COASTAL RECREATIONAL FISHING LICENSE
FINAL REPORT*

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Final Project Summary: During the study period, 8,845 red drum were tagged. Tagged red drum per year ranged from 1,720 (2013) to 2,816 (2014). Red drum were tagged by both North Carolina Division of Marine Fisheries staff and trained volunteers. Tagging occurred year-round throughout coastal waters of North Carolina. A wide range of sizes ranging from 227 mm to 1,321 mm fork length were tagged. Volunteer taggers were instructed to tag red drum greater than 27 inches total length, while North Carolina Division of Marine Fisheries staff tagged red drum of all sizes. Recapture rates varied by size of the fish at tagging and the tag type used. Overall, 6% of the tagged fish were recaptured. Reporting rate (percent of tag recaptures that are assumed to be reported) was estimated using of high reward ($100) tags. Low-reward internal anchor tags (n=2,639) had a recapture rate of 10.7%, while high-reward internal anchor tags (n=318) had a return rate of 17.3%. The corrected reporting rate, assuming 100% of the high-reward tags was reported, was approximately 61.8% for the low-reward tags. A total of 634 red drum were double tagged with internal anchor tags to determine tag retention. Ninety-three double tagged fish were reported as recaptured. Of these, 72% retained both tags with a maximum time at-large of 423 days. There was no consistent pattern for tag loss over time. For all tag types and scenarios, 601 tag recaptures were reported. The majority of red drum recaptures occurred in North Carolina waters with 1.6% occurring in other state waters. All movement out of state waters was north to either Virginia or Maryland. This pattern of movement is consistent with current stock structure assumptions where the states of North Carolina and north are considered a unit stock. The primary objective to continue tagging efforts in North Carolina for red drum, while incorporating needed auxiliary studies (tag reporting rate and tag retention) was achieved. Results will be used to provide data needed for future stock assessments and/or direct estimates of fishing mortality through tagging models.

North Carolina Cooperative Tagging Program
CRFL Grant 2F40 F012

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ABSTRACT

During the study period (June 2013 to December 2016), 8,845 red drum were tagged. Tagged red drum per year ranged from 1,720 (2013) to 2,816 (2014). Red drum were tagged by both North Carolina Division of Marine Fisheries staff and trained volunteers. Tagging occurred year-round throughout coastal waters of North Carolina. A wide range of sizes ranging from 227 mm to 1,321 mm fork length were tagged. Volunteer taggers were instructed to tag red drum greater than 27 inches total length, while North Carolina Division of Marine Fisheries staff tagged red drum of all sizes. Recapture rates varied by size of the fish at tagging and the tag type used. Overall, 6% of the tagged fish were recaptured. Reporting rate, through the use of high reward ($100) tags was assessed. Low-reward internal anchor tags (n=2,639) had a recapture rate of 10.7%, while high-reward internal anchor tags (n=318) had a return rate of 17.3%. The corrected reporting rate for the low-reward tags was approximately 61.8%. A total of 634 red drum were double tagged with internal anchor tags in the study to ascertain tag retention. Ninety-three (15%) were reported as recaptured. Of these, 72% retained both tags with a maximum time at-large of 423 days. There was no consistent pattern for tag loss over time. For all tag types and scenarios, 601 tag recaptures were reported. The majority of red drum recaptures occurred in North Carolina waters with 1.6% occurring in other state waters. All movement out of state waters was north to either Virginia or Maryland. This pattern of movement is consistent with current stock structure assumptions where the states of North Carolina and north are considered a unit stock.

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1 INTRODUCTION

While red drum (*Sciaenops ocellatus*) provide substantial recreational opportunity and economic benefit to North Carolina, they also present unique challenges to fisheries scientists tasked with determining the health of the stock. Past efforts to use traditional stock assessments have proven difficult, primarily due to the life history of red drum and the limited sizes and ages available to harvest. Red drum are a long-lived (50+ years) fish that begins maturing around age-3. As red drum mature they become less available to inshore fishing effort as fish migrate from inshore estuarine waters towards coastal inlets and eventually offshore to join the adult stock. Another confounding factor is that harvest size is restricted by a minimum and maximum size limit (i.e., slot limit). This slot limit (currently 18 to 27 inches total length) along with the rapid initial growth of red drum prior to maturing, results in harvest being centered around age-2 fish, with some limited harvest of age-1 and age-3 fish. Harvest data, therefore, only provides managers with limited information from which to determine the stock condition of this long-lived species.

Determining the selectivity of age-3 and older fish relative to age-2 fish is a critical data need of the red drum stock assessment. Early stock assessments were unable to internally estimate selectivity at age for red drum and had very little information from which to base external estimates (Vaughan and Carmichael 2000). Incorrect assumptions about selectivity have direct impacts on estimated population parameters such as population age structure and fishing mortality. A decrease in age-3 red drum landings can be due to a combination of factors such as reduced selectivity (migration), fishery regulations (growing out of slot limit), and prior fishing mortality (Bacheler et al. 2010). In order to address this issue, North Carolina Division Marine Fisheries (NCDMF) red drum tagging data were modeled to develop an efficient and direct method for estimating age-specific fishing mortality and selectivity patterns for both captured and released red drum (Bacheler et al.2008). Initial model runs were first used to provide direct estimates of selectivity at age for the NC red drum stock assessment (Takade and Paramore 2007). More recent red drum assessment used tag modeling based on Bacheler et al. (2008) to provide estimates of selectivity, as well as, age-specific estimates of fishing mortality (SEDAR 2009, ASMFC 2017). These assessments incorporated fishing mortality estimates as direct inputs into the statistical catch-at-age model. This inclusion of tagging data in the model greatly improved precision in estimated population parameters when compared to runs excluding the tagging data. Additionally, age specific selectivity vectors estimated from tagging data for recreationally released fish were input directly into the models to infer the age composition of released fish. No other data were available on the composition of releases from the recreational fishery. This information was deemed critical, as recreational releases have increased over time and mortality associated with releases represents a large portion of the total removals from the population (SEDAR 2009).

Modeling of tag data from NCDMF has been used to address many critical data needs for the assessment of red drum. However, Bacheler et al. (2008) noted that previous NCDMF red drum tagging lacked the auxiliary studies needed to estimate non-reporting and tag retention. The SEDAR 18 (2009) review panel also noted the need for a better statistical design in tagging studies as part of their research recommendations. The review panel suggested that fishing mortality estimated directly from tagging data could have merit as a basis for the stock determination and provide useful guidance for fisheries managers. They noted that tagging results can be provided with higher frequency than traditional assessments with the added option that tagging can still be incorporated into a traditional assessment. The panel also noted the benefit of a well-designed

tagging study as having wide fishery visibility and support. This study adds additional needed elements of a well-designed tagging study as has been recommended by previous studies (Pollock et al. 2001; Bacheler et al. 2010). The objective of this study is to continue the red drum tagging program in North Carolina, while incorporating needed auxiliary studies (tag reporting rate and tag retention) to provide data needed for future stock assessments and/or direct estimates of fishing mortality through tagging models.

The goals of this study are:

1. To maintain and enhance the ongoing tagging programs for red drum in North Carolina in a manner consistent with modeling needs.
2. To conduct a tag retention study to estimate tag loss from conventional internal anchor tags for red drum.
3. To conduct a high reward study to estimate annual reporting rates for red drum.
4. To make all tagging data collected available for inclusion in ongoing stock assessment efforts by the Atlantic States Marine Fisheries Commission (ASMFC).

2 METHODS

Red drum tagging was conducted by volunteer anglers and NCDMF staff. Trained recreational volunteers tagged adult red drum (>27 inches total length) during their routine fishing trips. North Carolina has maintained a red drum volunteer tagging program since 1983. Taggers were instructed to tag a representative sample of their catch during their normal fishing activities. They recorded date tagged, location, length of fish and tag number for each fish tagged. The NCDMF staff tagged red drum through existing fishery independent sampling programs or directed tagging effort. Common gears used to tag red drum included run-around gill nets, trammel nets, electroshocking, hook and line, longlines and anchored gill nets. Utilizing recreational anglers and NCDMF surveys allowed for tagging opportunities throughout the coastal estuarine waters of North Carolina.

All red drum tagging was done following a strict tagging protocols described hereafter. Only healthy red drum in very good condition were tagged. Red drum less than 27 inches total length were tagged with a wire core internal anchor tag (Floy FM-95W). Internal anchor tags were inserted into a small incision made by a scalpel approximately 10 mm posterior to the pelvic fin and dorsal to the mid-ventral line. Red drum greater than 27 inches total length were tagged with wire-thru stainless-steel dart tags (Hallprint FH-69). The steel dart tags were inserted firmly into the epaxial muscle within two or three scale rows of the dorsal fin at a location slightly posterior to the middle of the first dorsal fin. All tags were labeled with a unique tag number, a message ("REWARD"), and contact information. Standard rewards offered for tag returns were in the form of a hat, fish towel or $5. Upon the receipt of a recapture, NCDMF staff contacted the fisher to obtain information on the fate of the fish and tag, as well as, the gear used and location of capture.

Following the recommendations of Bacheler et al. (2008) a portion of the fish received either a high-reward tag or were double tagged (i.e., received two low-reward tags) to estimate the reporting rate for tag recaptures and to estimate the tag shedding rates. Double tagging involved inserting two tags of the same type into a single fish, with tags placed in the same location on opposite sides of the fish. Effort was made to distribute double tagged fish and the high-reward

fish evenly amongst the standard low reward fish to remove any spatial or temporal bias. For red drum tagged with internal anchor tags, approximately every fifth fish was double tagged and approximately every ninth fish received a high-reward tag. High reward tags were unique in color (red) and were designed to be highly recognizable. Large print on the high-reward tags stated "$100 reward for tag". Laminated signs describing the study and noting the tag rewards were placed at tackle stores, fish houses, and boat ramp/fishing access locations.

3 RESULTS

A total of 8,845 red drum (227 mm to 1,321 mm fork length) were tagged with conventional tags (i.e., internal anchor or steel dart) in this study. The number of red drum tagged annually ranged from 1,720 in 2013 to 2,816 in 2014 (Table 1). Red drum were tagged by both NCDMF staff (n = 5,125) and trained volunteers (n = 3,720). Volunteers tagged primarily adult and larger sub-adult red drum, while NCDMF staff tagged red drum over a wide range of sizes during each year (Table 1; Figure 1). Adult red drum were tagged primarily in the late summer and fall (August to October) each year (Table 2). No adult red drum were tagged during January or February. Sub-adult red drum were tagged during every month of the year. October and November were the most productive months (Table 3). Adult red drum were tagged throughout coastal North Carolina in both estuarine and oceanic waters. The majority of adults were tagged in an area ranging from the lower Neuse River to Ocracoke Inlet (Figure 2). Sub-adult red drum tagging was more evenly dispersed throughout the coastal waters of North Carolina with the majority tagged in estuarine waters (Figure 3). Red drum were tagged from a variety of gears (Table 4). Adult red drum were tagged primarily by hook and line in addition to the NCDMF longline survey. The majority of sub-adult red drum were tagged by either NCDMF gill nets, hook and line or by the NCDMF electrofishing boat. NCDMF gill nets included a variety of techniques such as run-around gill nets, trammel nets, and anchored gill nets.

During the study, 2,957 red drum were single tagged with internal anchor tags. Of these, 318 (11%) were tagged with high-reward tags ($100) and the remainder (n = 2,639) were tagged with low-reward tags (Table 5). Overall return rates for the low reward tags was 10.7% (range of 5.0% to 14.1% annually), while the return rate for high-rewards was 17.3% (range of 12.2% to 24.7% annually). Assuming 100% of the high-reward tags are reported, the corrected reporting rate for low-reward tags (% encountered that are actually reported to agency) would be approximately 61.8% (annual range of 41.0% to 70.2%).

Approximately 20% (n = 634) of the red drum tagged with internal anchor tags were double tagged in order to determine the long-term retention rate for these tags. Of the 634 red drum double tagged, 93 (15%) were reported as captured. Of these, 72% retained both tags. Fish were at-large from one to 423 days. Based on the sample size for the study period, there was no consistent pattern in tag loss relative to days out (Table 6).

The overall recapture rates for low-reward, single tagged fish varied by size at tagging (adult versus sub-adult) and the tag type used (internal anchor versus stainless steel dart tag). In all, 453 recaptures of low-reward, single tagged fish were reported (Table 7). Adult red drum tagged with stainless steel dart tags had recapture rates ranging from 1% to 3% for the tagging years of 2013 to 2016. Sub-adults tagged with stainless steel dart tags had recapture rates ranging from 2% to 7% for same time period. Conversely, sub-adults tagged with internal anchor tags during this time had recapture rates ranging from 5% to 14%. The overall recapture rate across all sizes and tag types was 6%.

Red drum tag recoveries covered a large range of sizes. The overall distribution, when compared to the size of tagged fish, was skewed to sub-adults. This is consistent with the observed higher overall recapture rates for smaller fish (Figure 4). Approximately 48% of the overall recaptures were reported as harvested. The majority of fish in this category were in the harvestable slot limit.

Red drum recaptures occurred throughout coastal North Carolina in both estuarine and coastal oceanic waters. Adult red drum were most commonly taken in the lower Neuse River and portions of lower Pamlico Sound in the same vicinity where they were tagged (Figure 5). Sub-adult recaptures were common throughout the state coastal waters (Figure 6). Sub-adults tagged in the upper estuary tended to be captured downstream in the lower estuary or in the nearshore ocean surf zone as time-at-large increased. Time-at-large was variable. Most fish recaptures occurred within two years of release. Time-at-large averaged 166 days for sub-adults and 268 days for adults. The longest time-at-large was 1,035 days or 2.8 years. Sub-adults average distance traveled before recapture was 19 miles, while adults was slightly higher at 23 miles.

In all, there were 601 reported recapture events that occurred during the study. These included 453 recaptures of low-reward fish, 55 recaptures of high-reward fish, 93 recaptures of double-tagged fish and 24 occurrences where a tagged red drum was recaptured a second time. Of the 601 reported recaptures, only nine (1.5%) occurred outside of North Carolina state territorial waters (Table 8). All nine fish moved north either into Virginia or Maryland waters. Three of the recaptures were adult fish and six were sub-adults at the time of release. The greatest distance traveled was for a sub-adult red drum tagged behind Oregon Inlet that traveled 230 miles over 459 days and was recaptured near the Maryland-New Jersey state line in Great Egg Harbor Bay.

4 DISCUSSION

The primary objective to continue tagging efforts in North Carolina for red drum, while incorporating needed auxiliary studies (tag reporting rate and tag retention) was achieved. Results will be used to provide data needed for future stock assessments and/or direct estimates of fishing mortality through tagging models. In addition, the current study will be continued as part of a multi-species tagging study under Coastal Recreational Fishing License funds through June of 2020. This study will continue to tag red drum under the same objectives of providing the data necessary for estimating exploitation on this stock and for determining stock status. Red drum tagging addresses critical data needs for stock delineation and stock status determination. Prior tagging data has been used to identify stock structure and stock boundaries, provide information on the size of recreational releases, and provide direct estimates of fishing mortality. All of these data sources have been incorporated into both of the two prior red drum stock assessments for red drum (SEDAR 2009; ASMFC 2017).

Tag return rates in the current study were similar to past studies in North Carolina. Bacheler et al.'s (2008) study of North Carolina tagging data from 1983 to 2006 had an overall reporting rate for sub-adult fish (ages 1-2) of approximately 17%. This value is similar to the overall return rate of sub-adult red drum from 2013 to 2015 (13-14%). For larger adults (ages 3-4+), Bacheler et al. reported a return rate of 2.6%, the current study reported rates ranged from 1-3%. Return rates in the current study may increase slightly with additional years of recaptures. It is difficult to ascertain what the cumulative impact of adding high-reward tags has had to reporting rates in the current study, so comparisons with prior years may be somewhat confounded. The inclusion of high-reward tags will however provide needed information for modeling efforts to determine exploitation rates during the current study period.

The use of high-reward tags is a primary tool for the estimation of the tag reporting rate. It is critical that high-reward tags are spread evenly over the entire study area, are dispersed evenly with low-reward tags, and are easily recognized by individuals capturing fish. In the current study, high-reward tags were interspersed systematically with low-reward tags to ensure even distribution within all NCDMF tagging effort. Further, the presence of high-reward tags was advertised widely through public outreach and informational fliers at public access points (boat ramps, piers, etc.). High-reward tags were also a distinct color (red) and clearly labeled with "$100 reward". Through these efforts, the reporting rates for high-reward tags becomes as close to 100% as can reasonably be assumed. In the current study, the reporting rate (percent of low-reward tags encountered that were returned) was estimated to be 61.8%. This rate is in the range of Bacheler et al.'s (2008) estimate of 49% for NCDMF tags and 76% for NCSU tags. Studies from other states have estimated reporting rates for red drum to be between 36-63% (Green et al. 1983; Denson et al. 2002).

Approximately 20% of the internal anchor tagged red drum were double tagged. A total of 93 recaptures of double tagged fish occurred during the study. Double tags were limited to fish with internal anchor tags. Future work would benefit from double-tagging fish for all tag-types used in the study (i.e., steel dart tags). Estimation of tag loss is critical for accurate estimates of exploitation from tagging models. Prior work by Bacheler et al. (2008) used tag retention estimates from prior studies conducted on red drum and similar species with internal anchor tags (Sprankle et al. 1996; Wallin et al. 1997; Henderson-Arzapalo et al. 1999; Latour et al. 2001). Future double-tagging efforts and subsequent returns from this study will provide for a more robust estimate of tag loss that will be beneficial to modeling efforts.

Movement patterns exhibited by red drum in this study were consistent with prior tagging work for red drum in North Carolina (Bacheler et al. 2009; Ross et al. 1995). Results indicate the majority of tagged fish remain in North Carolina coastal waters while some mixing did occur with fish moving north into Virginia and Maryland waters. A small portion of both the adult and sub-adult fish exhibited this pattern. The furthest north a fish traveled was near the New Jersey border. In all, approximately 1.5% of the returns occurred outside of North Carolina in either Virginia or Maryland waters. This pattern of mixing is consistent with the current stock structure assumed in the stock assessment for red drum along the Atlantic coast. The assessment is conducted separately for a northern (North Carolina and north) and southern (South Carolina and south) stock (ASMFC 2017). This assumption is based on prior tagging analysis, genetics and distinct differences in life history (growth, maturity and longevity) between these regions.

5 RECOMMENDATIONS

- Continued tagging effort on red drum to provide data critical for determining changes in exploitation rates and stock status either through incorporation into traditional stock assessments or as a standalone tagging model.
- Continue auxiliary studies to determine changes in reporting rates (i.e., high-reward tagging) over time and tag retention rates (double tagging).

- Incorporate double tagging and high reward studies for all tag types used on red drum. The current study limits double tagging and high rewards to the sub-adult population using internal anchor tags.
- Conduct a post-release tagging mortality study to estimate mortality and acute tag loss associated with the gear used to capture the fish upon tagging and any stress related to the initial tagging event.

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7 TABLES

Table 1. Number of red drum (adults and sub-adults) tagged by NCDMF and volunteers from July 2013 to December 2016. Sub-adults include fish less than 824 mm total length (size at 50% maturity). Includes all tagging modes (single tagged, double tagged and high/low rewards).

Year	Sub-Adult		Adult		Total
	NCDMF	Volunteer	NCDMF	Volunteer	Combined
2013	475	128	292	825	1,720
2014	1,352	476	277	711	2,816
2015	971	261	264	565	2,061
2016	1,297	250	197	504	2,248
Total	4,095	1,115	1,030	2,605	8,845

Table 2. Number of adult red drum tagged by month from July 2013 to December 2016.

Year	2013	2014	2015	2016	Total
January					
February					
March				3	3
April		1	1	51	53
May		3	12	13	28
June		5	1	1	7
July	27	41	41	15	124
August	432	215	191	160	998
September	420	240	255	97	1,012
October	164	356	275	263	1,058
November	74	118	51	93	336
December		9	2	5	16
Total	1,117	988	829	701	3,635

Table 3. Number of sub-adult red drum tagged by month from July 2013 to December 2016.

Month	2013	2014	2015	2016	Total
January		1	6	20	27
February		156	3	41	200
March		143	102	218	463
April		211	71	54	336
May		167	92	89	348
June		159	148	70	377
July	53	59	75	28	215
August	93	102	101	79	375
September	54	159	101	148	462
October	133	381	347	449	1,310
November	241	198	137	242	818
December	29	92	49	109	279
Total	603	1,828	1,232	1,548	5,210

Table 4. Number of red drum tagged by gear type and size from July 2013 to December 2016.

		Year				
Size	Gear Type	2013	2014	2015	2016	Total
Adult	Division gill nets*	22	25	21	13	81
	Division longline	270	252	242	184	948
	Hook and line	825	711	566	504	2,606
	Electric shocker	0	0	0	0	0
Sub-adult	Division gill nets*	402	968	741	986	3,097
	Division longline	5	2	1	4	12
	Hook and line	178	559	395	374	1,506
	Electric shocker	18	299	95	183	595
Total	All Gears	1,720	2,816	2,061	2,248	8,845

*Division gill nets includes run-around nets, anchored nets and trammel nets

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Table 5. Red drum tagging based on reward type and mean return rate (%) for red drum single tagged with internal anchor tags from July 2014 to December 2016. Corrected reporting rate represents the percent of tags assumed to be returned based on fish with "$100 Reward" message.

	Tag Message						
	"Reward"			"$100 Reward"			
Year	No. Released	No. Returned	% Returned	No. Released	No. Returned	% Returned	Corrected Reporting Rate*
2014	1,085	153	14.1	85	21	24.7	57.1
2015	678	86	12.7	94	17	18.1	70.2
2016	876	44	5.0	139	17	12.2	41.0
Total	2,639	290	10.7	318	55	17.3	61.8

*Example: Total: "$100 Reward" tags reported = 100%: 10.7/17.3 = 61.8% reporting for "Reward" tags.

Table 6. Red drum double tag results based on days-at-large for red drum tagged with internal anchor tags from July 2014 to December 2016.

Days Out	Both Tags	One Tag	% Missing
0 to 100	41	8	16.3
101 to 200	12	9	42.9
201 to 300	4	5	55.6
301 to 400	9	1	10.0
401 to 500	1	3	75.0
All	67	26	28.0

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Table 7. Red drum tagging and returns based on single tagged fish with low reward tags. Results are provided by tag type (SSD WT =stainless steel wire thru dart tag and INT WT = internal anchor wire thru tag) and size of fish at time of tagging for all fish tagged from July 2014 to December 2016.

Tag Type	Size	Year	Tagged	Recapture Year 2013	2014	2015	2016	Total Reported	Percent Reported
SSD WT	Adult	2013	1,117	6	7	1	1	15	1%
		2014	988		6	16	3	25	3%
		2015	829			7	5	12	1%
		2016	701				5	5	1%
	Sub-Adult	2013	152	8	2	0	0	10	7%
		2014	479		19	6	0	25	5%
		2015	275			6	4	10	4%
		2016	256				4	4	2%
INT WT	Sub-Adult	2013	451	31	25	6	2	64	14%
		2014	1,085		100	46	7	153	14%
		2015	678			37	49	86	13%
		2016	876				44	44	5%
		Total	7,884					453	6%

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Table 8. All out of state reported tag returns for red drum tagged in North Carolina from July 2014 to December 2016.

Tag Date	Tagging Location	Tagging Gear	Fork Length (mm)	Recapture Location	Recapture Gear	Distance Traveled	Days-at-Large
11/7/2014	Avon Fishing Pier	Hook and line	1,156	near Bay Bridge Tunnel	Hook and line	104	332
11/14/2014	Avon Fishing Pier	Hook and line	1,168	Chesapeake Bay near VA/MD line	Hook and line	168	161
11/22/2014	Avon Fishing Pier	Hook and line	1,118	Chesapeake Bay, Pocomoke Sound	Gill Net	165	172
5/15/2015	behind Oregon Inlet	Division Gill Net	783	Great Egg Harbor Bay near MD/NJ line	Hook and line	230	459
5/15/2015	behind Oregon Inlet	Division Gill Net	729	Fisherman's Island, Chesapeake Bay	Hook and line	92	376
6/24/2015	behind Oregon Inlet	Division Gill Net	726	Hog Island Bay, Eastern Shore VA	Hook and line	108	12
6/30/2015	behind Oregon Inlet	Division Gill Net	703	near mouth of Potomac River	Hook and line	151	415
10/20/2015	Askins Creek, Avon	Division Gill Net	464	Rudee Inlet	Hook and line	98	16
3/8/2016	End Point, Hatteras	Division Gill Net	428	lower Chesapeake Bay	Hook and line	125	134

8 FIGURES

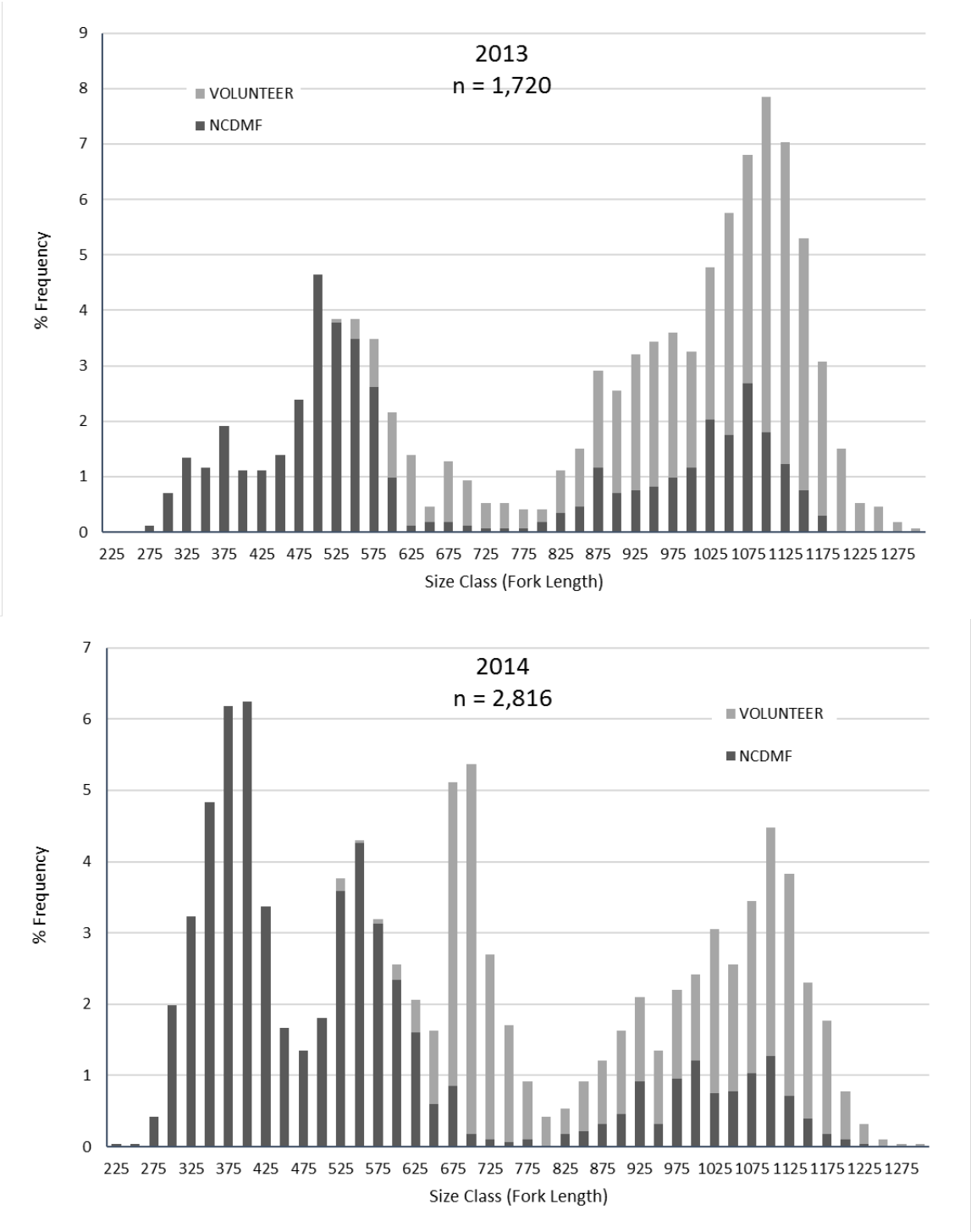
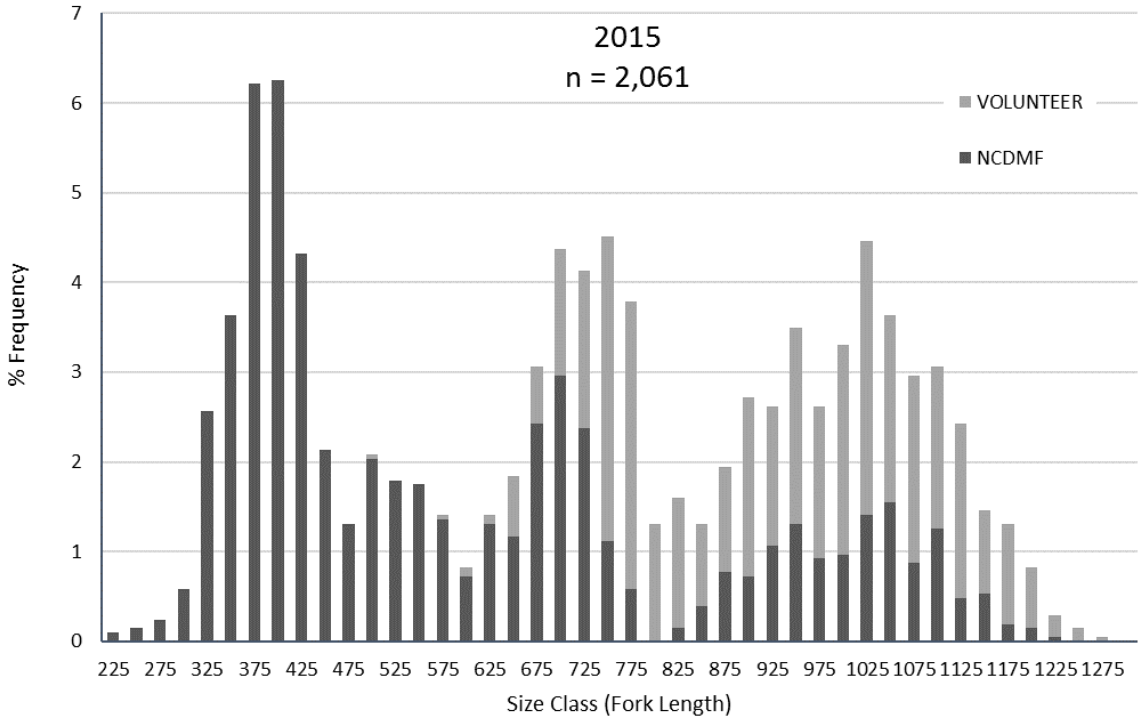


Figure 1. Length frequency of red drum tagged annually by Division staff and volunteer taggers from July 2013 to December 2016.



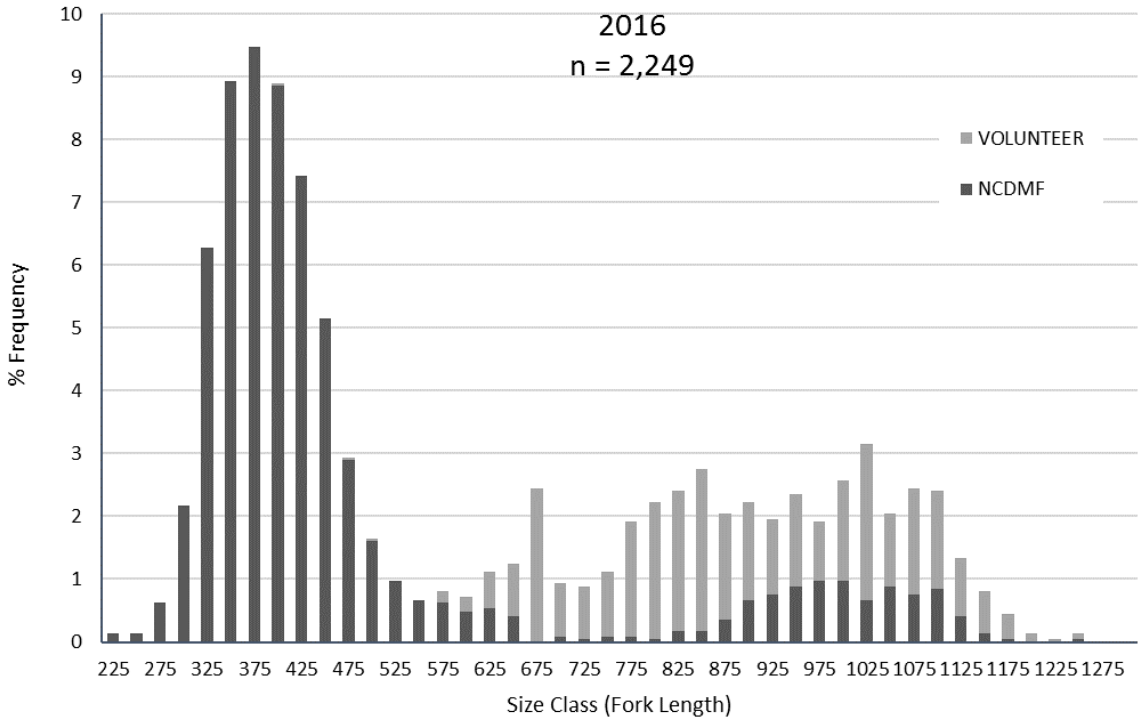


Figure 1. Continued.

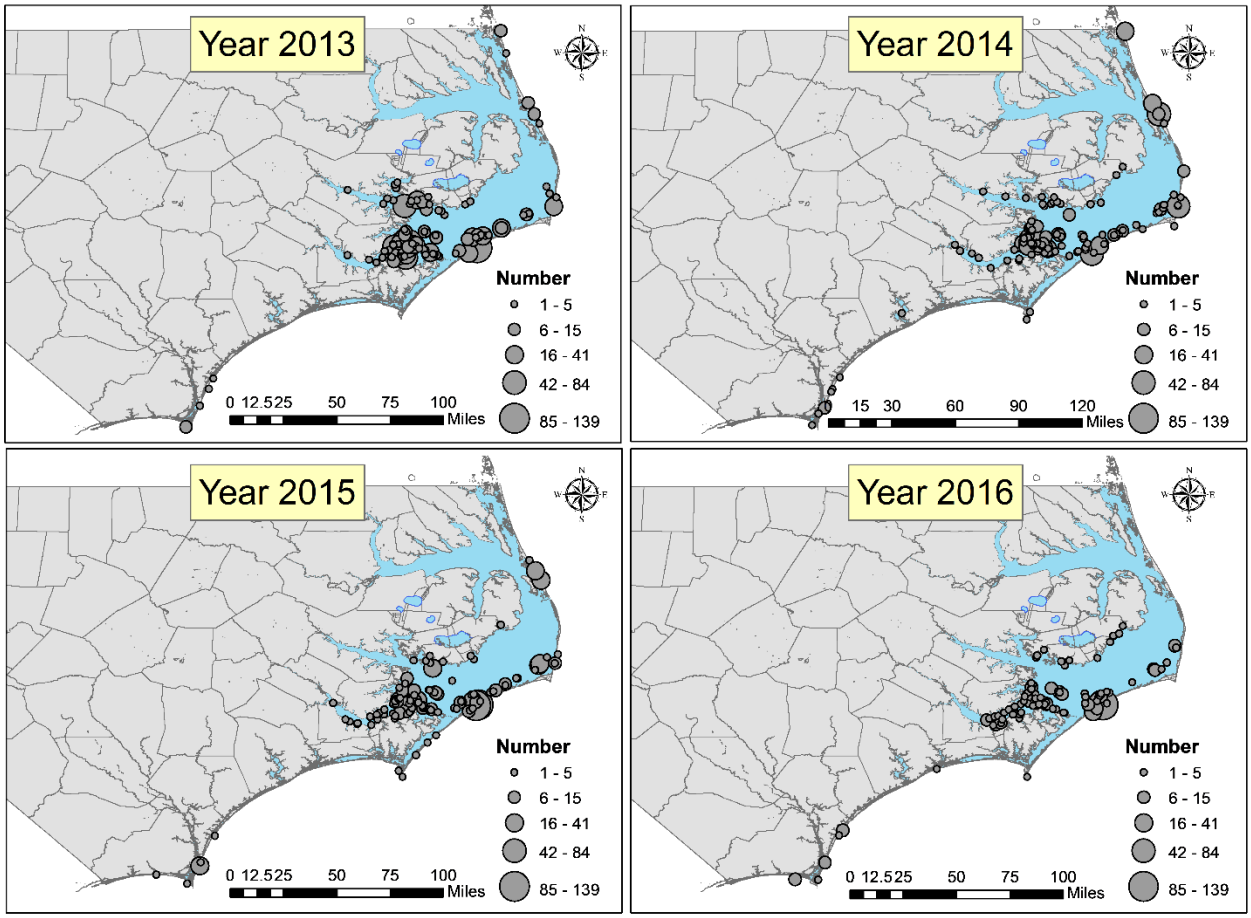


Figure 2. Adult red drum tagging locations for all red drum tagged from July 2014 to December 2016.

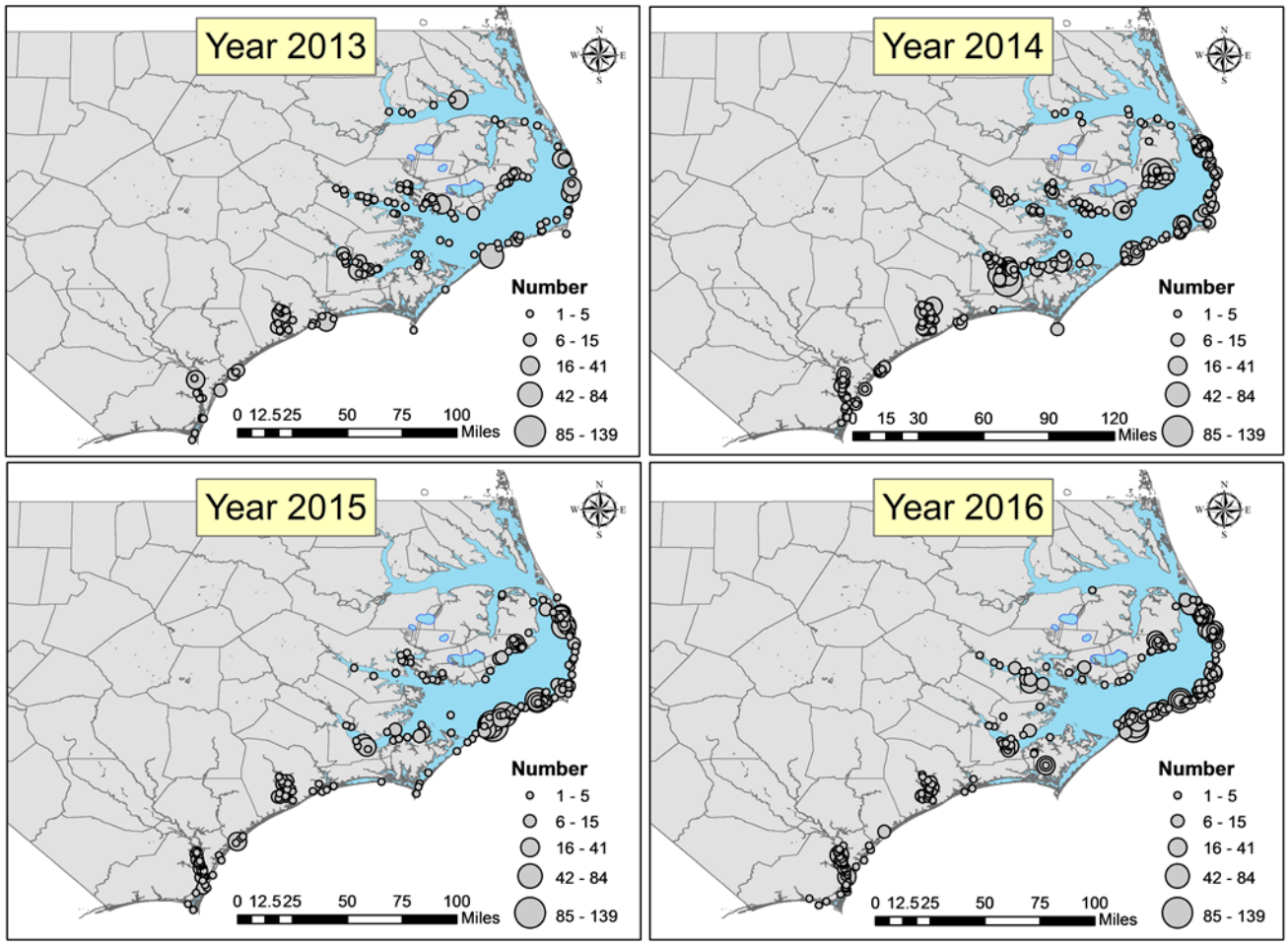


Figure 3. Sub-adult red drum tagging locations for all red drum tagged from July 2014 to December 2016.

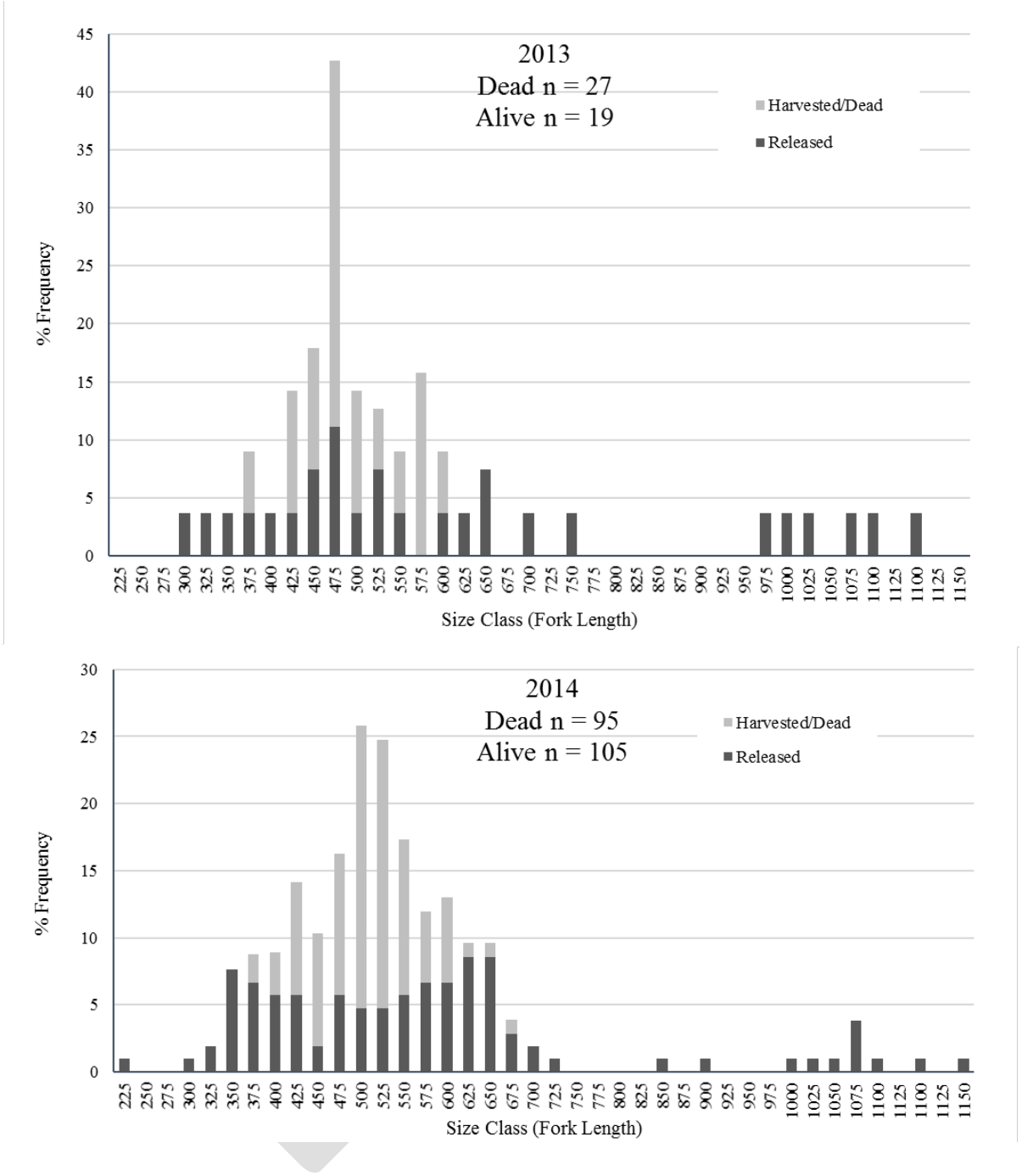
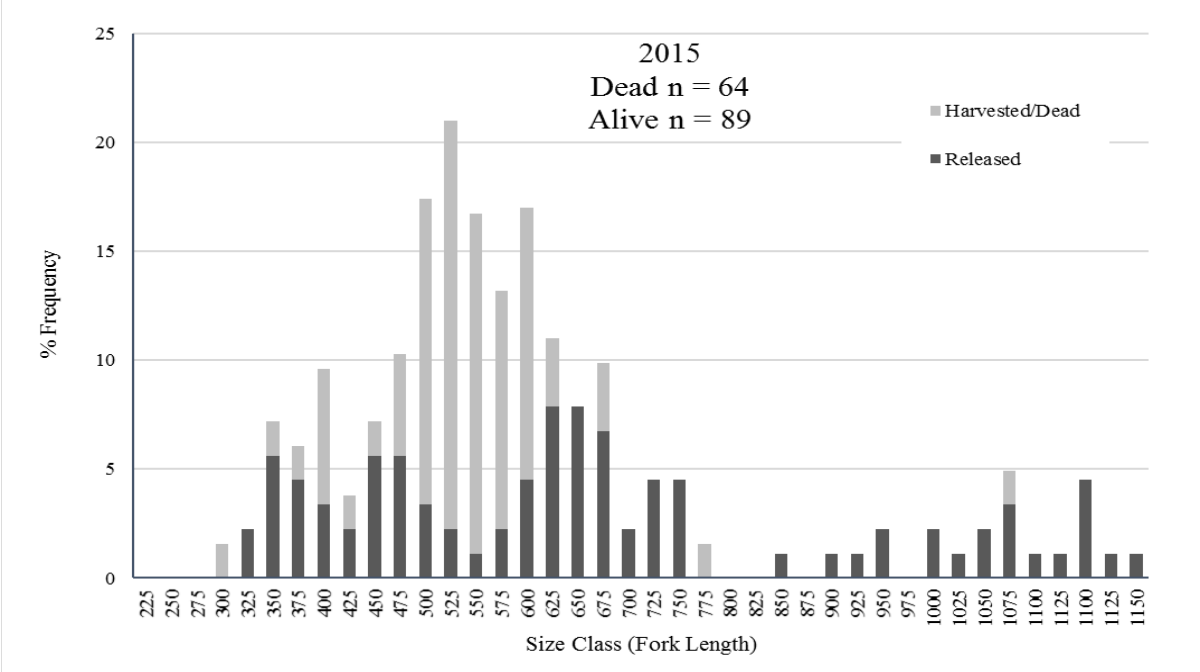


Figure 4. Length frequency of tagged red drum recaptures reported by year from July 2013 to December 2016.



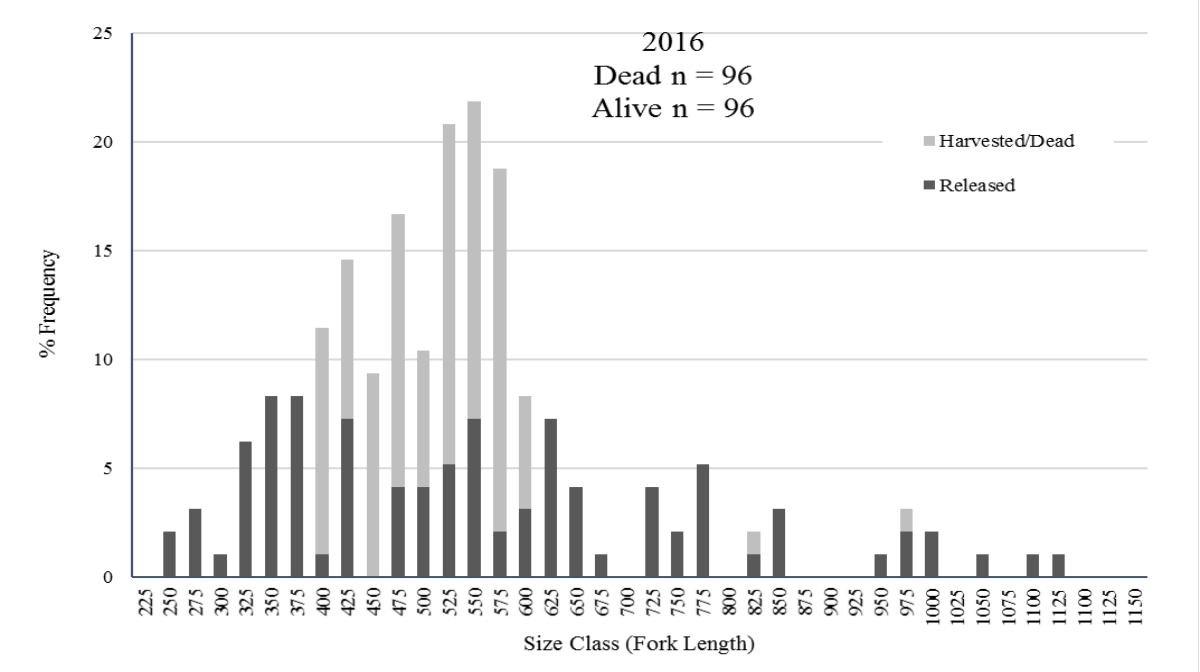


Figure 4. Continued.

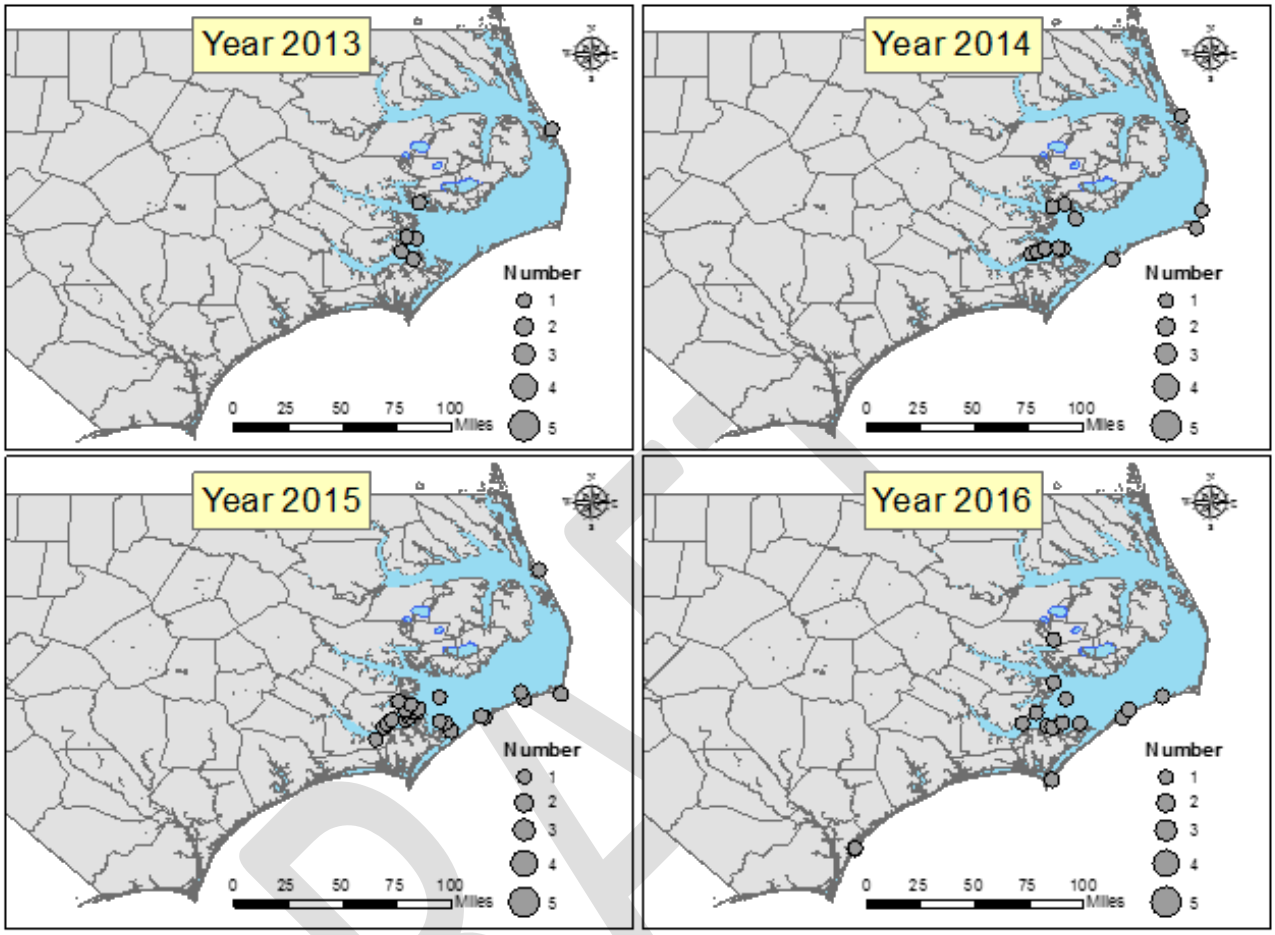


Figure 5. Recapture locations of tagged Adult red drum reported from July 2014 to December 2016.

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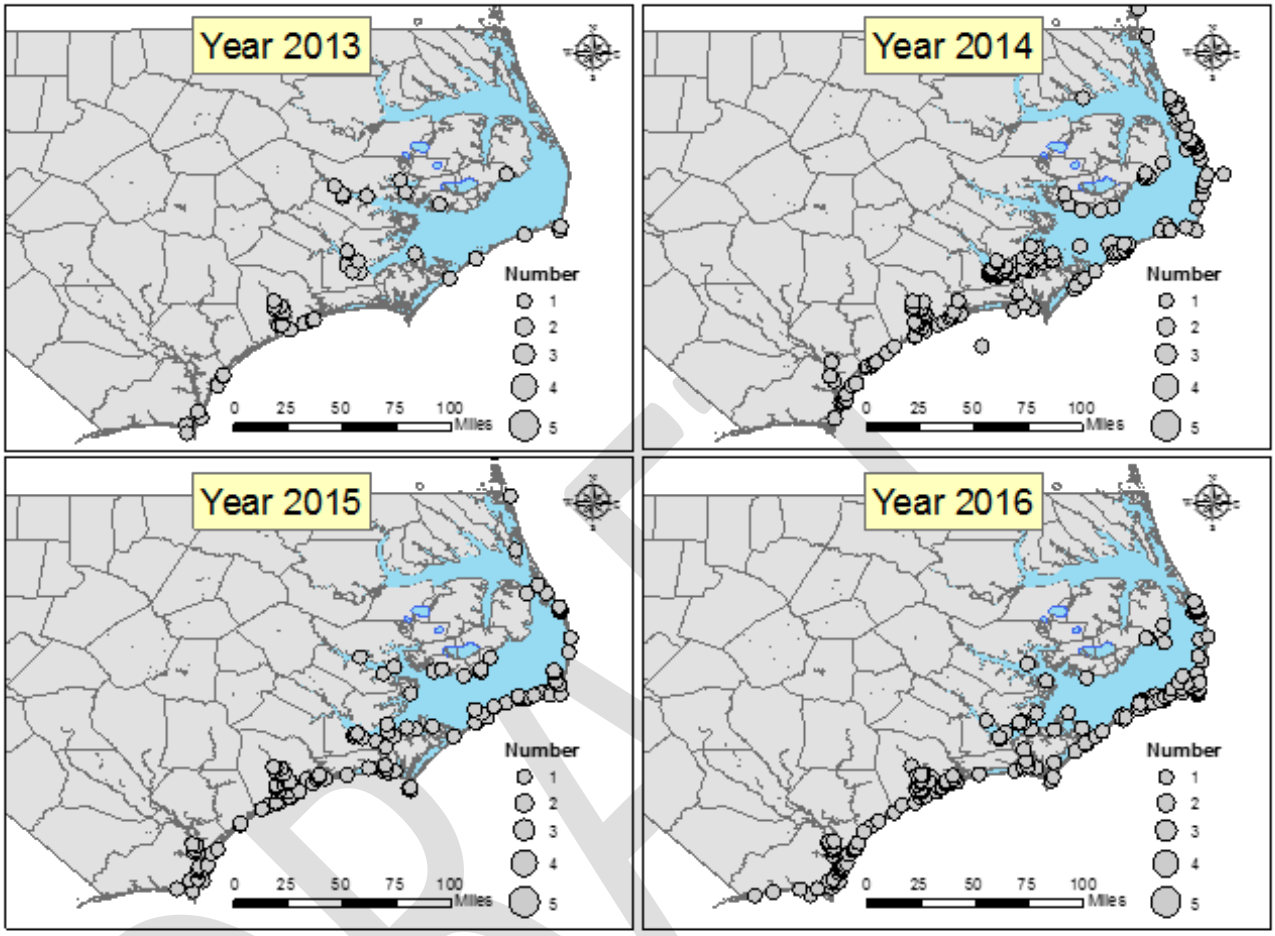

Figure 6. Recapture locations of tagged Sub-adult red drum reported from July 2014 to December 2016.

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