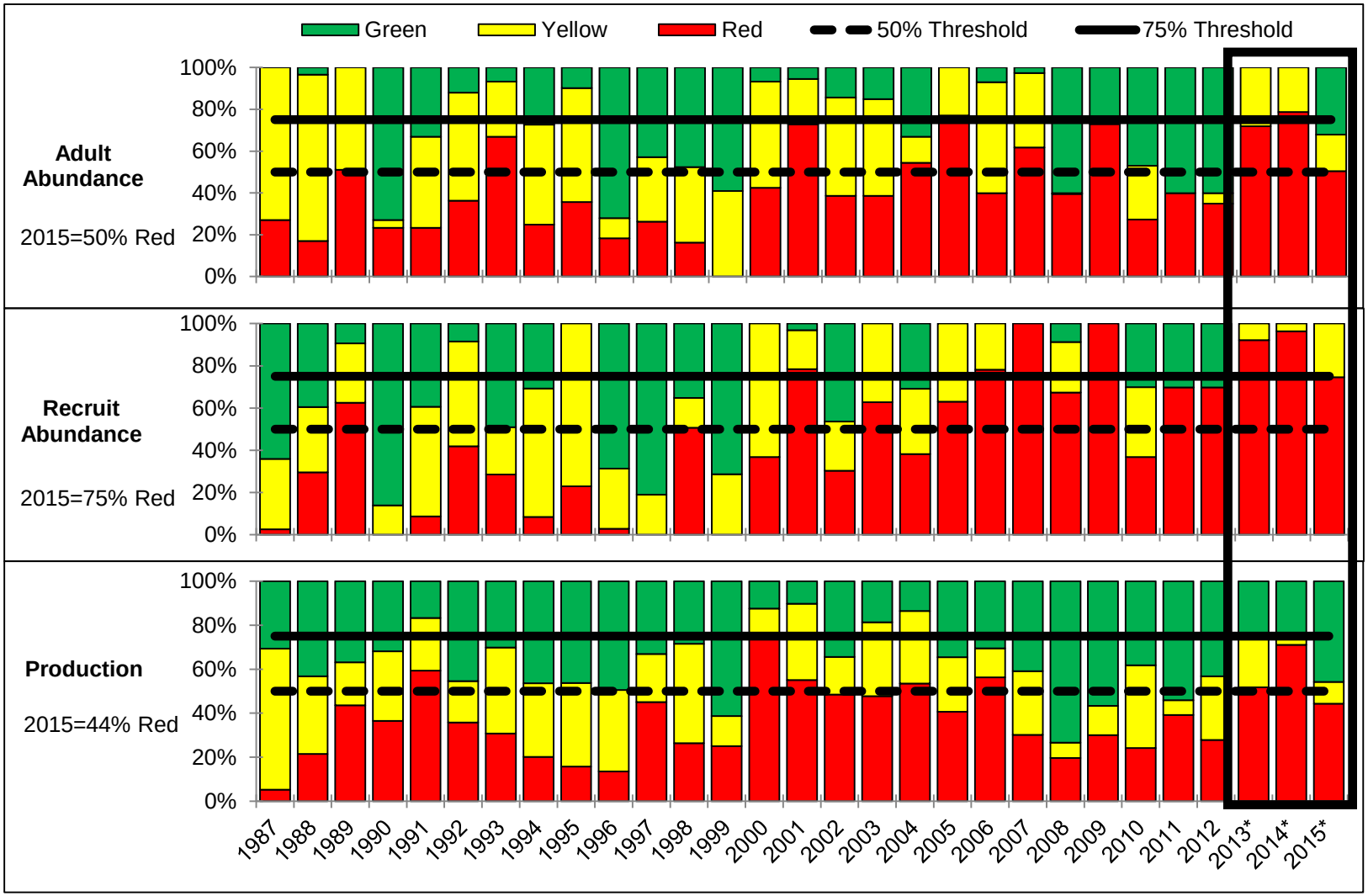




Blue Crab Traffic Light Overview

- Divided into three characteristics
  - Adult Abundance (four indicators)
  - Recruit Abundance (four indicators)
  - Production (11 indicators)
- Management Triggers
  - Moderate: adult abundance or production ≥ 50 percent red for three consecutive years
  - Elevated: adult abundance or production ≥ 75 percent red for two of three consecutive years

Blue Crab Traffic Light Results



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Blue Crab Traffic Light Results

- Production did not meet the moderate management threshold.
- Adult Abundance has met the moderate management threshold for the required three-year period.
- Recruit Abundance has met the elevated management threshold.

Adaptive Management Framework

Adaptive Management Framework

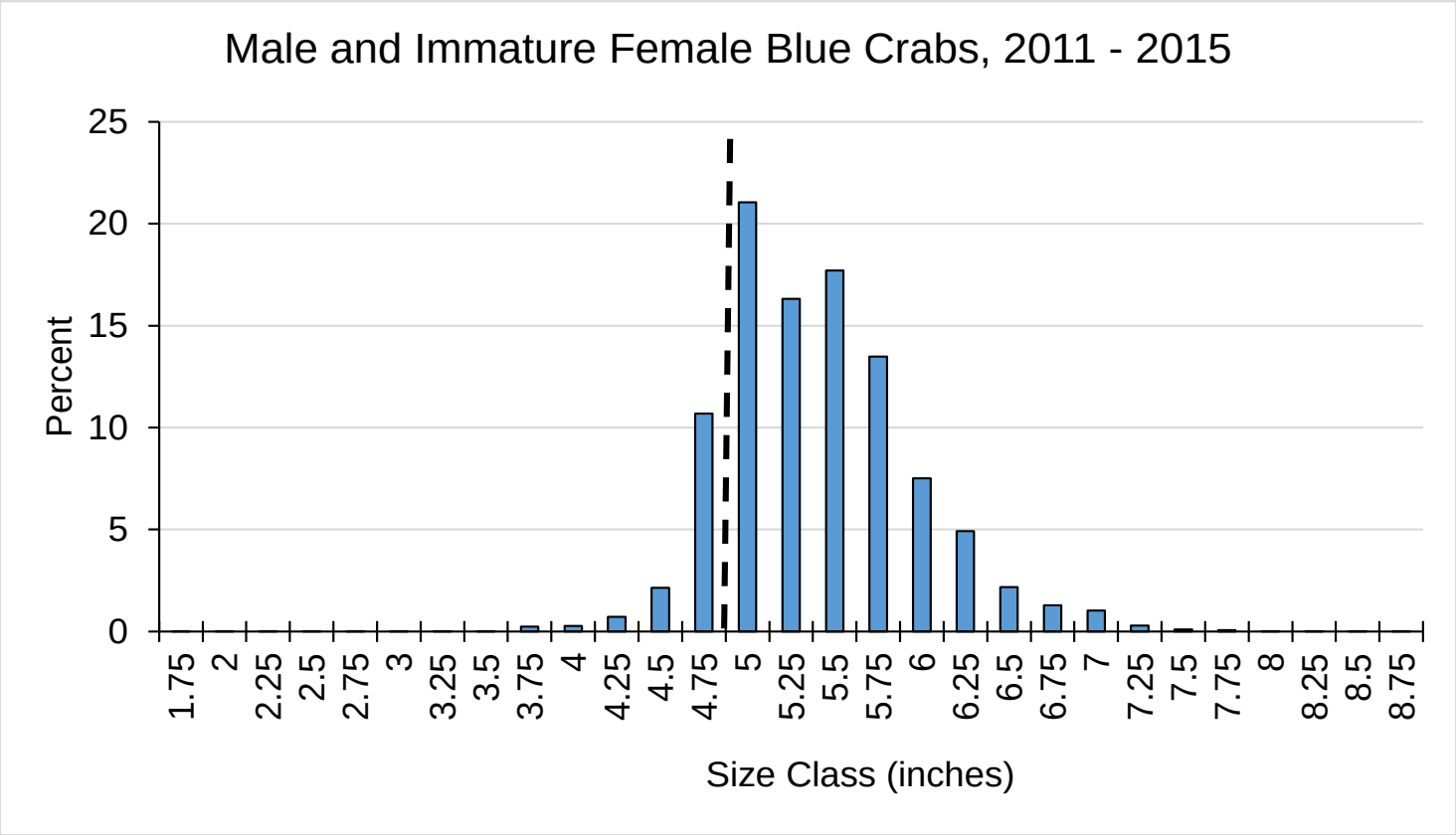
- Once triggered, management action must be taken.
- Management measures for each characteristic and management level already specified.
- Management measures must remain in place until the triggering characteristic is < 50 percent red for three consecutive years.
- Does not identify specific reduction levels for moderate and elevated management measures.
- Reduction level should be based on the degree of concern for the blue crab stock.

Adaptive Management Framework

Characteristic	Moderate management level	Elevated management level
Adult abundance	A1. Increase in minimum size limit for male and immature female crabs	
	A2. Reduction in tolerance of sub-legal size blue crabs (to a minimum of 5%) and/or implement gear modifications to reduce sublegal catch	
	A3. Eliminate harvest of v-apron immature hard crab females	
Recruit abundance	R1. Establish a seasonal size limit on peeler crabs	R4. Prohibit harvest of sponge crabs (all) and/or require sponge crab excluders in pots in specific areas
	R2. Restrict trip level harvest of sponge crabs (tolerance, quantity, sponge color)	R5. Expand existing and/or designate new crab spawning sanctuaries
	R3. Close the crab spawning sanctuaries from September 1 to February 28 and may impose further restrictions	R6. Closure of the fishery (season and/or gear)
		R7. Gear modifications in the crab trawl fishery

Adult Abundance Moderate (A1)

Increase size limit for males and immature females



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Adult Abundance Moderate (A1)

Increase size limit for males and immature females

- Assumes zero percent culling tolerance
- Recoupment likely as crabs grow

Minimum Size Limit	Estimated Harvest Reduction
5 1/4-inch	35%
5 1/2-inch	52%
5 3/4-inch	69%
6-inch	82%

Recruit Abundance Moderate (R1)
Establish a seasonal size limit on peeler crabs

Assumes zero percent culling tolerance

Minimum Size Limit	Peeler Size Limit Reduction Percent			
	Albemarle	Pamlico	Southern	Statewide
3-inch	1.1%	2.8%	0%	1.8%
3 1/4-inch	3.2%	7.3%	2.1%	4.8%
3 1/2-inch	6.9%	15.3%	4.1%	10.2%
3 3/4-inch	13.4%	28.2%	10.3%	19.2%

Adult Abundance Moderate (A2)

Reduce tolerance of sub-legal blue crabs and/or implement gear modifications

Cull Tolerance	Percent of Sampled Trips Above Cull Tolerance
10% (current rule)	12%
5%	26%
3%	37%
0%	63%

Adult Abundance Moderate (A2)

Reduce tolerance of sub-legal blue crabs and/or implement gear modifications

Cull Ring Size	Percent of Sampled Trips By Cull Ring Size
2 5/16-inch (min. legal size)	67%
2 3/8-inch	13%
2 7/16-inch	18%
2 1/2-inch	1%
>2 1/2-inch	1%

Adult Abundance Moderate (A2)
Reduce tolerance of sub-legal blue crabs and/or implement gear modifications

Increase cull ring size in crab pots

- Rudershausen and Turano 2009
  - Tested three sizes of cull rings (2 5/16, 2 3/8, and 2 7/16 inches)
  - Catch rates of sublegal males reduced by increasing cull ring size but not number of cull rings
  - Catch rates of legal males and mature females maintained
  - Estimated length of minimally legal male crabs not less than the current minimum cull ring diameter (2 5/16 inches)

- Rudershausen and Hightower 2016
  - Tested three sizes of cull rings (2 5/16, 2 3/8, and 2 7/16 inches)
  - Mean number of legal male crabs not significantly different among traps
  - Mean number of sublegal male crabs significantly less in pots with largest two cull ring sizes

Adult Abundance Moderate (A2)

Reduce tolerance of sub-legal blue crabs and/or implement gear modifications

Number of Cull Rings	Percent of Sampled Trips
2	80%
3	11%
4	5%
5	3%
>5	1%

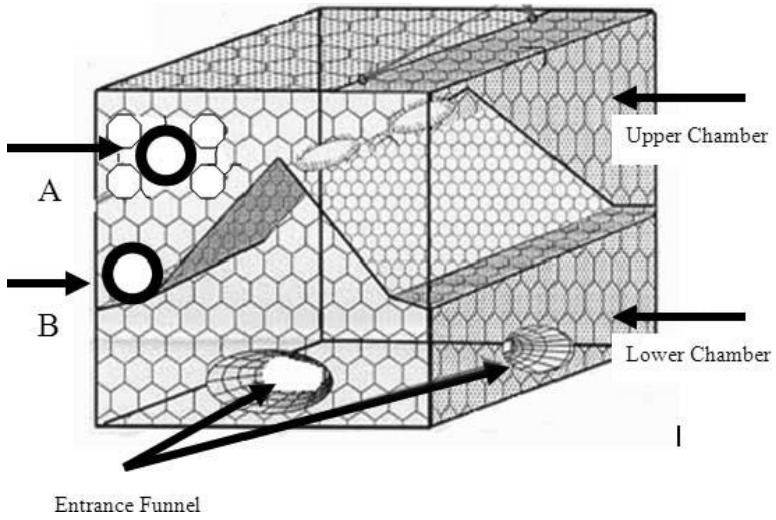
Adult Abundance Moderate (A2)

Reduce tolerance of sub-legal blue crabs and/or implement gear modifications

Require cull rings in crab pots to be placed flush with the floor of the upper chamber

Havens et al. 2009

- 4 percent of sublegal crabs escaped within one hour in unmodified pots (A) .
- 60 percent of sublegal crabs escaped within one hour in modified pots (B).
- Odds of escape in 24 hours for sublegal crabs were 18 times greater in pots with modified cull ring placement.



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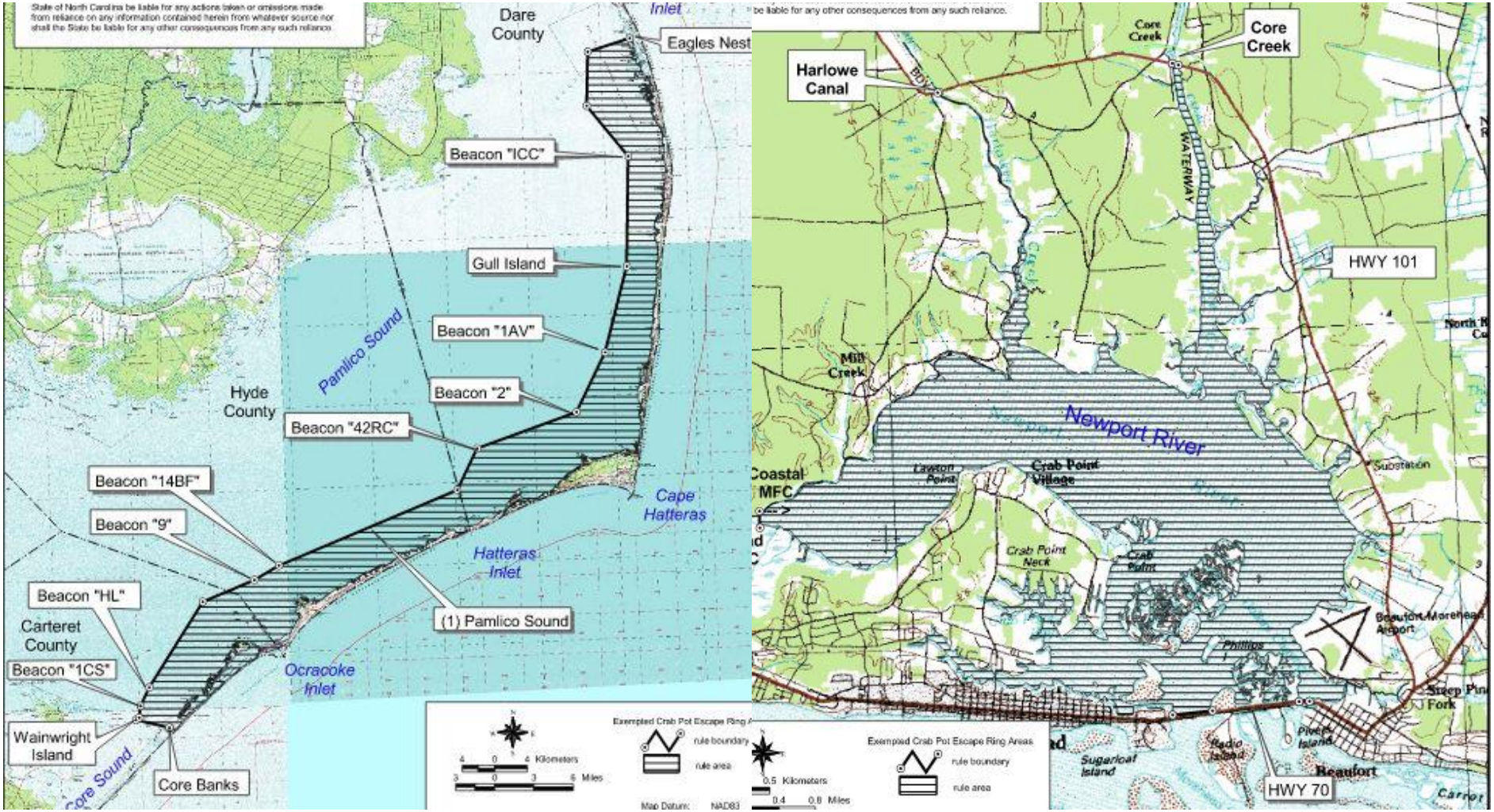
Adult Abundance Moderate (A2)
Reduce tolerance of sub-legal blue crabs and/or implement gear modifications

Remove escape ring exemptions for eastern Pamlico Sound and Newport River

- Average 13.1 percent reduction for eastern Pamlico Sound
- Reduction estimate assumes:
  - Cull tolerance of zero percent
  - Five-inch minimum size limit
- Not enough data for Newport River to estimate reduction
- Newport River exempted from April 1-June 15

Adult Abundance Moderate (A2)

Reduce tolerance of sub-legal blue crabs and/or implement gear modifications



Adult Abundance Moderate (A3)

Eliminate harvest of V-apron immature hard crab females

- Assumes zero percent culling tolerance
- Females mature before harvest
- Recoupment likely as females mature

Year	Albemarle	Pamlico	Southern	Statewide	Statewide Pounds
2001	1.14	0.91	0.26	0.96	270,310
2002	1.02	0.86	0.12	0.91	316,871
2003	1.82	0.41	0.42	1.02	405,511
2004	1.03	0.76	0.58	0.85	266,358
2005	0.86	0.49	0.30	0.61	140,722
2006	0.91	0.33	0.12	0.63	150,232
2007	0.95	0.23	1.33	0.76	154,209
2008	0.41	0.43	0.03	0.40	121,737
2009	0.63	0.72	0.33	0.63	177,017
2010	0.84	1.10	0.27	0.91	266,793
2011	1.18	1.17	0.21	1.12	319,833
2012	0.79	0.59	0.31	0.70	179,100
2013	1.59	0.28	0.07	1.18	250,127
2014	1.03	0.65	0.36	0.91	227,940
2015	0.75	0.77	-	0.72	223,421
Average	**1.00**	**0.65**	**0.32**	**0.82**	**231,345**

Recruit Abundance Moderate (R2)
Restrict trip level harvest of sponge crabs

State	Prohibit the sale or possession of sponge crabs	Have established crab spawning sanctuaries
New Jersey	Yes	No
Delaware	Yes	No
Maryland	Yes	No
Virginia	Yes*	Yes
North Carolina	**No**	**Yes**
South Carolina	Yes	No
Georgia	Yes	No
Florida	Yes	No
Alabama	No	No
Mississippi	Yes	No
Louisiana	Yes	No
Texas	Yes	No

*Prohibits brown and black sponge crab harvest from March 17 through June 15

Recruit Abundance Moderate (R2)
Restrict trip level harvest of sponge crabs

Cull Tolerance	Percent of Sampled Trips
10%	11.5%
5%	13.2%
3%	14.1%
1%	15.9%

Recruit Abundance Elevated (R4)

Prohibit harvest of sponge crabs (all) and/or require sponge crab excluders in pots in specific areas

Prohibit harvest of sponge crabs with zero percent tolerance

	Albemarle			Pamlico			Southern			Statewide		
Year	Total Pounds (Millions)	Sponge Crab Pounds	Percent Reduction	Total Pounds (Millions)	Sponge Crab Pounds	Percent Reduction	Total Pounds (Millions)	Sponge Crab Pounds	Percent Reduction	Total Pounds (Millions)	Sponge Crab Pounds	Percent Reduction
2001	11.8	-	-	14.4	1,373,754	9.6	2.0	11,473	0.6	28.2	1,385,228	4.9
2002	20.2	-	-	12.7	2,005,454	15.8	1.8	3,374	0.2	34.7	2,008,828	5.8
2003	17.3	-	-	20.3	2,850,359	14.0	2.1	7,654	0.4	39.6	2,858,013	7.2
2004	11.8	-	-	17.6	2,018,331	11.5	1.8	17,566	1.0	31.2	2,035,897	6.5
2005	8.7	1,017	<0.1	12.3	2,147,818	17.5	1.9	8,473	0.4	22.9	2,157,308	9.4
2006	12.9	-	-	9.4	431,200	4.6	1.7	14,531	0.9	24.0	445,731	1.9
2007	12.9	349	<0.1	6.0	1,623,618	27.2	1.4	68,447	4.9	20.3	1,692,414	8.4
2008	21.2	-	-	7.8	166,608	2.1	1.6	50,142	3.2	30.5	216,750	0.7
2009	19.7	-	-	6.7	498,300	7.4	1.6	33,904	2.2	27.9	532,204	1.9
2010	16.7	-	-	11.1	204,807	1.9	1.5	85,826	5.8	29.3	290,632	1.0
2011	15.2	-	-	11.8	779,301	6.6	1.6	8,223	0.5	28.6	787,524	2.8
2012	16.3	-	-	7.6	1,083,365	14.3	1.9	37,953	2.0	25.7	1,121,318	4.4
2013	14.9	-	-	4.7	313,317	6.7	1.6	47,937	3.0	21.1	361,254	1.7
2014	18.2	-	-	5.3	97,564	1.8	1.4	53,461	3.7	25.0	151,025	0.6
2015	19.5	-	-	10.0	1,516	<0.1	1.5	-	-	31.0	1,516	<0.1
Average	**15.8**	**91**	**<0.1**	**10.5**	**1,039,687**	**9.4**	**1.7**	**29,931**	**1.9**	**28.0**	**1,069,709**	**3.8**

Recruit Abundance Elevated (R4)

Prohibit harvest of sponge crabs (all) and/or require sponge crab excluders in pots in specific areas

Sponge Crab Pounds Sampled	Year														
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Eastern Pamlico Sound	2,695	3,362	1,762	2,376	1,647	691	1,858	451	-	199	1,881	5,889	885	608	-
Total Pamlico Region	2,695	3,886	1,818	2,963	2,007	691	1,877	467	792	385	1,881	6,351	886	611	11
Percent Eastern Pamlico Sound	**100**	**86.5**	**96.9**	**80.2**	**82.1**	**100**	**99.0**	**96.6**	**0**	**51.5**	**100**	**92.7**	**99.8**	**99.5**	**0**

Recruit Abundance Elevated (R4)

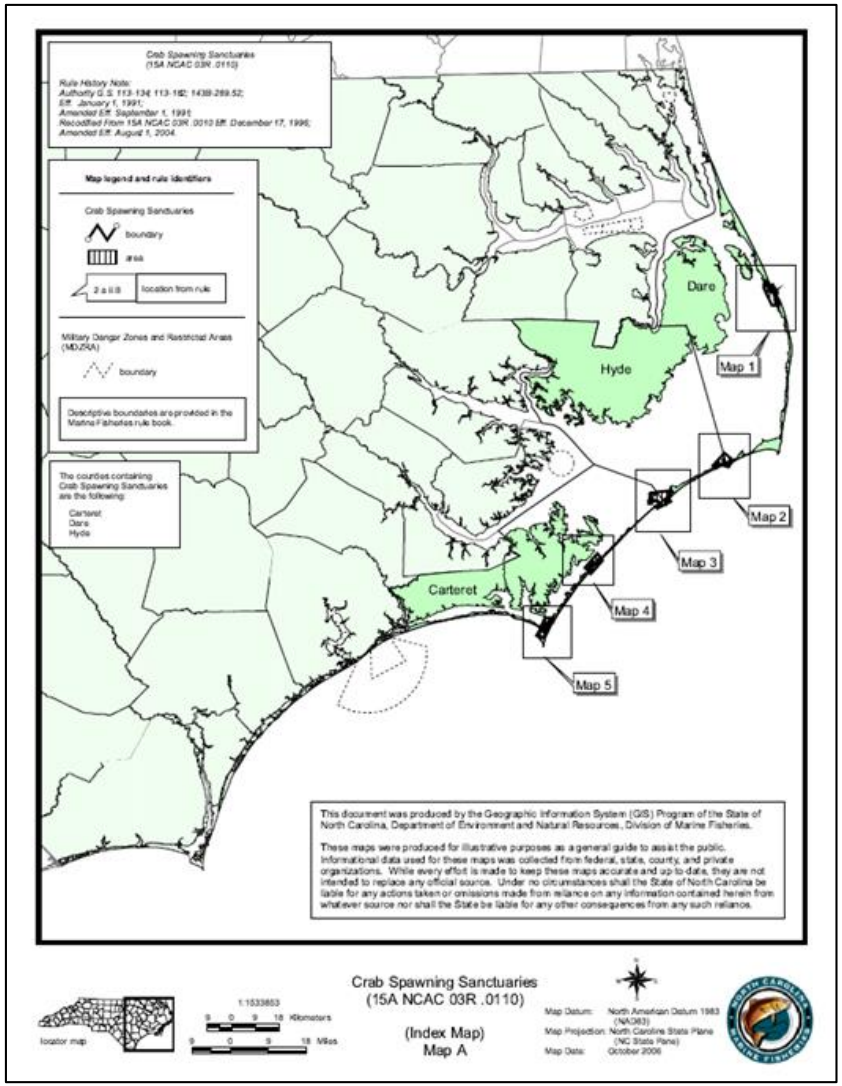
Prohibit harvest of sponge crabs (all) and/or require sponge crab excluders in pots in specific areas

Require sponge crab excluders in areas and during times with a high percentage of sponge crabs in the harvest

- Dickinson et al 2006
  - Sponge damage significantly greater in crabs caught by pots than crabs caught by hand
  - Majority of crabs caught by pots had on average 60 percent of sponge remaining.
- Rudershausen and Turano 2006
  - No significant difference in median carapace width of mature female crabs
  - Significantly smaller males than control traps

Recruit Abundance Moderate (R3)

Close the crab spawning sanctuaries from Sept. 1 through Feb. 28 and may impose further restrictions



Recruit Abundance Moderate (R3)

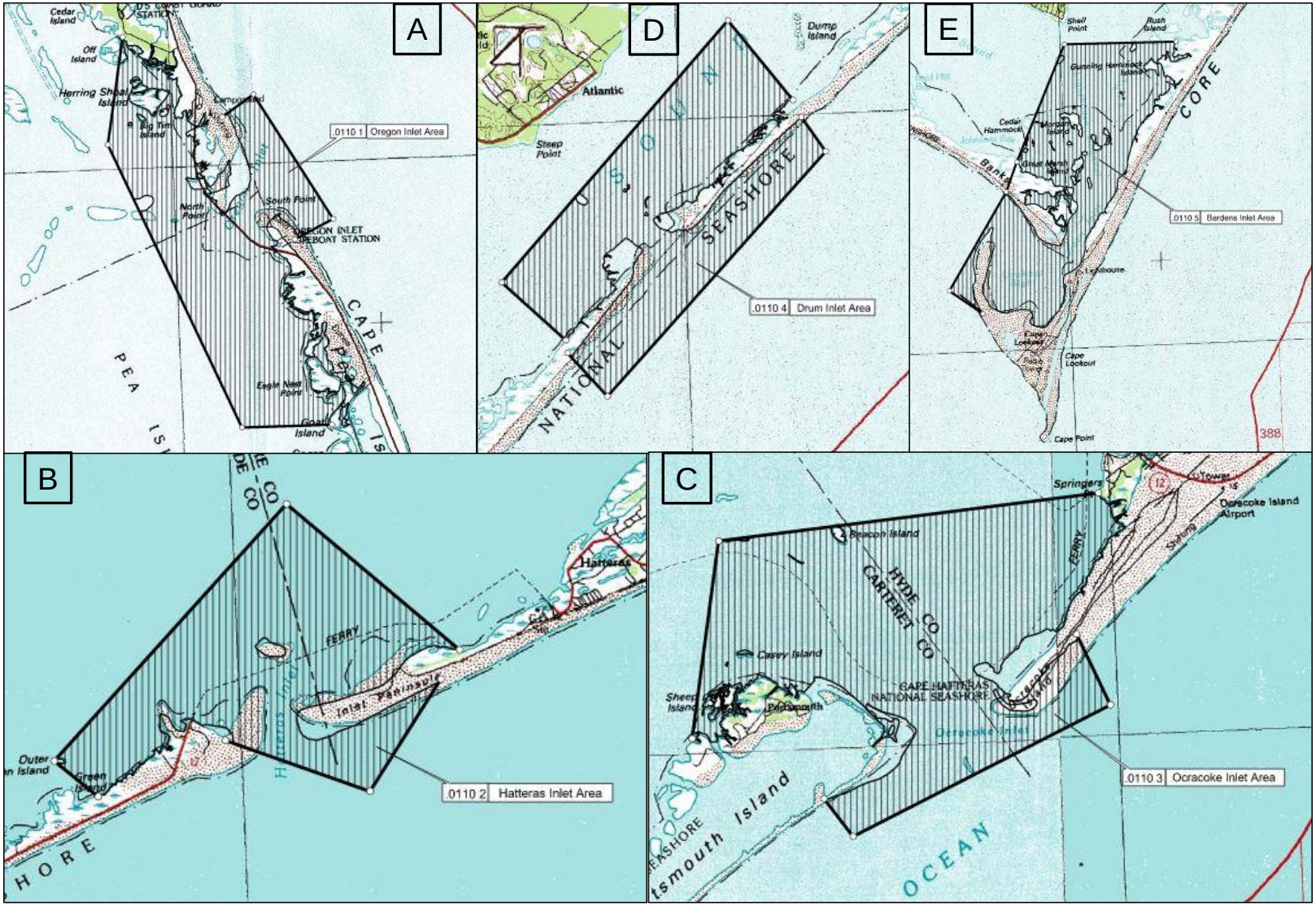
Close the crab spawning sanctuaries from Sept. 1 through Feb. 28 and may impose further restrictions

- Currently unlawful to set or use trawls, pots, and mechanical methods for oysters or clams or take crabs with the use of commercial fishing equipment from March 1 through Aug. 31

- Will result in year-round closure of crab spawning sanctuaries

Recruit Abundance Elevated (R5)

Expand existing and/or designate new crab spawning sanctuaries



Recruit Abundance Elevated (R5)

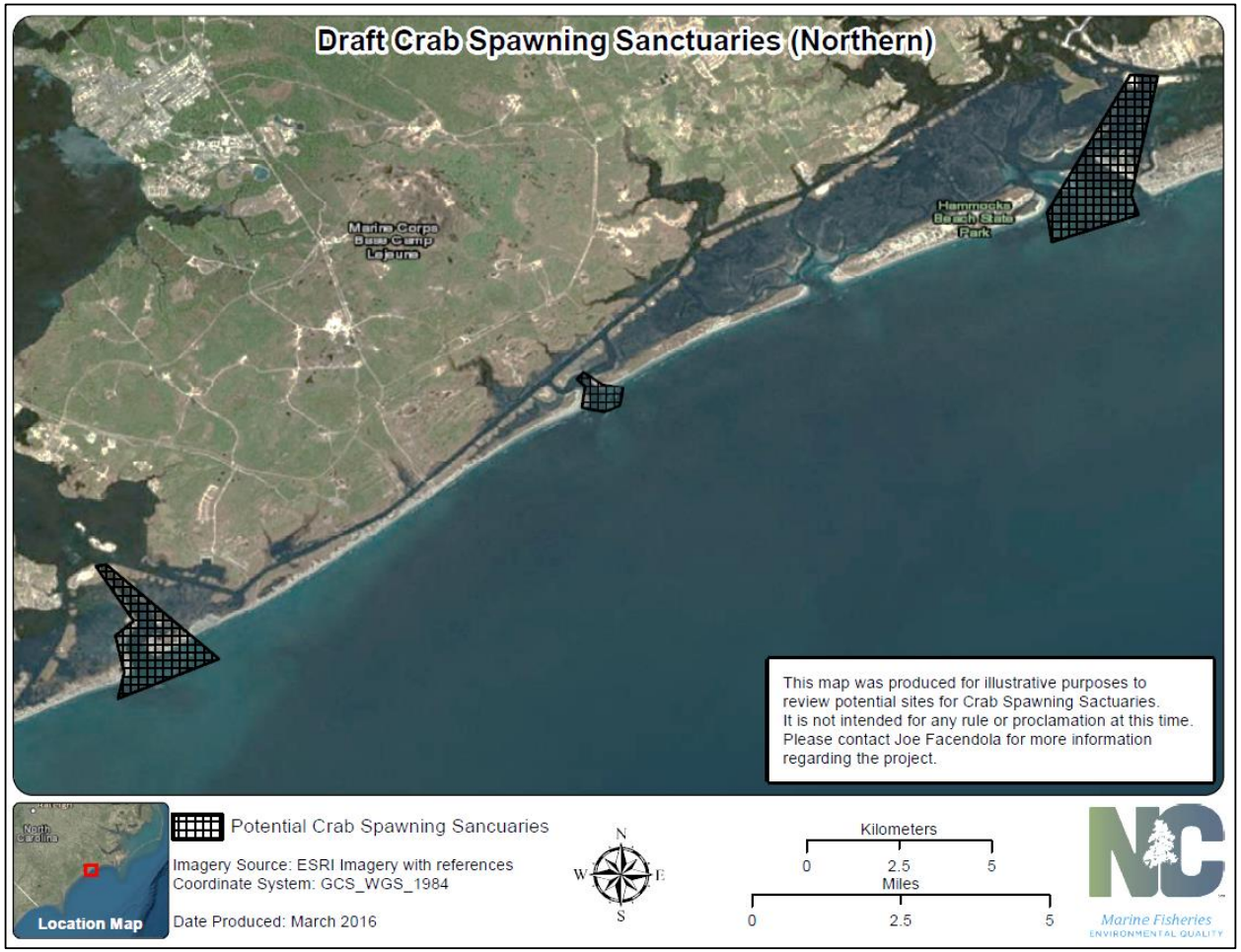
Expand existing and/or designate new crab spawning sanctuaries

Medici 2004

- Tagged crabs showed movement seaward and toward the closest inlet.
- Females move seaward at night at edges of sloughs and channels with little movement during the day.
- Females do not stay in the spawning sanctuaries due to their small size relative to movement patterns.

Recruit Abundance Elevated (R5)

Expand existing and/or designate new crab spawning sanctuaries



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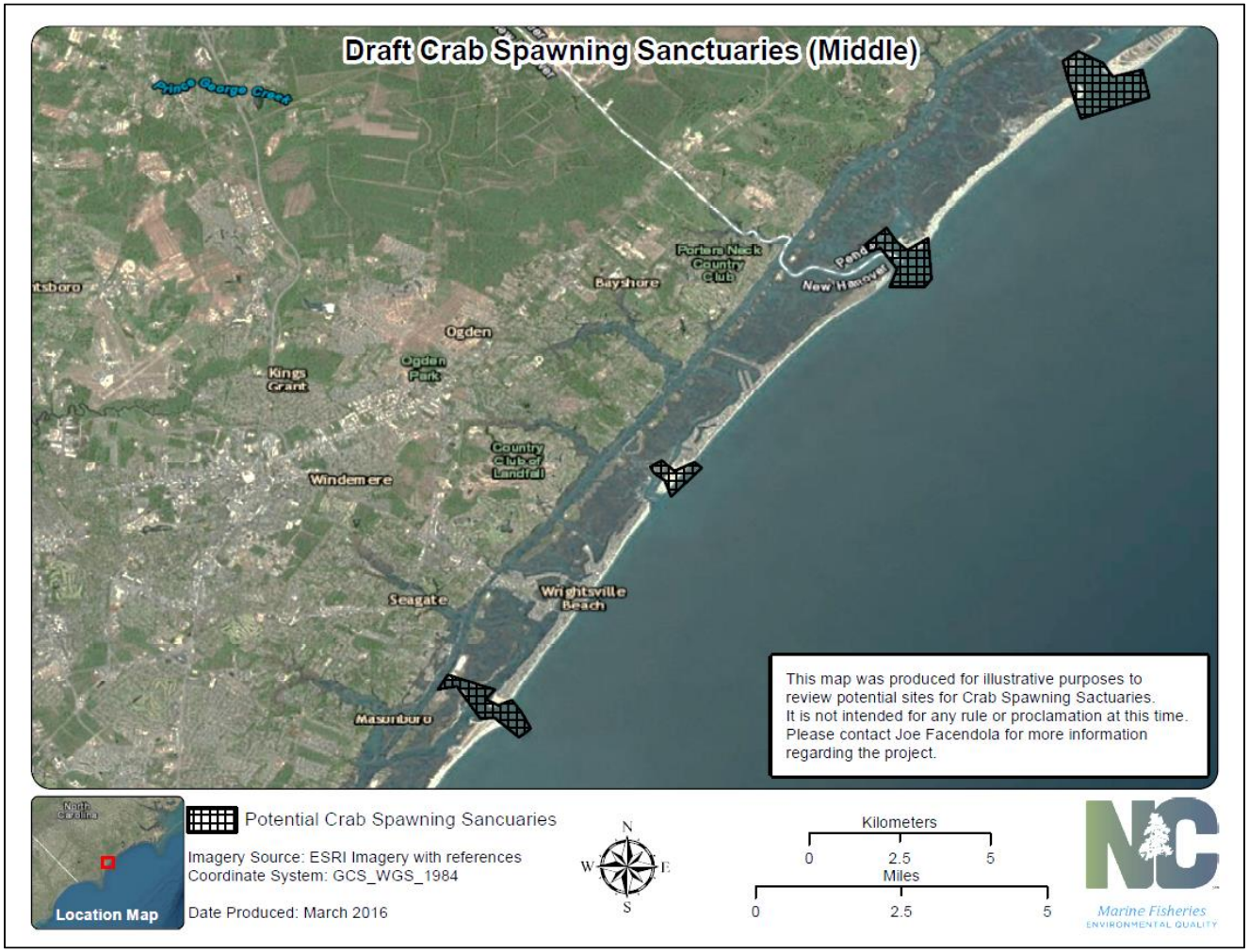
Recruit Abundance Elevated (R5)

Expand existing and/or designate new crab spawning sanctuaries



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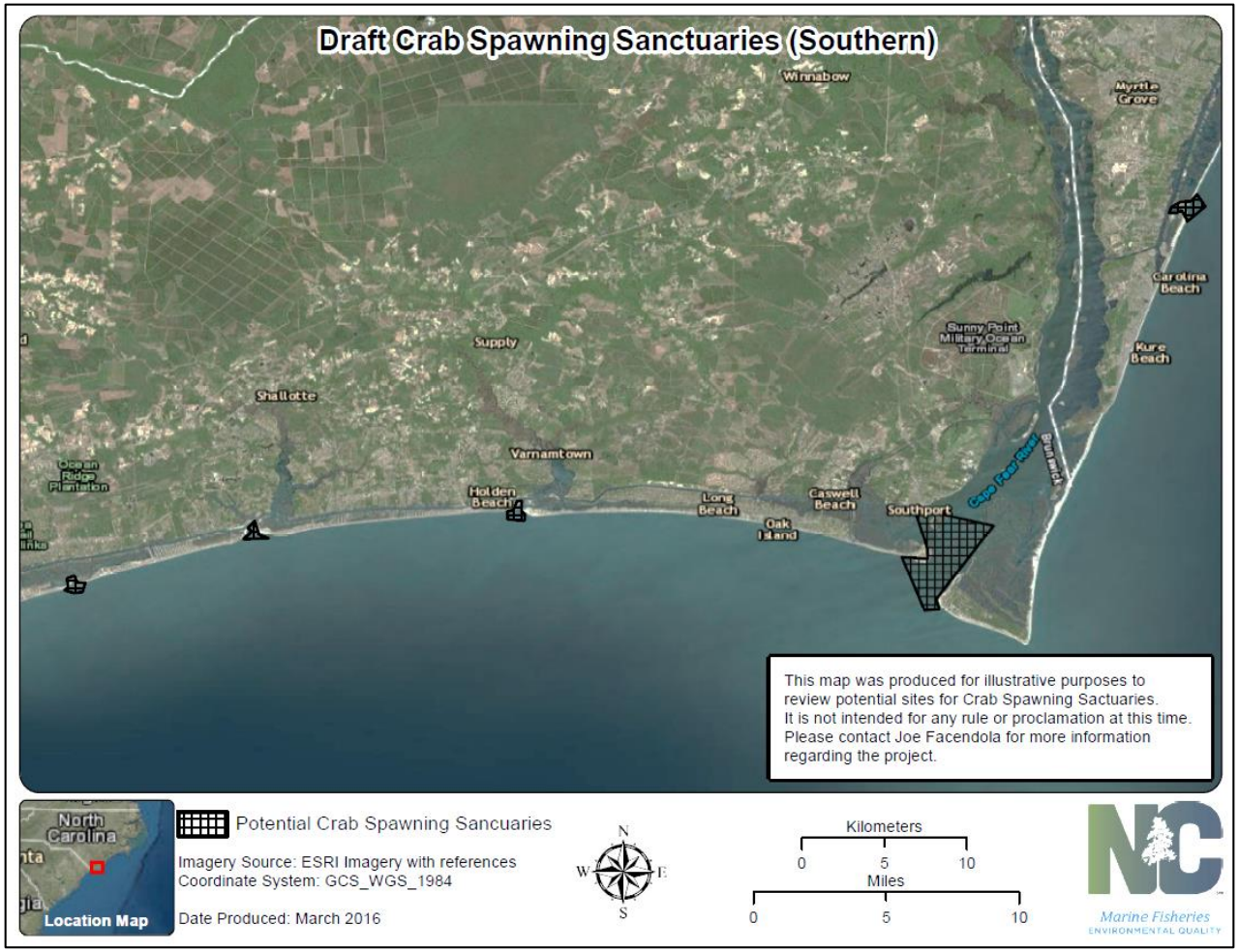
Recruit Abundance Elevated (R5)

Expand existing and/or designate new crab spawning sanctuaries



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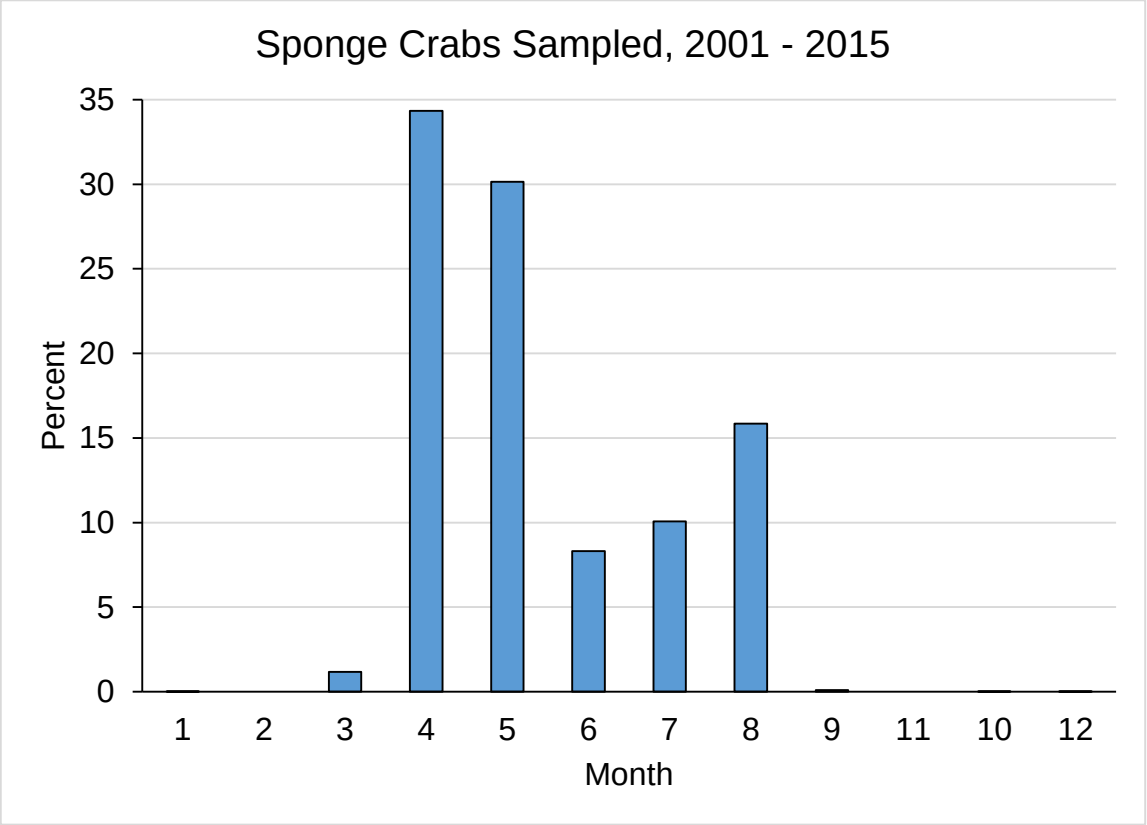
Recruit Abundance Elevated (R6)
Closure of the fishery (season and/or gear)

Season closure:

- Prohibit sponge crab harvest during peak periods of abundance



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Recruit Abundance Elevated (R6)
Closure of the fishery (season and/or gear)

Season closure

- Prohibit harvest from April 1 – April 30
- Prohibit harvest from Aug. 1 – Aug. 31

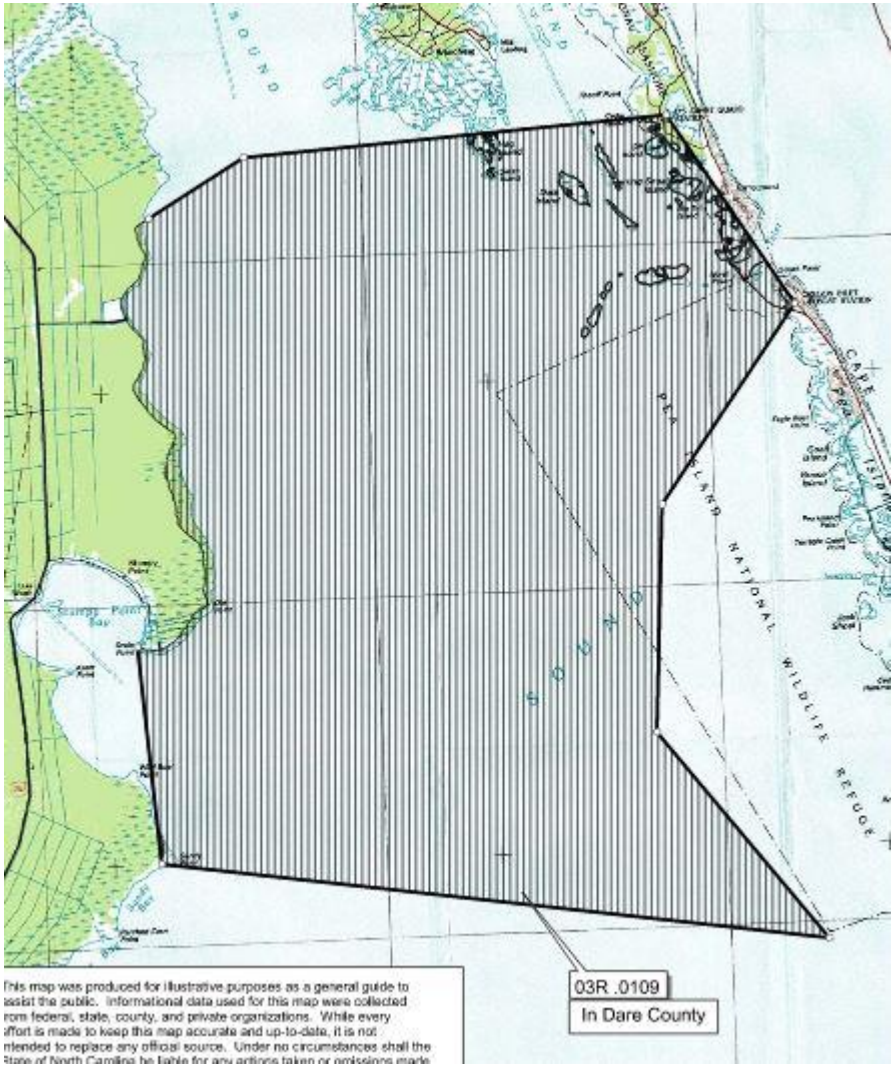
Average monthly hard crab landings, 2011-2015

	January	February	March	April	May	June	July	August	September	October	November	December
Percent Landings	0.2%	0.4%	2.0%	3.4%	10.9%	15.7%	14.4%	15.7%	15.9%	13.6%	6.0%	1.8%

Recruit Abundance Elevated (R6)
Closure of the fishery (season and/or gear)

Gear specific closure:

- Prohibit the harvest of crabs with dredges (all dredges)



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Recruit Abundance Elevated (R6)
Closure of the fishery (season and/or gear)

Gear specific closure:

Prohibit the harvest of crabs with crab dredges

Annual dredge landings (lb.), 2011-2015			
Year	Crab Dredge	Oyster Dredge	Total
2011	6,843	31,861	38,704
2012	4,051	2,756	6,807
2013	-	1,305	1,305
2014	-	7,372	7,372
2015	1,382	5,203	6,585

Average monthly dredge landings (lb.), 2011-2015		
Month	Crab Dredge	Oyster Dredge
January	1,634	1,870
February	600	2,155
March	-	615
April	-	124
November	-	615
December	-	508

Recruit Abundance Elevated (R6)
Closure of the fishery (season and/or gear)

Gear specific closure:

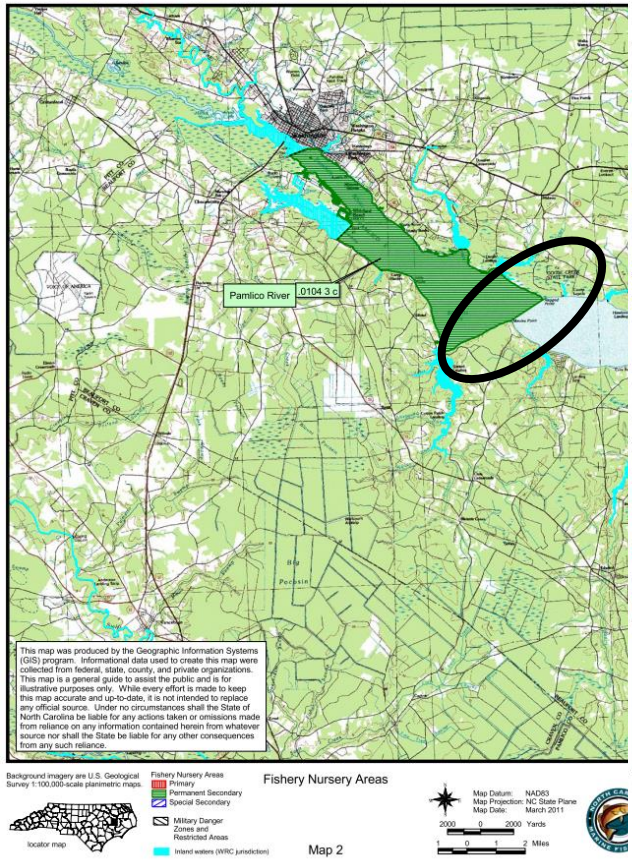
- Move crab trawls back to shrimp trawl lines in Pamlico, Pungo, and Neuse rivers

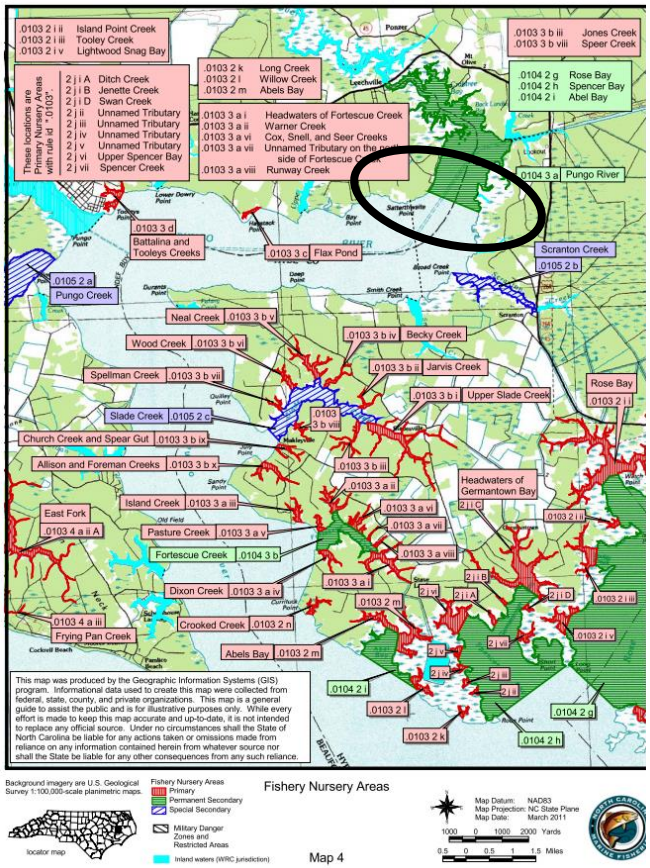
Annual crab landings from crab and shrimp trawls (lb.), 2011-2015

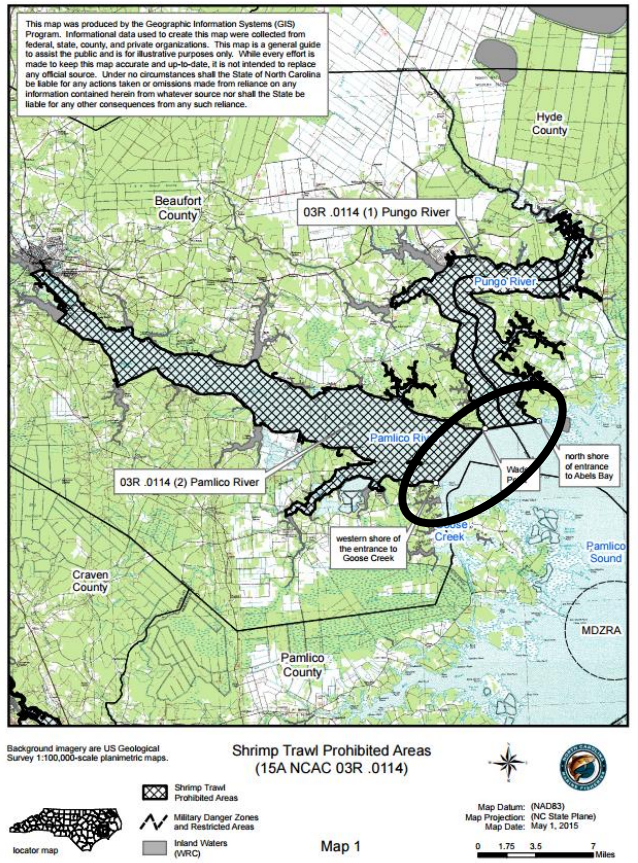
Year	Crab Trawl			Shrimp Trawl		
	Neuse	Pamlico	Pungo	Neuse	Pamlico	Pungo
2011	-	141	-	48	371	77
2012	450	-	-	-	12	-
2013	-	-	-	904	-	-
2014	220	-	-	2,561	-	-
2015	302	329	320	451	49	-

Recruit Abundance Elevated (R6)

Closure of the fishery (season and/or gear)







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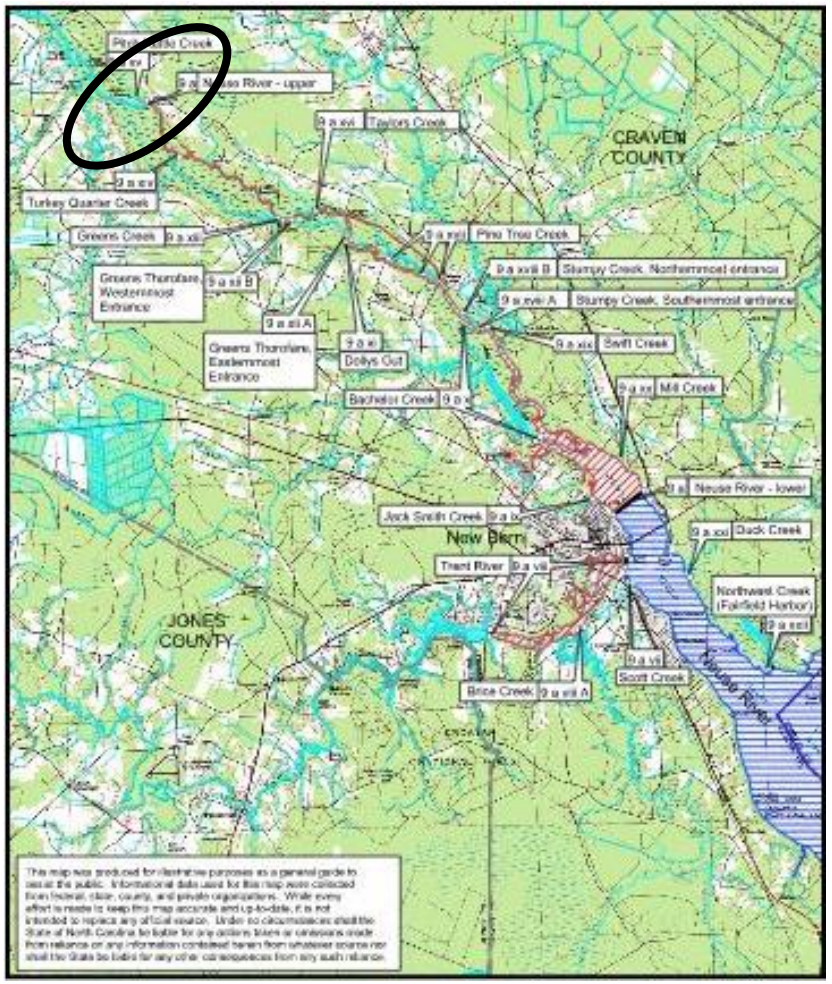
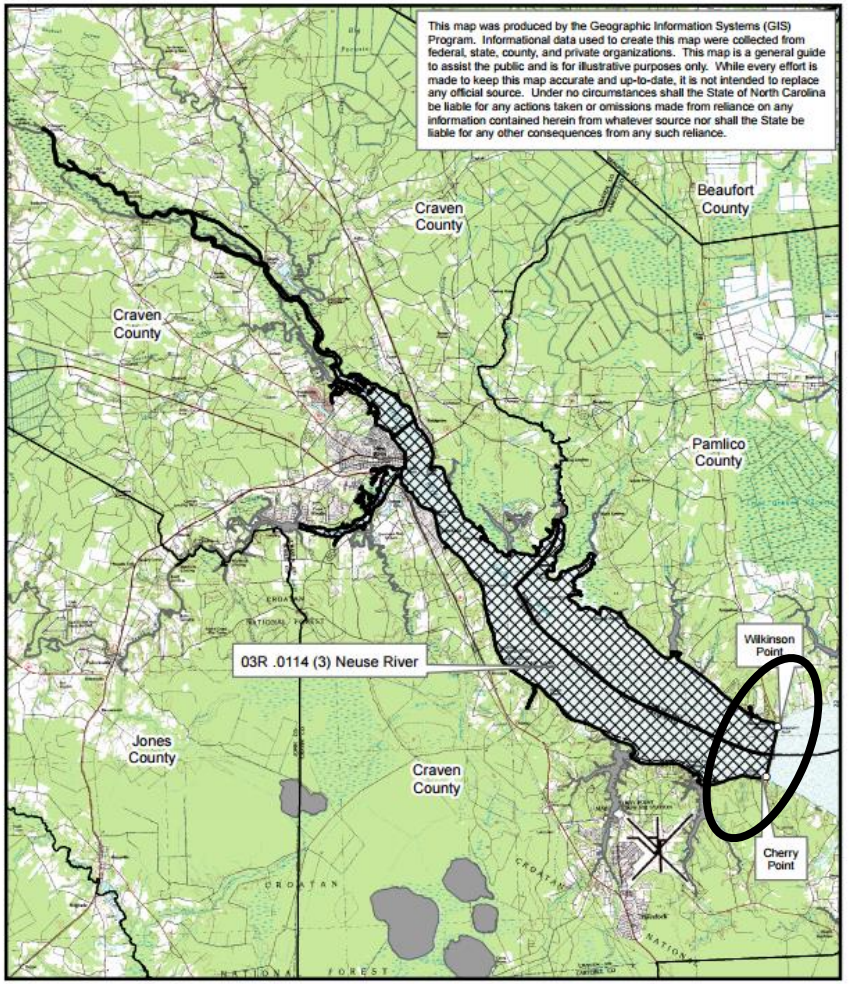
Recruit Abundance Elevated (R6)

Closure of the fishery (season and/or gear)





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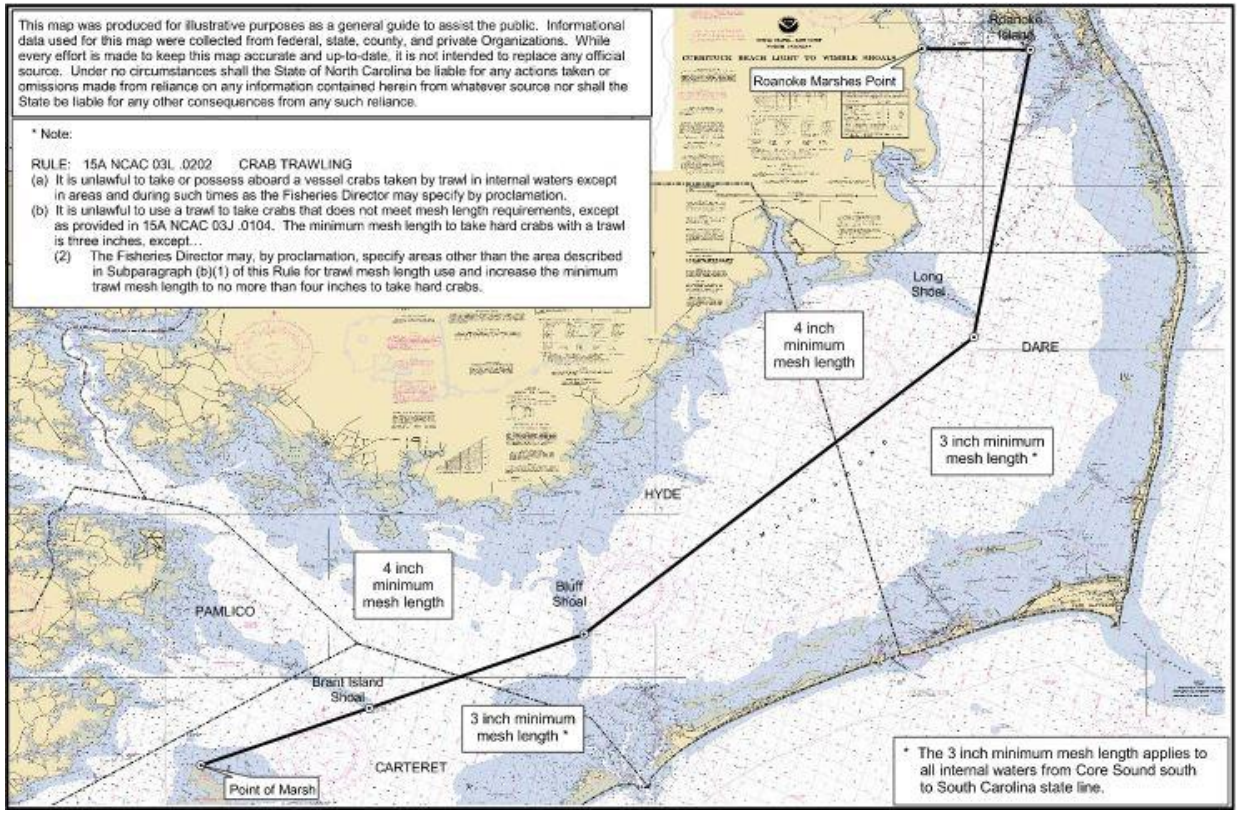
Recruit Abundance Elevated (R7)
Gear modifications in the crab trawl fishery

Increase the crab trawl minimum mesh length to 4 inches statewide



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Recruit Abundance Elevated (R7)
Gear modifications in the crab trawl fishery

Increase the crab trawl minimum mesh length to four inches statewide

- McKenna and Camp 1992 – Pamlico River
  - 4-inch tail bag vs. a 3-inch tail bag reduced sublegal crabs 12 percent
- Lupton 1996 – Bay River
  - 4-inch tail bag vs. a 3-inch tail bag reduced sublegal crabs 22 percent
- Hannah and Hannah 2000 – Pamlico Sound
  - 4-inch tail bag vs. a 3-inch tail bag reduced sublegal crabs 31 percent

Public Comment and Management Recommendations

Public Comment

Management measures receiving no public support:

- Restrict trip level harvest of sponge crabs (tolerance, quantity, sponge color)
- Close the crab spawning sanctuaries from Sept. 1 to Feb. 28 and may impose further restrictions
- Closure of the fishery (season and/or gear)
- Gear modifications in the crab trawl fishery

Public Comment

MANAGEMENT MEASURE	Comment 1	Comment 2	Comment 3	Comment 4	Comment 5	Comment 6	Comment 7	Comment 8	Comment 9	Comment 10	Comment 11	TOTAL SUPPORT
INCREASE IN MINIMUM SIZE LIMIT FOR MALE AND IMMATURE FEMALE CRABS			5 1/2" SIZE LIMIT									**1**
REDUCTION IN TOLERANCE OF SUB-LEGAL SIZE BLUE CRABS (TO A MINIMUM OF 5%) AND/OR IMPLEMENT GEAR MODIFICATIONS TO REDUCE SUBLEGAL CATCH			5% AND 2 3/8" CULL RINGS	2 3/8" CULL RINGS	5% BY WEIGHT							**3**
ELIMINATE HARVEST OF V-APRON IMMATURE HARD CRAB FEMALES	X	X				X	X	WITH 1% TOLERANCE	X		X	**7**
ESTABLISH A SEASONAL SIZE LIMIT ON PEELER CRABS	LESS THAN 4" NOT WORTH THE TIME		3" SIZE LIMIT	DID NOT SPECIFY SIZE								**3**
PROHIBIT HARVEST OF SPONGE CRABS (ALL) AND/OR REQUIRE SPONGE CRAB EXCLUDERS IN POTS IN SPECIFIC AREAS	X	X								IN ONE AREA TO SEE RESULT	BLACK SPONGE ONLY	**4**
EXPAND EXISTING AND/OR DESIGNATE NEW CRAB SPAWNING SANCTUARIES					EXPAND BY 10%		X					**2**

Recommendations

Northern Regional Advisory Committee

- No possession of v-apron crabs (consistent with moderate management measure A3) and to keep a 10 percent cull tolerance across the board

- Investigate re-tooling the data collection system for the blue crab industry and work with the industry to identify a more appropriate sampling approach (e.g. winter dredge survey).

- Add two additional cull rings to crab pots. One cull ring must be within one full mesh of the bottom of the apron/stairs of the upper chamber of the pot, effective Jan. 16, 2017.

Recommendations

Southern Regional Advisory Committee

- Reduce the tolerance of sublegal size blue crabs to a minimum of five percent; and look at gear modifications to reduce sublegal catch; and to eliminate harvest of v-apron immature hard crab females.

- No take of black sponge crabs with a cull tolerance of five percent

Recommendations

Shellfish/Crustacean Advisory Committee

- Adopt the measures of no v-apron hard crabs and no black sponge crab harvest with a 5 percent tolerance for both (excludes v-apron peelers).

- Keep two cull rings (no additional cull rings and current legal size) but to reposition one cull ring within one full mesh of the bottom of the apron/stairs of the upper chamber of the pot, effective Jan. 16, 2017.

- Request that other commissions under the Coastal Habitat Protection Plan look at Division of Marine Fisheries blue crab recruit abundance data; and ask what the Environmental Management Commission and Coastal Resources Commission have done to improve habitat and water quality conditions for blue crab; and determine if they can develop a suite of options that the Environmental Management Commission and Coastal Resources Commission could implement to improve water quality and habitat conditions in those areas.

Recommendations

Shellfish/Crustacean Advisory Committee (cont.)

- Request Division of Marine Fisheries observers on commercial crab boats to collect data to assist with the Blue Crab Traffic Light assessment

- Request Division of Marine Fisheries staff analyze the 21 years of commercial fishery data, refined by taking into account socio-economic information such as storms, prices, picking house availability, etc. that affects fishing effort, and align it with 21 years of Division of Marine Fisheries fishery-independent data and summarize in a report. In the future, refine the fishery-dependent data set so it can be incorporated.

- Request Division of Marine Fisheries staff look at the effect of predation by striped bass, red drum, cownose rays, and other species on blue crabs.

Recommendations

Division of Marine Fisheries

- Add two additional cull rings to crab pots, one of which must be located within one full mesh of the corner of the pot and within one full mesh of the bottom of the apron/stairs of the upper chamber of the pot.
- Eliminate the harvest of v-apron immature female hard crabs (excluding peeler crabs) and that v-apron immature hard crab females be added to the current 10 percent culling tolerance (currently only includes sublegal male and immature female hard crabs).
- Prohibit sponge crab harvest (all stages) from April 1 – April 30.
- Prohibit crab harvest with dredges except incidental to lawful oyster dredging as outlined in North Carolina Marine Fisheries Commission Rule 15A NCAC 03L .0203(a)(2).

Questions?

Department of Environmental Quality