A Tag and Recapture study of greater amberjack, *Seriola dumerili*, from the Southeastern United States

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Abstract

During 1995-1999, 2,277 greater amberjack were tagged off the southeastern United States from North Carolina to southern Florida, primarily from commercial fishing vessels. Prior to release, the swim bladder of tagged fish was deflated with a 16-gauge hypodermic needle. Approximately 19% of the greater amberjack were recaptured. Greater amberjack are capable of extensive movement and there is genetic exchange between the Atlantic and Gulf of Mexico where they are managed differently. Many greater amberjack (34%) moved < 2 km but 32% moved distances greater than 185 km. Most greater amberjack that moved greater than 185 km were tagged off South Carolina and recaptured off Georgia, Florida and Gulf of Mexico. Analysis of Variance indicated that the distance moved by greater amberjack was not related to depth or size tagged but was related to the number of days at large. Depth related mortality does not appear to be a factor as the recapture rate of greater amberjack showed no trends with depth.

Introduction

The greater amberjack, *Seriola dumerili* (Risso), is a large carangid that occurs in the Atlantic, Pacific, and Indian Oceans. In the western Atlantic, greater amberjack are found from Nova Scotia to Brazil at depths of 18-360 m (Manooch and Potts 1997a). Using mtDNA, Gold and Richardson (1998) stated two subpopulations (stocks) of greater amberjack exist; one stock in the northern Gulf of Mexico and a second along the U.S. Atlantic coast including the Florida Keys (Gold and Richardson 1998). Maximum reported size is 190 cm and 80.6 kg (Paxton et al. 1989).

Greater amberjack are of commercial and recreational importance throughout their range. In the U.S. Southeast Atlantic, greater amberjack are managed with a commercial quota 1.17 million pound quota, commercial size limit of 36 inches fork length, seasonal closure (April), 1 fish per person recreational bag limit, and 28-inch fork length recreational size limit (SAFMC 1991; 1998). In contrast to the status of the greater amberjack stock in the Gulf of Mexico, greater amberjack from the southeast U.S. Atlantic are not overfished or experiencing overfishing (NMFS 2006). These determinations are based on a stock assessment conducted by Legault and Turner (1999). A new Southeast Data Assessment and Review (SEDAR) stock assessment is scheduled in 2007.

In the Southeast U.S. Atlantic, maximum reported age of greater amberjack was 17 years (Manooch and Potts 1997a); however, there was quite a bit of variability in the size at age by different studies (Beasley 1993, Burch 1979, Manooch et al 1997a; 1997b, Thompson et al. 1998). In the north-central Gulf of Mexico, greater amberjack were

found to be fast growing (through age four) and live for at least 15 years (Manooch and Potts 1997b). Beasley (1993) in Thompson et al. (1998) determined growth rates were not significantly different for males and females; however, males did not live as long as females and females attained larger sizes than males.

The purpose of this paper was to document movement, estimate growth rates, examine the effect of size and days at large on movement, and provide information for a new SEDAR stock assessment for greater amberjack off the southeastern U.S. Atlantic.

Methods

During 1995-1999, greater amberjack were captured by commercial fishermen aboard commercial fishing vessels and double tagged with a nylon barbed tag and an internal tag. Nylon barbed tags (14.5 cm long) were hooked on the pterygiophore of a dorsal spine using a hollow, handle-mounted canula. Internal tags (10.5 cm) were inserted on the left side of the abdomen, ~1 cm above the ventral midline. Incisions were made with size 12 surgical scalpel blades. The insertion area, tag, and surgical tools were cleansed with a 75% iodine solution before the incision was made. Prior to release, the swimbladder was deflated with a 16 gauge hypodermic needle inserted through the body wall posterior to the base of the left pectoral fin.

Total length, standard length, date, species, tag number, condition of specimen, depth of capture, and release location were recorded on paper and video for each specimen. Fishermen were paid $0.50 per pound above market price to tag and release greater amberjack. Some greater amberjack were also captured with a chevron trap or hook and line gear from the R/V PALMETTO and from chartered vessels. Other species included in the tagging project were gag (*Mycteroperca microlepis* (Goode and Bean)), red porgy (*Pagrus pagrus* Linneaus), gray triggerfish (*Balistes capriscus* Gmelin), vermilion snapper (*Rhomboplites aurorubens* (Cuvier)), white grunt (*Haemulon plumieri* (Lacepède), and black sea bass (*Centropristis striata* Linneaus).

Both types of tags were blaze orange, marked with a number, address and reward message. Posters displaying information and rewards were placed at marinas from North Carolina to Florida. Anglers who returned tags were rewarded with a t-shirt or hat. There was also an annual draw of returned tags worth $500.00. Number on tag, length of

fish, and location and date of capture were obtained from anglers by letter, phone, or e-mail.

Analysis of variance (ANOVA) and the Scheffe multiple range test was used to examine distances moved with total length of capture and days at large. ANOVA was also used to determine if depth related mortality was a factor by examining the relationship between recapture rate and depth. The theoretical mean size at age from Manooch and Potts (1997a; 1997b), Beasley (1993), and Harris et al. (In Review) was used to partition recaptured greater amberjack into age categories. Growth rates from recaptured greater amberjack were determined for the size category that defined each age in each study as: Growth (mm/d) = (Recapture TL –Tagging TL)/days at large.

Results

During 1995-1999, a total of 2,277 greater amberjack were tagged off North Carolina, South Carolina, Georgia, and throughout the east coast of Florida to Key West (Figure 1; Table 1). Most greater amberjack were tagged off North Carolina and South Carolina (56%) and the Florida Keys (26%). Approximately 19% (n = 434) of the tagged fish were recaptured. The longest period of time a specimen was at large was 2,166 days (Table 2) and the greatest distance moved was estimated at 2,007 km. Tagged fish were at large for an average of 335 days and moved an average distance of 274 km. ANOVA and the Scheffe Multiple Range Test indicated the number of days at large had a significant effect on distance moved (Table 2). There was no relationship between size of recaptured fish and distance moved; however, the distance moved was significantly related to the depth (Table 3) with greater amberjack captured between 21-30 m moving the greatest distance.

For greater amberjack tagged at all latitudes, 44% moved more than 37 km (Table 2) and 32% moved greater than 185 km. Many individuals (34%), moved 2 km or less. The highest percentage of greater amberjack that moved more than 185 km were tagged off South Carolina and moved south to Georgia, east Florida, the Florida Keys, west Florida, Alabama, northern Cuba, southern Cuba, the Yucatan Peninsula, and Bahamas (Fig. 2).

Recapture rate was similar for greater amberjack tagged off the Carolinas (21%) and the Florida Keys (22%; Table 1). Fish tagged off the Carolinas were at large for an average of 376 days and moved an average of 377 km. Only 10% of the greater amberjack tagged off the Carolinas were recaptured within the same latitude they were

tagged. In contrast, greater amberjack tagged in the Florida Keys were at large for an average of 259 days and moved only 54 nm. Approximately 86% of greater amberjack tagged off the Florida Keys were recaptured within the same latitude they were tagged.

The recapture rate showed no significant trends with depth (Table 4) indicating release mortality was probably not a function of depth. The maximum depth at which a greater amberjack was tagged and later recaptured was 92 m (302 ft). ANOVA and the Scheffe multiple range test indicated the size at tagging was significantly related to depth with larger individuals occurring in deeper water. There was no relationship between length of recaptured fish and depth.

Based on tagging data, the average growth rate of greater amberjack was 0.43 mm/day. Growth rates were determined for size intervals at age from several age-growth studies (Manooch and Potts 1997a; 1997b; Beasley 1993; Harris et al. In Review). Growths rates of greater amberjack at age were most similar to Beasley (1993) who aged greater amberjack from the Gulf of Mexico and Harris et al. (In Review) who aged greater amberjack from the U.S. South Atlantic (Table 5).

DISCUSSION

Data presented here indicate greater amberjack are capable of extensive movement and this contributes to genetic exchange between the Atlantic Ocean and Gulf of Mexico. A number of individuals tagged off the Carolinas moved to South Florida; the Gulf of Mexico; Yucatan, Mexico; Cuba; and the Bahamas. Greater amberjack exhibiting the greatest movement were tagged at depths of 21-30 m off South Carolina. McClellan and Cummings (1996) summarized tagging information from five programs that took place during 1959-1994. There was a 1.4% exchange between the Atlantic and Gulf of Mexico fish and a 1.6% exchange between the Gulf of Mexico and Atlantic. McClellan and Cummings (1996) indicated a spring movement of the Atlantic stock occurred from the Carolinas to southeast Florida and stated movement may have been spawning related.

We also believe movement from the Carolinas to areas off south Florida may have been related to spawning activity; however, we were unable to identify a seasonal component to greater amberjack that moved > 185 km since these individuals were at large for an average of 518 days and were collected throughout the year. Based on the occurrence of migratory nucleus oocytes and postovulatory follicles, spawning occurs from January through June, with peak spawning in April and May. Although greater amberjack in spawning condition were captured from North Carolina through the Florida Keys, spawning appears to occur primarily off south Florida and the Florida Keys (MARMAP unpublished data).

Greater amberjack in spawning condition off south Florida may be particular susceptible to capture as they aggregate in large schools. Currently, commercial harvest

is prohibited during April to protect spawning individuals. However, greater amberjack appear to be very vulnerable to capture on either side of the April seasonal closure (March and May) (Figure 5). During 2001-2004, 38% of the harvest of greater amberjack occurred during March and May with most individuals landed in Florida (Figure 5).

Recapture rate was similar for greater amberjack tagged off the Carolinas and south Florida. However, regardless of tagging location, most greater amberjack were recaptured off of Florida. This suggests greater amberjack may be subject to more fishing pressure by commercial and recreational fishermen off Florida due to the very narrow continental shelf. Furthermore, 35% of the recaptured greater amberjack tagged off South Carolina and North Carolina were recaptured off Florida. The average number of days at large for fish tagged off Florida was significantly less than for greater amberjack tagged off North Carolina and South Carolina further supporting higher fishing mortality in the south. In addition, landings data (Figure 5) suggest aggregations of greater amberjack probably occur off Florida during the spawning season and could be easily accessed by fishermen. The narrow continental shelf off Florida may increase fishing mortality for many other species by "funneling' them close to shore in the vicinity of high human population (McGovern et al. 2005).

McGovern et al. (2005) indicated the recapture rate of tagged gag decreased with increasing depth and used these data to estimate depth related mortality. However, no trends in recapture rate with depth were evident for greater amberjack. Since gag are associated with the bottom they may be more susceptible to changes in pressure when brought to the surface by fishing gear than greater amberjack, which readily move

throughout the water column. Therefore, while greater amberjack most likely experience some level of release mortality due handling, hook damage, predation, etc., depth-related mortality might not be much of a factor. Several investigations indicated mortality of released fishes can be high and generally increases with depth (Parker, 1991; Gitschlag and Renaud, 1994; Wilson and Burns, 1996) but these studies are based on demersal species.

Greater amberjack have very small otoliths and can be difficult to age (Harris et al. In Review). A number of studies in the southeast U.S. Atlantic and Gulf of Mexico have examined otoliths from greater amberjack and arrived at very different interpretations of the size at age (Burch 1979, Beasley 1993, Manooch et al. 1997a; 1997b, Thompson et al. 1998, Harris et al. In Review). Incorporation of incorrect age determinations in stock assessments or discrepancies in age determinations from different investigators can increase the uncertainty in the results of stock assessments (SEDAR 2-SAR 2 2003). A comparison of the size at age derived from several different studies indicated the growth rate of tagged greater amberjack in this study was most similar to growth rates derived from ages derived from greater amberjack by Beasley (1993) in the Gulf of Mexico and Harris et al. (In Review) in the U.S. South Atlantic.

As greater amberjack appear to move to specific locations at predictable times, the stock could be vulnerable to intense fishing pressure. However, fast growth and a lack of depth related mortality could indicate the stock's susceptibility to overfishing is less than other species such as gag, which are slower growing and experience a direct relationship to release mortality and depth (McGovern et al. 2005). Actions were taken to reduce fishing effort on greater amberjack during the 1990s. In 1992, the South

Atlantic Fishery Management Council (SAFMC) established a minimum size limits of 28 and 36 inches fork length, respectively for the recreational and commercial fishery (SAFMC 1991). In 1999, the SAFMC imposed a 1.17 million pound commercial quota, commercial closure for April, and recreational bag limit of 1 fish (SAFMC 1998). Furthermore, the SAFMC is currently developing an amendment to establish MPAs, which could provide some protection for spawning individuals. When the stock was assessed by Legault and Tuner (1999) it was determined greater amberjack was not overfished and was not experiencing overfishing. A new assessment will be conducted by SEDAR in 2007 using updated data, life history information, indices, and assessment models to determine the status of greater amberjack in the U.S. South Atlantic.

Acknowledgements

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Literature Cited

Beasley, M.L. 1993. Age and growth of greater amberjack, *Seriola dumerili*, from the northern Gulf of Mexico. MS thesis, Louisiana State University, Baton Rouge.

Burch, R.K. 1979. The greater amberjack, *Seriola dumerili*,: its biology and fishery off southeastern Florida. MS thesis, University of Miami, Coral Gables, FL.

Cummings, N.J. and D.B. McClellan. Status of the greater amberjack, *Seriola dumerili*, in the southeastern United States through 1995. Proceedings of the Gulf and Caribbean Fisheries Institute 49:246-272.

Gitschlag, G.R. and M.L. Renaud. 1994. Field experiments on survival rates of caged and released red snapper. N. Amer. J. Fish. Management. 14:131-136.

Gold, J.R. and L.R. Richardson. 1998. Population structure in greater amberjack, *Seriola dumerili*, from the Gulf of Mexico and the western Atlantic Ocean. Fishery Bulletin 96: 767-778.

Legault, C.M. and S.C. Turner. 1999. Stock assessment analysis on Atlantic greater amberjack. Sustainable Fisheries Division Contribution SFD-98/99-63.

Manooch, C.M., III and J. C. Potts. 1997a. Age, growth and mortality of greater amberjack from the southeastern United States. Fisheries Research 30: 229-240.

Manooch, C.M., III and J.C. Potts. 1997b. Age, growth, and mortality of greater amberjack, *Seriola dumerili*, from the Gulf of Mexico headboat fishery. Bulletin of Marine Science 61:671-683.

McClellan, D.B. and N. J. Cummings. 1996. Preliminary analysis of tag and recapture data of the greater amberjack, *Seriola dumerili*, in the southeastern United States. Proceedings of the Gulf and Caribbean Fisheries Institute 49:25-45.

McGovern, J.C., George R. Sedberry, H. Scott Meister, T. Mark Westendorff, David M. Wyanski and Patrick J. Harris. 2005. A Tag and Recapture Study of Gag, *Mycteroperca microlepis*, from the Southeastern United States. Bulletin of Marine Science 76:47-59.

NMFS 2006. NOAA's National Marine Fisheries Service's Report on the Status of U.S. Fisheries for 2005.

Parker, R.O. 1991. Survival of released fish -- a summary of available data. Report to the South Atlantic Fishery Management Council. 7 p.

Paxton, J.R., D.F. Hoese, G.R. Allen, and J.E. Hanley. 1989. Pisces. Petromyzontidae to Carangidae. Zoological Catalogue of Australia, Vol. 7. Australian Government Publishing Service, Canberra, 665 p.

Thompson, B.A., M. Beasley, C.A. Wilson. 1998. Age distribution and growth of greater amberjack, *Seriola dumerili*, from the north-central Gulf of Mexico. Fishery Bulletin 97:362-371.

SAFMC (South Atlantic Fishery Management Council). 1991. Amendment Number 4, Regulatory Impact Review, Initial Regulatory Flexibility Analysis and Environmental Assessment for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. 200 pp.

SAFMC (South Atlantic Fishery Management Council). 1998. Amendment Number 9, Final Supplemental Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact

Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. 246 pp.

SEDAR 2-SAR2. 2003. Complete Assessment and Review Report of South Atlantic Vermilion Snapper. Results of a series of workshops convened between October 2002 and February 2003. South Atlantic Fishery Management Council, One Southpark Circle #306, Charleston, SC 29414.

Wilson, R.R. and K.M. Burns. 1996. Potential survival of released groupers caught deeper than 40 m based on shipboard and in-situ observations, and tag-recapture data. Bull. Mar. Sci. 58:234-247.

Figure Legends

Figure 1. Greater amberjack tagging locations.

Figure 2. Greater amberjack recapture locations.

Figure 3. Tagging locations for greater amberjack that moved > 185 km.

Figure 4. Recapture locations for greater amberjack tagged off South Carolina that moved > 185 km.

Figure 5. Percentage of monthly commercial landings of greater amberjack and unclassified amberjack for the U.S. Southeast Atlantic during 2001-2004. A seasonal commercial closure of greater amberjack harvest occurs in April of each year. Source: NMFS Accumulative Landings System.

Table 1. Number of greater amberjack tagged and recaptured by latitude.

Tagged		Recapture Data														
Lat Tagged	No. Tagged	No. Recap	33	32	31	30	29	28	27	26	25	24	23	22	21	No Data
33	102	14	4	1	0	0	0	0	1	2	3	2	0	0	0	1
32	1174	253	1	131	5	11	0	4	5	5	25	31	2	0	3	30
31	77	9	0	0	1	0	0	1	1	0	2	4	0	0	0	0
30	18	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
29	240	17	0	0	0	7	5	1	0	1	3	0	0	0	0	0
28	16	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
27	20	4	0	0	0	0	0	1	3	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	9	4	0	0	0	0	0	0	0	0	2	0	0	0	0	2
24	588	130	0	0	0	0	1	0	2	2	5	111	1	0	0	8
No Data	33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	2277	434	5	132	6	19	6	7	12	10	40	149	3	0	3	42

Table 2. Distance moved, number of specimens, mean length (TL mm) tagged, mean length recaptured (TL mm), and mean days at large for tagged greater amberjack that were recaptured. Letters indicates significant (ANOVA and Scheffe Multiple Range Test; $p < 0.0001$) difference in distance moved.

Dist. Moved (km)	# Rec	Mean TL Tagged (mm) (Range)	Mean TL Recaptured (mm) (Range)	Mean Days at Large (Range)	Mean Depth (m) Tagged (Range)
No Data	47				
< 2	131	1027 (576-1380	1100 (576-1397)	254 (1-1820)[A]	54 (8-91)
2 to 37	88	1025 (700-1460)	1098 (813-1470)	233 (2-1393)[A]	52 (21-91)
38 to 93	32	1060 (745-1405)	1052 (762-1194)	295 (9-1562)[A]	58 (10-74)
94 to 185	14	1108 (930-1295)	1066 (762-1175)	97 (24-489)[A]	49 (33-73)
>185	126	1075 (610-1372)	1174 (711-1500)	518 (30-2116)[B]	50 (20-92)
Total	391[1]	1047 (576-1460)	1111 (576-1500)	333 (1-2116)	52 (8-92)

1. Total does not include information for 47 greater amberjack that had no distance data.

Table 3. Depth at tagging, mean length tagged, mean total length (TL) recaptured (Rec), mean distance moved, mean days at large and sample size for gag tagged off NC and SC (32-33^{o} N). Values in parentheses represents the standard deviation. Letters indicates significant (ANOVA and Scheffe Multiple Range Test; $p < 0.0001$) difference in distance moved.

Depth (m)	Mean TL (mm) Tagged	Mean TL (mm) Rec	Mean Dist (km) Moved	Mean Days at Large	N
1 to 20	1094 (75)	1086 (41)	111 (204)^{B}	137 (132)	4
21 to 30	1016 (126)	1112 (146)	625 (469)^{A}	671 (606)	14
31 to 40	989 (115)	1090 (118)	313 (390)^{AB}	361 (357)	48
41 to 50	1059 (112)	1131 (125)	320 (464)^{AB}	319 (351)	161
51 to 60	1062 (145)	1103 (125)	211 (368)^{AB}	342 (358)	77
61 to 70	1065 (177)	1153 (151)	176 (339)^{AB}	345 (379)	47
71 to 80	1013 (174)	1063 (120)	87 (248)^{B}	273 (297)	38

Table 4. Number of greater amberjack tagged, number recaptured, and percent recaptured. Letters indicates significant (ANOVA and Scheffe Multiple Range Test; $p < 0.0001$) difference in distance moved.

Depth (m)	Number Tagged	Number Recaptured	Percent Recaptured	Mean Total Length at Capture	Mean Total Length at Recapture
< 25	44	8	18.2	994^{A}	1,077
25-34	189	25	13.2	1023^{AB}	1,134
35-44	401	59	14.7	999^{A}	1,102
45-54	657	128	19.5	1048^{AB}	1,134
55-64	485	86	17.7	1033^{AB}	1,101
>64	476	72	15.1	1057^{B}	1,126
No Data	169	29			

Table 5. Estimated growth rate (mm/d) from tagging data based on size (TL) at age ranges from Manooch and Potts (1997a), Beasley 1993 (in Thompson et al. 1998), Manooch and Potts (1997b), and Harris et al. (In Review) determined by otolith analysis. Growth rates based on tagging data have been determined for the size at age from the three studies.

Age	Manooch and Potts (1997a) Gulf			Beasley (1993) Gulf			Manooch and Potts (1997b) Atlantic			Harris et al. (In Review) Atlantic		
	Size	Growth	This study	Size	Growth	This study	Size	Growth	This study	Size	Growth	This study
1	426			577		0.64	384			630		0.62 (0.20)
2	598	0.47	0.64	800	0.60	0.62 (0.27)	526	0.39	0.61 (0.22)	878	0.68	0.55 (0.25)
3	735	0.38	0.62 (0.20)	973	0.47	0.48 (0.33)	652	0.34	0.69 (0.21)	992	0.31	0.45 (0.36)
4	844	0.3	0.61 (0.30)	1109	0.37	0.31 (0.29)	764	0.31	0.58 (0.27)	1103	0.31	0.35 (0.30)
5	931	0.24	0.47 (0.17)	1216	0.29	0.32 (0.27)	863	0.27	0.43 (0.25)	1197	0.26	0.31 (0.27)
6	1000	0.19	0.49 (0.38)	1298	0.22	0.26 (0.17)	951	0.24	0.44 (0.40)	1245	0.13	0.12 (0.07)
7	1056	0.15	0.34 (0.32)	1363	0.18	0.17 (0.14)	1029	0.21	0.37 (0.34)	1276	0.09	0.27 (0.21)
8	1100	0.12	0.43 (0.47)	1414	0.14		1099	0.19	0.25 (0.17)	1330	0.15	
9	1135	0.1	0.27 (0.12)	1454	0.11		1160	0.17	0.51 (0.41)	1342	0.03	
10	1163	0.08	0.23 (0.20)	1485	0.08		1215	0.15	0.16 (0.16)	1383	0.11	
11	1185	0.06	0.30 (0.06)	1509	0.07		1264	0.13	0.30 (0.10)	1339		
12	1203	0.05	0.33 (0.24)	1528	0.05		1307	0.12	0.13	1391	0.14	
13	1217	0.04		1543	0.04		1345	0.1	0.18 (0.17)	1252		
14	1228	0.03		1554	0.03		1379	0.09				
15	1237	0.02		1563	0.02		1409	0.08				
16	> 1237						1436	0.07				
17							1460	0.07				

Figure 1. Greater amberjack tagging locations.

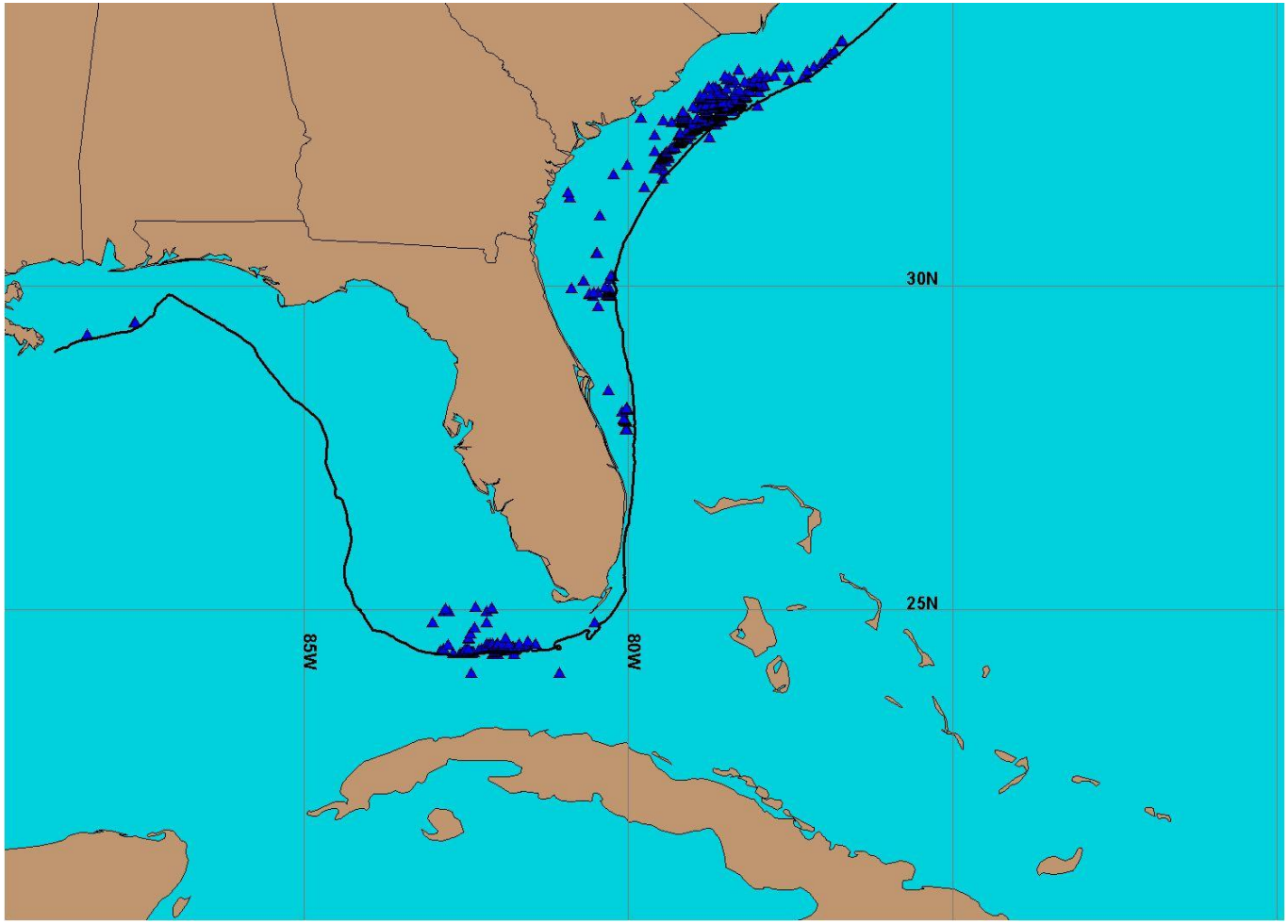

Figure 2. Greater amberjack recapture locations.

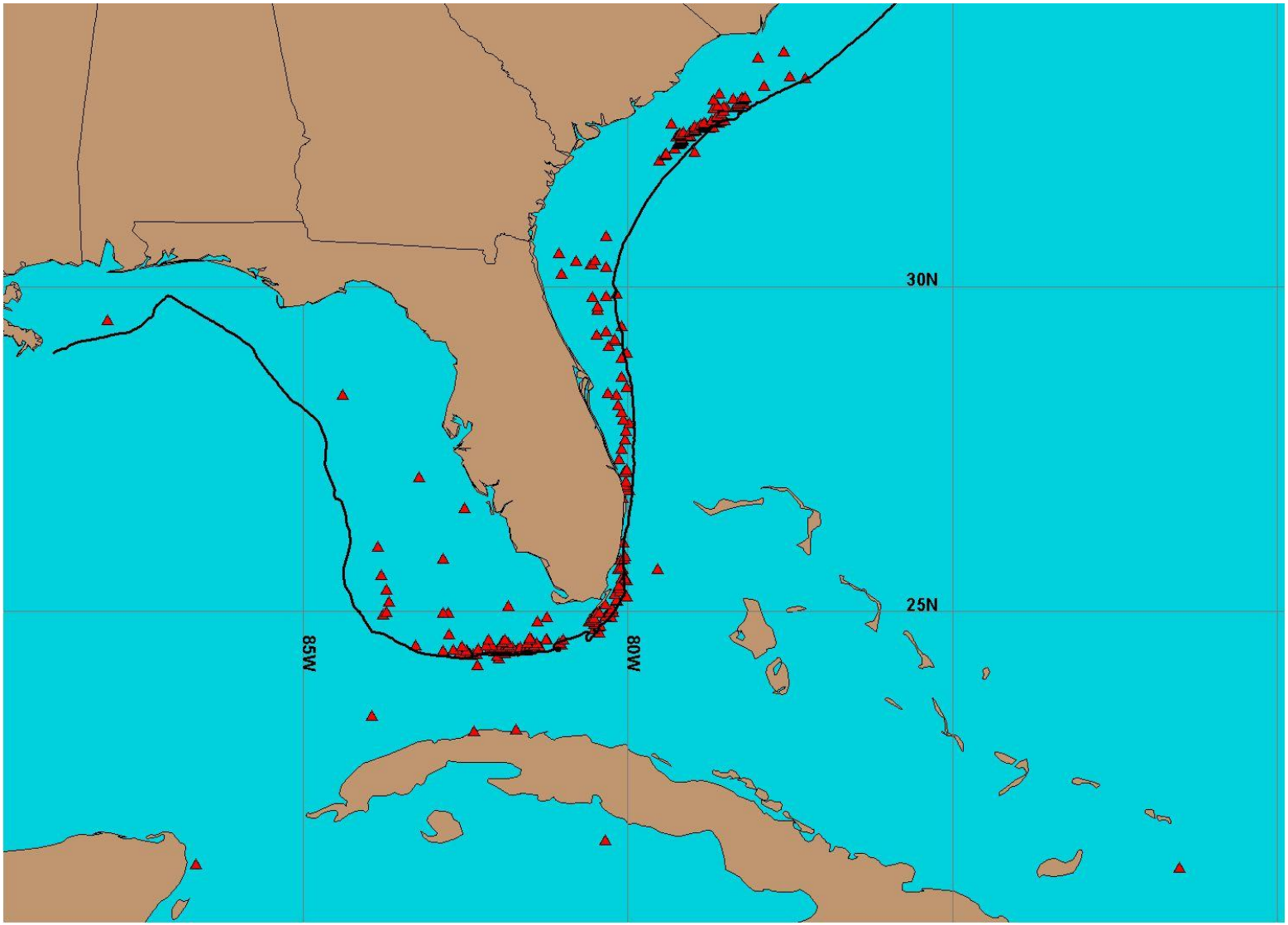

Figure 3. Tagging locations for greater amberjack that moved > 185 km.

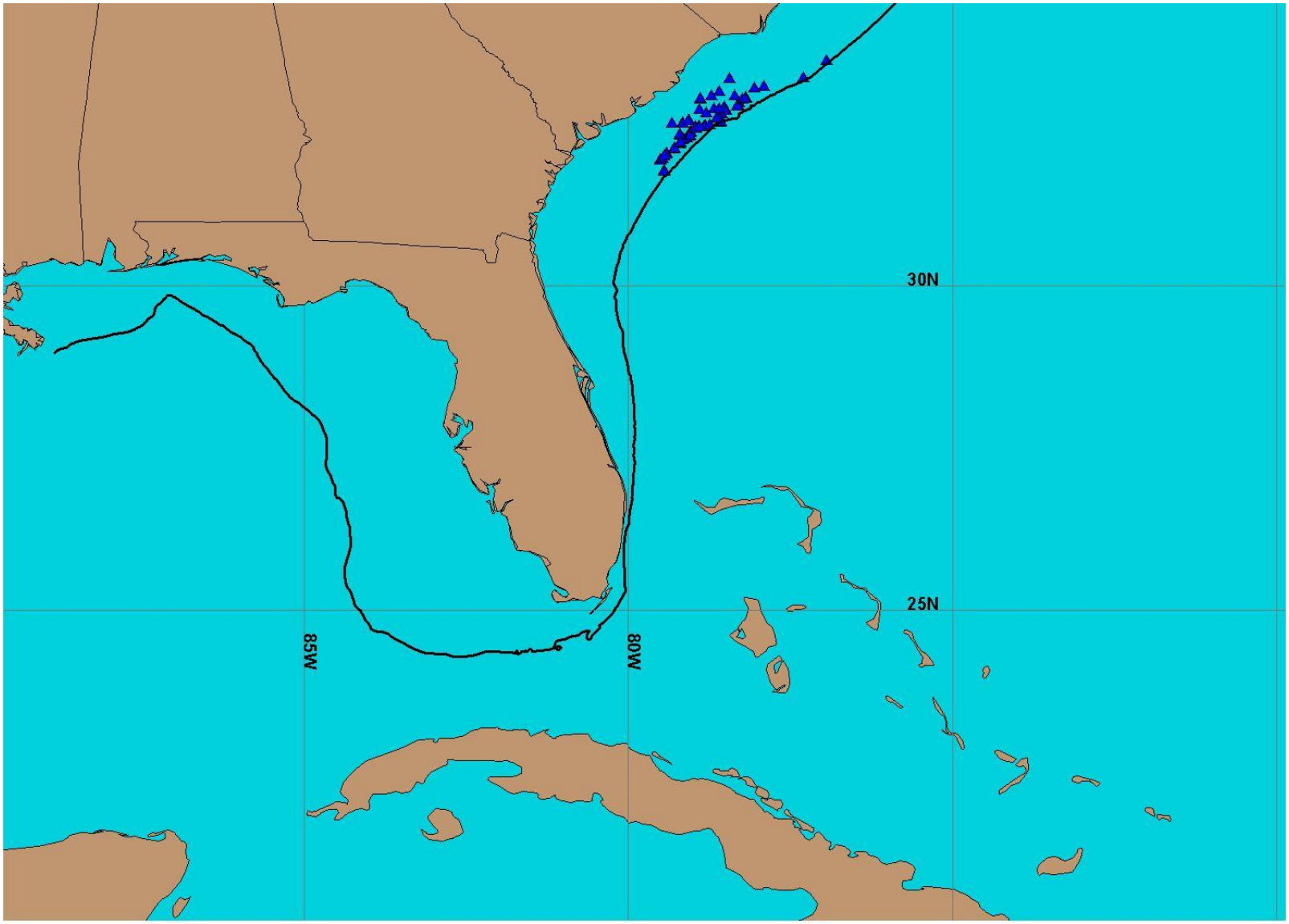

Figure 4. Recapture locations for greater amberjack tagged off South Carolina that moved > 185 km.

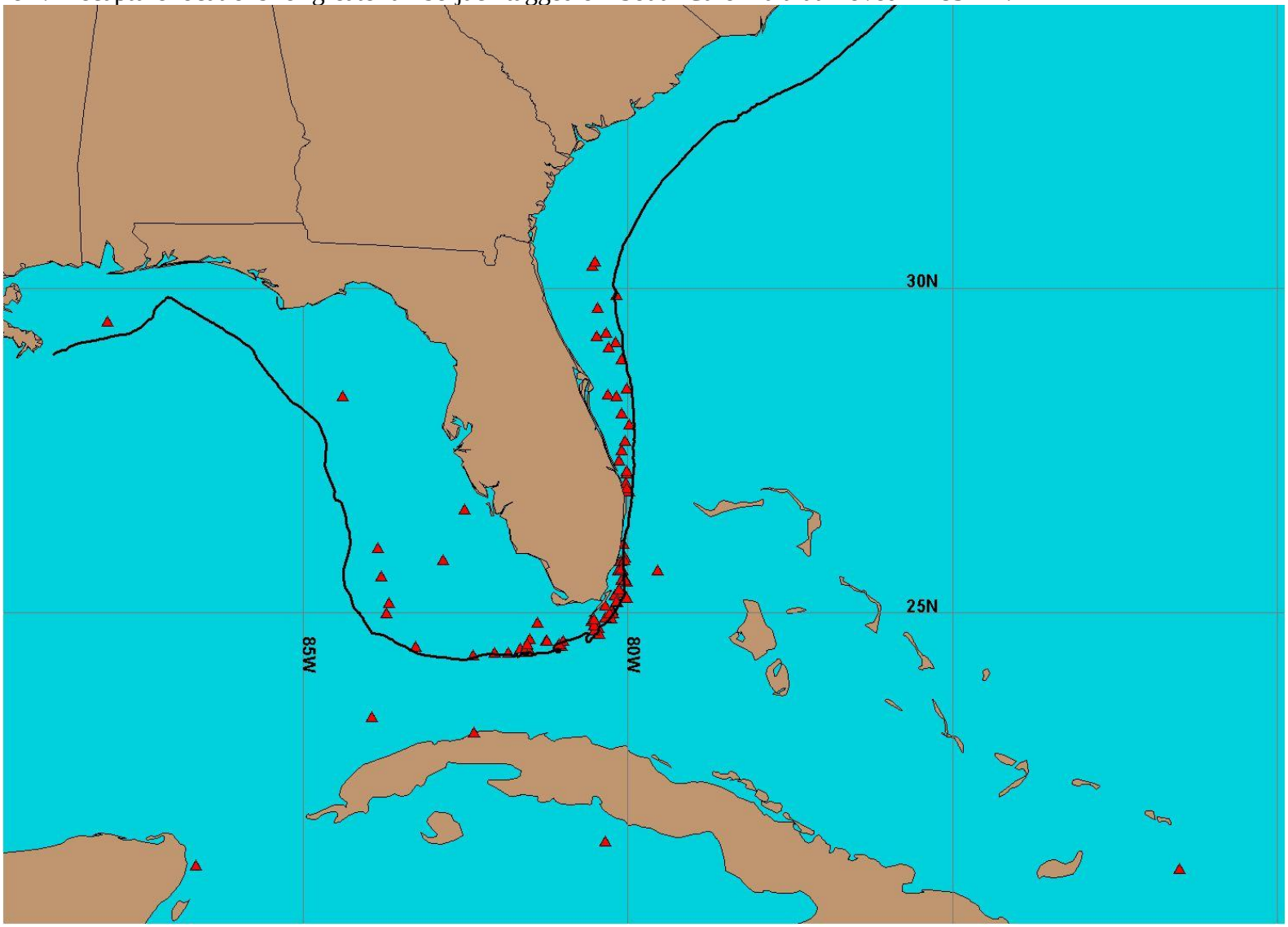

Figure 5. Percentage of monthly commercial landings of greater amberjack and unclassified amberjack for the U.S. Southeast Atlantic during 2001-2004. A seasonal commercial closure of greater amberjack harvest occurs in April of each year. Source: NMFS Accumulative Landings System.