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Distribution of blueline tilefish (*Caulolatilus microps*) in the U.S. EEZ from fishery-dependent and fishery-independent data collections

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Introduction

Blueline tilefish (*Caulolatilus microps*) is currently managed by the Gulf of Mexico, South Atlantic, and Mid-Atlantic Fishery Management Councils (GMFMC, SAFMC, and MAFMC, respectively). The reported distribution of blueline tilefish is generally described as Virginia to the Gulf of Mexico, including Campeche Bank, Mexico (Dooley 1978, Ross and Huntsman 1982, Ross and Merriner 1983, Robins et al. 1986, Harris et al. 2004). Klibansky (2016) provides additional information from the Northeast Fisheries Science Center Bottom Trawl Survey and other sources that indicate blueline tilefish are distributed further north than Virginia. Klibansky (2016) also provided information regarding environmental (i.e., depth, temperature, sediment) variables that might influence the East Coast distribution of blueline tilefish. This report provides additional information on the distribution of blueline tilefish from fishery-dependent and fishery-independent data collected in the Southeastern United States including the Gulf of Mexico. It also provides some potential mechanisms for connectivity between managed regions.

Materials and Methods

Catch records

Spatially precise records of blueline tilefish, with latitude, longitude, and date information were obtained from six sources: Northeast Fisheries Science Center Bottom Trawl Survey (NEFSC BTS; Nitschke and Miller 2016b), the Northeast Fisheries Observer Program (NEFOP; Nitschke and Miller 2016a), the Southeast Reef Fish Survey (SERFS; Kolmos et al. 2016), the Cooperative-With-Industry Data Collection Project (CDCP; Kellison 2016), the National Marine Fisheries Service (NMFS) Bottom Longline Survey (BLL; accessed May 2010, http://www.sefsc.noaa.gov/labs/mississippi/surveys/longline.htm), the Southeast Reef Fish Observer Program (RFOP; accessed May 2016, http://www.galvestonlab.sefsc.noaa.gov/forms/observer/), and the NMFS Remotely Operated Vehicle survey (ROV; S. Harter, NMFS, unpublished data). The first four surveys are described by Klibansky (2016). NMFS has conducted fishery-independent bottom-longline (BLL) surveys throughout the Gulf of Mexico since 1995. Surveys initially sampled depths from 9 to 55 m (Grace and Henwood 1997). In 1999, the BLL survey was expanded out to depths of 366 m (Henwood et al. 2004). Study sites were randomly selected. Longline sets were made parallel to depth contours. Gangion test and length varied between years. J-hooks were used prior to 1999, and circle hooks have been used since 1999. Soak times were always one hour, using 100 #15/0 hooks baited with Atlantic mackerel (*Scomber* *scombrus*). Methods were standardized in 2001. Effort was proportionally allocated based upon shelf width within 60–nautical mile statistical zones (81–82° W, 82–83° W, etc.) and stratified by depth (50%: 9–73 m, 40%: 73–183 m, 10%: 183–366 m). The RFOP is a mandatory program implemented in July 2006 to characterize the reef fish fishery operating in the U.S. Gulf of Mexico. The RFOP provides set-level information on species encountered on trips using bottom longline, electric (bandit) reel, and handlines. The ROV program samples areas in and around existing and proposed protected areas, using video transects to document fish densities and habitats. Together, these observations represent the most complete set of spatially-precise records for this species. Aggregating and mapping these data also allowed us to evaluate the continuity of the distribution of blueline tilefish.

Periodically, the SERFS program has supplemented routine fishery-independent biological data via targeted fishery-dependent sampling of fish houses for particular species to obtain biological samples from species that were caught infrequently by monitoring gears and/or collect biological samples from months and/or seasons of the year outside the routine fishery-independent monitoring season. Histological analysis of fishery-independent and fishery-dependent SERFS samples provided locations for female blueline tilefish within 48 hours of spawning.

Additional information regarding the spatial distribution of blueline tilefish was inferred from fishery-dependent catch records from the NMFS Southeast Fisheries Science Center Coastal Logbook Program (CLP; accessed April 2016) and Southeast Region Headboat Survey (SRHS; accessed April 2016). The CLP provides captain-reported trip level information for each species encountered including landings (in whole pounds), primary gear used, and primary area and depth of capture (in feet). Commercial catches were summarized by year and latitude and standardized to the mean landings across all years to protect confidentiality. Commercial catch-per-unit-effort on directed trips for blueline tilefish was summarized for hook-and-line (including bandit gear, electric rigs, and handlines) and longline gear as landings in pounds whole weight per hook-hour. Directed trips were considered any trip where blueline tilefish represented the majority of the landed catch. To visually assess the distribution of CLP landings, mean landings for each decade were assigned to area depth grids using the NOAA Coastal Relief Model (CRM: http://www.ngdc.noaa.gov/mgg/coastal/crm.html) binned in 5 m depth bands and parsed by the NOAA commercial statistical reporting grids.

Headboats are large, for-hire vessels that typically accommodate 20 or more anglers on half- or full-day trips. SRHS records contain trip-level information on number of anglers, trip duration, date, and area fished for encounters (landings and releases) of each species. To visually assess the distribution of SRHS landings, mean landings for each decade were assigned to captain-reported subareas.

Environmental data

Blueline tilefish habitat characteristics were summarized for point observations where possible. Klibansky (2016) provides information on depth, bottom temperature, salinity, and sediment compositions associated with positive observations along the east coast of the USA. For the Gulf of Mexico, depth of catch for the RFOP data was summarized, and point observations for all sources were plotted relative to depths from the CRM. Point observations were also plotted relative to over 400,000 observations of sea floor sediment characteristics in the Gulf of Mexico, collected from a variety of sources in the global dbSEABED project (http://csdms.colorado.edu/wiki/DBSEABED, Jenkins 2010). Finally, to evaluate potential connectivity across regions, blueline tilefish point observations were plotted relative to surface current flow patterns recorded by over 15,000 satellite drifters deployed by the Global Drifter Program (GDP; http://www.aoml.noaa.gov/phod/dac/index.php) and South Carolina's Department of Natural Resources (SC-DNR; G. Sedberry, unpublished data). Samples of blueline tilefish females within 48 hours of spawning were plotted in GIS relative to satellite drifters released by SC-DNR (G. Sedberry, unpublished data) that passed within 1 nautical mile during months of peak spawning (May-Sept).

Results and Interpretation

Figure 1 shows that blueline tilefish have been collected off the continental shelf from the Northern Gulf of Mexico in western Louisiana to New Jersey. Discussion of the Atlantic sampling programs may be found in Klibansky (2016). Nearly 12,000 blueline tilefish were observed in over 54,000 sets made by the Gulf of Mexico sampling programs (i.e., NMFS-BLL and RFOP). **Figure 1** indicates these programs provide comprehensive coverage of most locations in federal waters in the Gulf of Mexico. Assuming these programs provide representative sampling, the blueline tilefish distribution in the Gulf of Mexico is centered off the southwestern Florida shelf. Additionally, the NMFS ROV survey program encountered 95 blueline tilefish in and around the MPAs on the SAFMC continental shelf-edge.

Historically, most blueline tilefish commercial landings have originated from the SAFMC's jurisdiction (**Figure 2**). The Gulf of Mexico has also accounted for a substantial percentage of blueline tilefish landings and has managed the species in the Grouper-Tilefish IFQ Program since 2010 (https://portal.southeast.fisheries.noaa.gov/). Blueline tilefish landings in the Gulf of Mexico have changed in response to IFQ Program implementation, potentially because the allocation prices are pooled for golden (*Lopholatilus chamaeleonticeps*) and blueline tilefish, but golden tilefish commands a higher price per pound ($2.81/lb for golden, $1.35/lb for blueline tilefish; Table 30 in the 2014 Grouper-Tilefish IFQ Annual Report), incentivizing increased harvest of golden at the expense of blueline tilefish. In the most recent years, with increasing regulations upon SAFMC commercial fishermen, landings in the MAFMC's jurisdiction have substantially increased. The highest landings observed were 2008-2010; landings dropped substantially following the implementation of a prohibition on blueline tilefish harvest beyond 240-ft depth in the SAFMC's jurisdiction in 2011 (SAFMC Amendment 17B 2011). Landings increased close to 2008-2010 levels following the removal of this prohibition in 2012 (SAFMC Regulatory Amendment 11 2012).

In the SAFMC's jurisdiction, commercial landings of blueline tilefish have been recorded predominantly at 32°, 35°, and 24° N latitude (**Figure 3**). Landings from 35-36° N (Cape Hatteras, North Carolina and north) have increased substantially in the past 6 years. Hook-and-line CPUE on directed trips for blueline tilefish showed less pronounced trends than landings, although CPUE at the north and south end of the SAFMC's jurisdiction did appear higher than in the center (**Figure 4: top**). Due to restrictions on the use of longline gear in the SAFMC's jurisdiction, catch rates were much patchier for this gear, with high CPUEs predominantly off North Carolina (**Figure 4: bottom**). These results may be biased by defining a directed trip as any trip with the majority of landings comprised by blueline tilefish; there is undoubtedly effort towards blueline tilefish that fails to clear this threshold.

Prior to 2010, commercial landings of blueline tilefish in the SAFMC's jurisdiction were primarily off Key West, Florida and Charleston, South Carolina (**Figure 5: left**). Post-2011, the majority of blueline tilefish in the SAFMC's jurisdiction have been commercial landed off North Carolina (**Figure 5: right**). Recreational landings of blueline tilefish by headboats in the Southeastern USA had been concentrated off Miami, Florida, with increased landings off Cape Hatteras, North Carolina since 2000 (**Figures 6-7**).

The average depth of capture for blueline tilefish reported to the RFOP was 208 ± 32 m (range: 68-353 m, n = 11615; **Figure 8**). There was no apparent relationship between blueline tilefish size and depth of capture for the exploited portion of the stock sampled by the RFOP (**Figure 9**). **Figure 10** shows a consistent depth range for blueline tilefish offshore of the continental shelf from the Gulf of Mexico to the Gulf of Maine. Klibansky (2016) reported two depth modes on the east coast of the USA with peaks around 100 m and 180 m; the Gulf of Mexico fishery appears to be slightly deeper than the east coast fishery.

Figure 11 shows Gulf of Mexico blueline tilefish encounters relative to sediment classifications from the dbSEABED project. The majority of BLL (70%) and RFOP (67%) samples of blueline tilefish were from habitats classified as "Sand Dominant" or "Sand Very Dominant." These observations are consistent with Able et al. (1987)'s observations that blueline tilefish occupy predominantly sandy sites, although the predominant habitat types seem to vary spatially, suggesting that habitat use may be influenced by microhabitat trends near the actual blueline tilefish burrows that would not be apparent given the coarse resolution of the Gulf of Mexico sediment mapping.

Blueline tilefish are believed to be highly residential, occupying scour depressions in carbonate substratum and burrows in soft bottom (Able et al. 1987) and cavities created by rock piles and ledges (G. Sedberry, pers. obs. from ROV). Since blueline tilefish eggs are pelagic (Lewis et al. 2016) and adults spawn in locations near where they have been collected by fishery-dependent and fishery-independent sampling, the Loop Current provides a mechanism for transport of larvae from the offshore the southwest Florida shelf to the east coast of the United States (**Figures 12-13**). Similarly, the Gulf Stream and its associated eddies provide mechanisms for larval transport up the east coast (**Figure 12**). Counter-current eddies may also provide connectivity from North to South in some areas, although this mechanism is not as clear from surface drifter flow.

Histological analysis of SERFS samples provided eight fishery-independent and 51 fishery-dependent records for female blueline tilefish within 48 hours of spawning. All records were located off South Carolina in the core SERFS sampling area (**Figure 14**). Blueline tilefish females were collected in spawning condition at a similar depth to the core of their SERFS distribution (mean=182 m; **Table 1**). Bottom water temperature for samples with spawning condition females was 15-16° C (**Table 1**). Blueline tilefish spawning females were captured offshore of existing no-take MPAs and SMZs (**Figures 14-15**). Pelagic blueline tilefish eggs and larvae could be transported north by the Gulf Stream (**Figure 14**) or locally retained by eddies and gyres (**Figure 15**). Further research into larval characteristics, planktonic egg and larval duration, passive vs. active larval swimming behavior, and geographically expanded histological sampling are all necessary before any conclusions regarding blueline tilefish larval connectivity can be drawn. However, data on ocean current patterns and paths of large numbers of drifter buoys suggest that it is very likely that pelagic eggs and larvae spawned in locations where blueline tilefish are found in the Gulf of Mexico could drift into the South Atlantic. Likewise, eggs and larvae produced in the South and Mid-Atlantic regions are likely to be transported by ocean currents across the North Carolina - Virginia border in considerable numbers.

References

Able, K., D. Twichell, C. Grimes, and R. Jones. 1987. Tileshes of the genus Caulolatilus construct burrows in the sea floor. Bulletin of Marine Science 40:1-10.

Dooley, J. K. 1978. Systematics and biology of the tileshes (Perciformes: Branchiostegidae and Malacanthidae), with descriptions of two new species. US Department of Commerce, National Marine Fisheries Service.

Grace, M.A. and T. Henwood. 1997. Assessment of the distribution and abundance of coastal sharks in the U.S. Gulf of Mexico and Eastern Seaboard, 1995 and 1996. Mar. Fish Rev. 59: 23–32.

Harris, P. J., D. M. Wyanski, and P. T. P. Mikell. 2004. Age, growth, and reproductive biology of blueline tilefish along the southeastern coast of the United States, 1982-1999. Transactions of the American Fisheries Society 133: 1190-1204.

Henwood, T., W. Ingram, and M. Grace. 2004. Shark/snapper/grouper longline surveys. SEDAR-7 Data Workshop Technical Document 8, NMFS Southwest Fisheries Science Center, Pascagoula, MS. 22 pp.

Kellison, T., 2016. Summary of the 2015 blueline tilefish cooperative-with-industry data collection project. SEDAR50-DW02. Report, SEDAR, North Charleston, SC.

Klibansky, N. 2016. Distribution of scientifically collected bluelient tilefish (*Caulolatilus microps*) in the Atlantic, and associated habitat. SEDAR50-DW04. SEDAR, North Charleston, SC. 29 pp.

Kolmos, K. J., S. Falk, D. M. Wyanski, and M. A. Schmidtke, 2016. A Preliminary Assessment of Reproductive Parameters for Blueline Tilefish in Atlantic Waters from Virginia to Florida. SEDAR50-DW03. Report, SEDAR, North Charleston, SC.

Lewis, L. A., D. E. Richardson, E. V. Zakharov, and R. Hanner. 2016. Integrating DNA barcoding of fish eggs into ichthyoplankton monitoring programs. Fishery Bulletin 114.

Nitschke, P., and A. Miller, 2016*a*. Summary of Mid-Atlantic Commercial Blueline Tilefish Data. SEDAR50-DW10. Report, SEDAR, North Charleston, SC.

Nitschke, P., and A. Miller, 2016*b*. Summary of Northeast Fisheries Science Center Blueline Tilefish Survey Data. SEDAR50-DW09. Report, SEDAR, North Charleston, SC.

Robins, C. R., G. C. Ray, and J. Douglass. 1986. Peterson field guides: Atlantic coast fishes. Houghton-Mifflin Company.

Ross, J. L., and G. R. Huntsman. 1982. Age, growth, and mortality of blueline tilefish from North Carolina and South Carolina. Transactions of the American Fisheries Society 111:585-592.

Ross, J. L., and V. Merriner. 1983. Reproductive biology of the blueline tilefish, Caulolatilus microps, off North Carolina and South Carolina. Fishery Bulletin 81.

South Atlantic Fishery Management Council (SAFMC). 2010. Amendment 17B to the Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. SAFMC, North Charleston, SC. Available online: http://safmc.net/Library/pdf/17B%20Final.pdf

South Atlantic Fishery Management Council (SAFMC). 2011. Regulatory Amendment 11 to the Management Plan for the Snapper Grouper Fishery of the South Atlantic Region: 240-ft (40-Fathom) Closure. SAFMC, North Charleston, SC. Available online: http://safmc.net/Library/pdf/SGRegAmend11_FINAL%2020110927.pdf

Table 1. Summary statistics for water depth (m), salinity (ppt), and temperature (°C) during SERFS fishery-independent collections of spawning condition females.

Common name	Scientific name		N	Valid	Mean	SD	Min	Max
Blueline Tilefish	*Caulolatilus microps*	Depth	8	8	181.9	33.8	100	205
		Salinity	8	7	36.1	0.0	36	36
		Temp	8	7	16.0	0.3	15	16

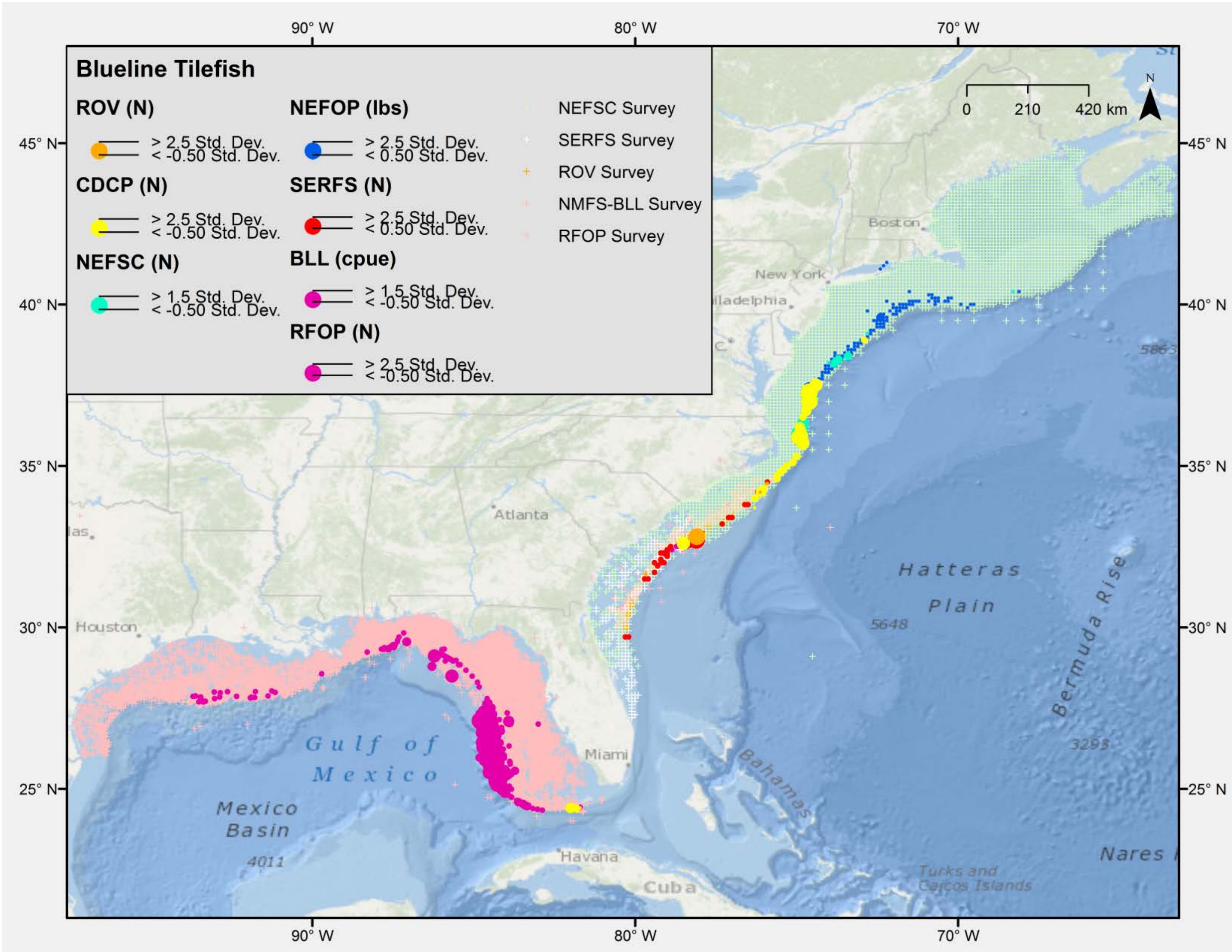

Figure 1. Sampling (crosses) and positive encounters (circles) of blueline tilefish by various sampling programs from the Gulf of Mexico to the Gulf of Maine. NMFS-BLL and RFOP encounters with blueline tilefish are presented under the same color scheme to protect confidentiality.

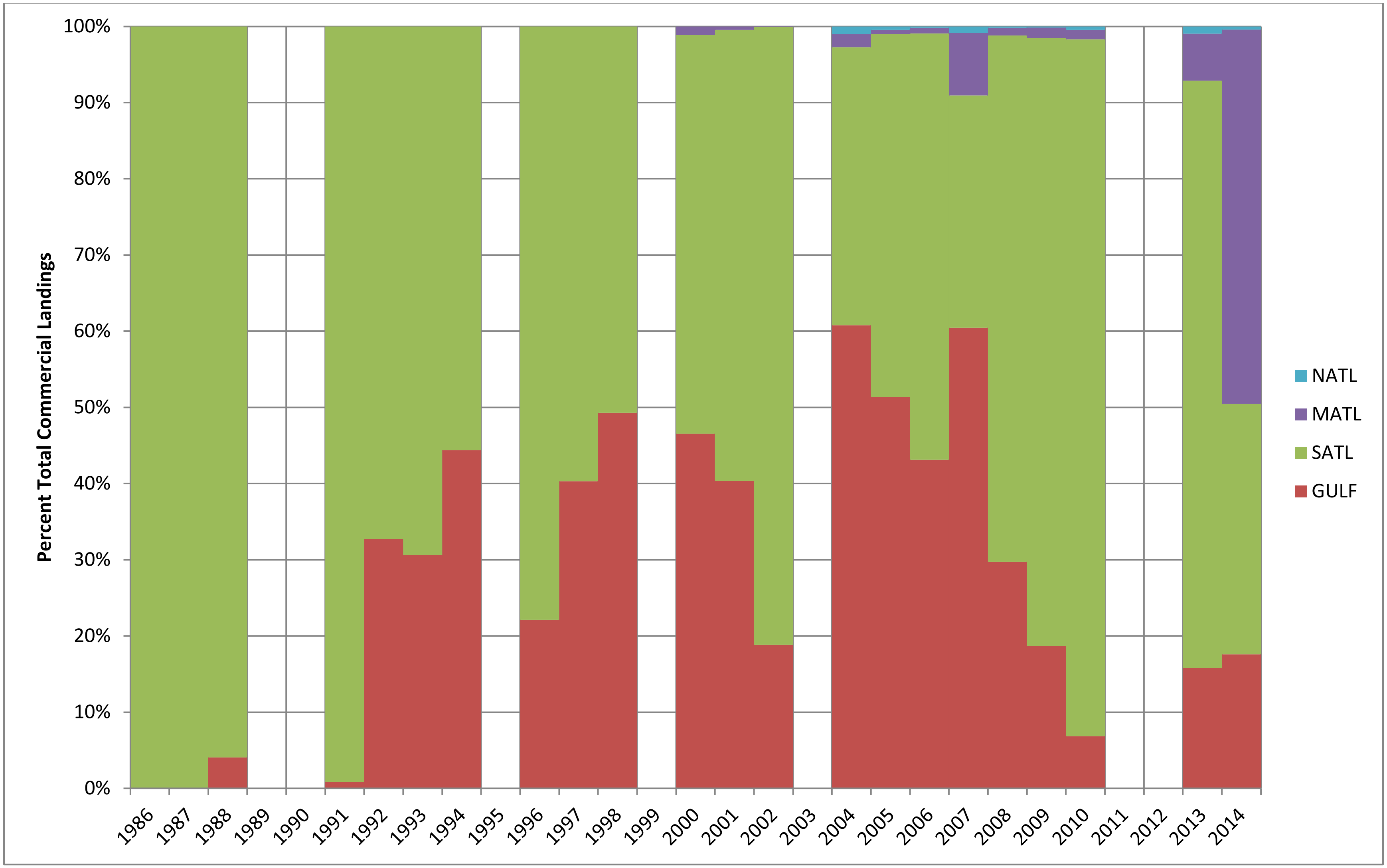

Figure 2. Percentage of blueline tilefish commercial landings (lbs ww) reported caught from each region, by year. Some years omitted to protect confidentiality. Source: SEFSC Commercial ACL Database (accessed Dec 2015). NATL: North Atlantic, MATL: Mid-Atlantic, SATL: South Atlantic, GULF: Gulf of Mexico.

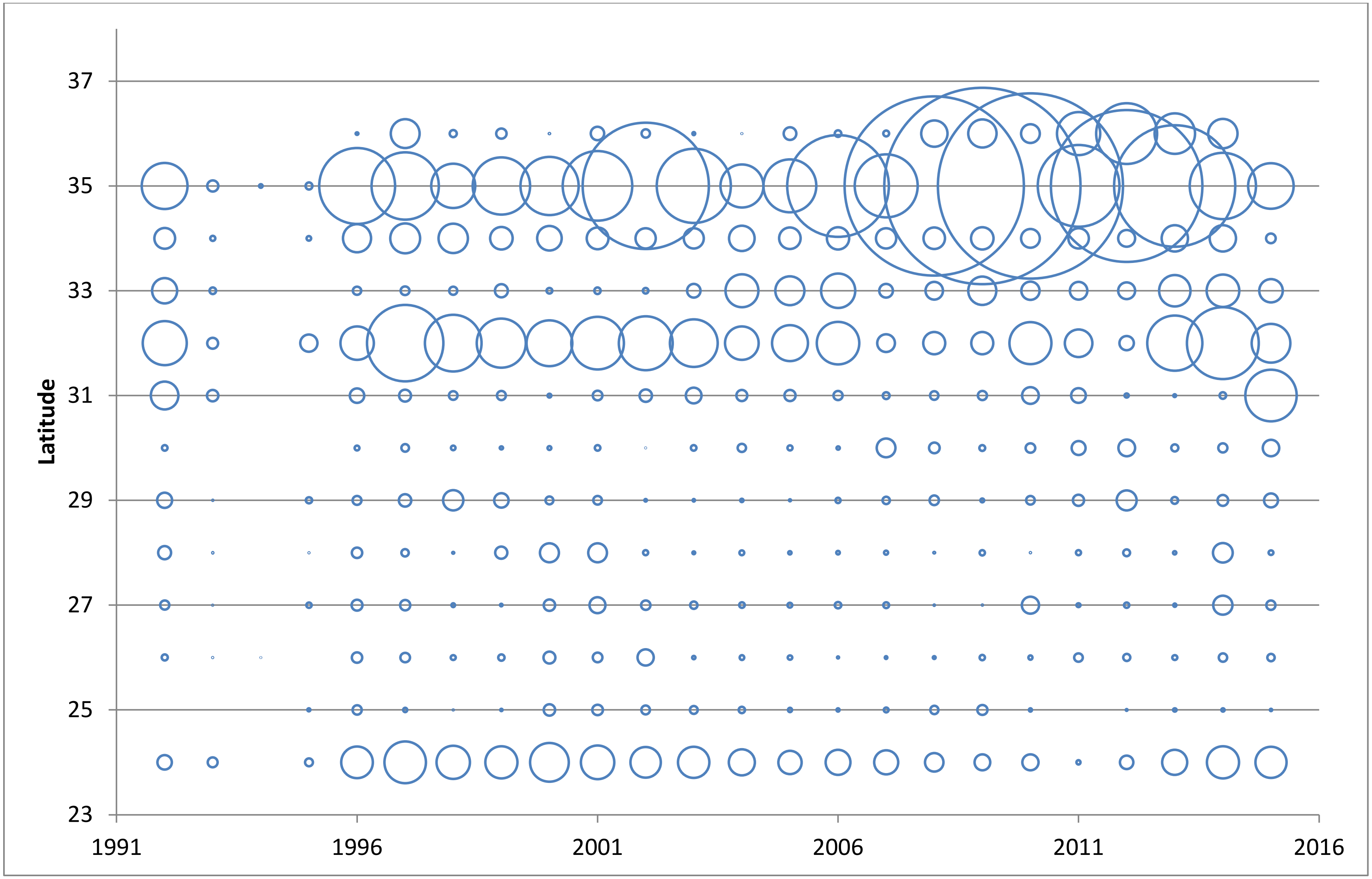

Figure 3. Blueline tilefish commercial landings (lbs ww) reported caught in the SAFMC's jurisdiction by latitude and year. Bubble sizes scaled to annual mean for time series to protect confidentiality. Source: SEFSC Commercial Logbook Program (accessed April 2016).

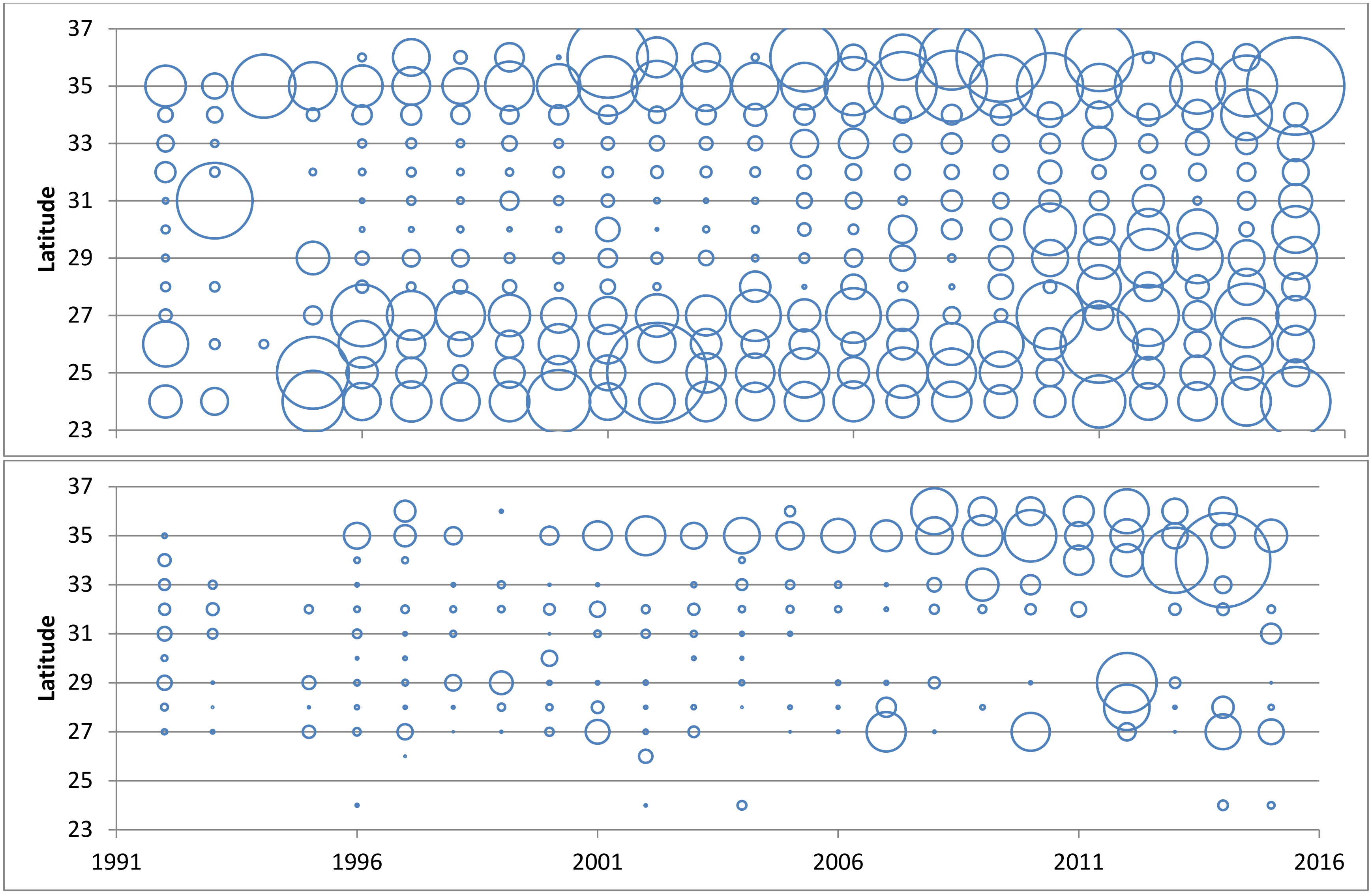

Figure 4. Blueline tilefish commercial catch-per-unit-effort on directed hook-and-line (top) and longline (bottom) trips in the SAFMC's jurisdiction by latitude and year. Bubble sizes scaled to annual mean for time series to protect confidentiality. Source: SEFSC Commercial Logbook Program (accessed April 2016).

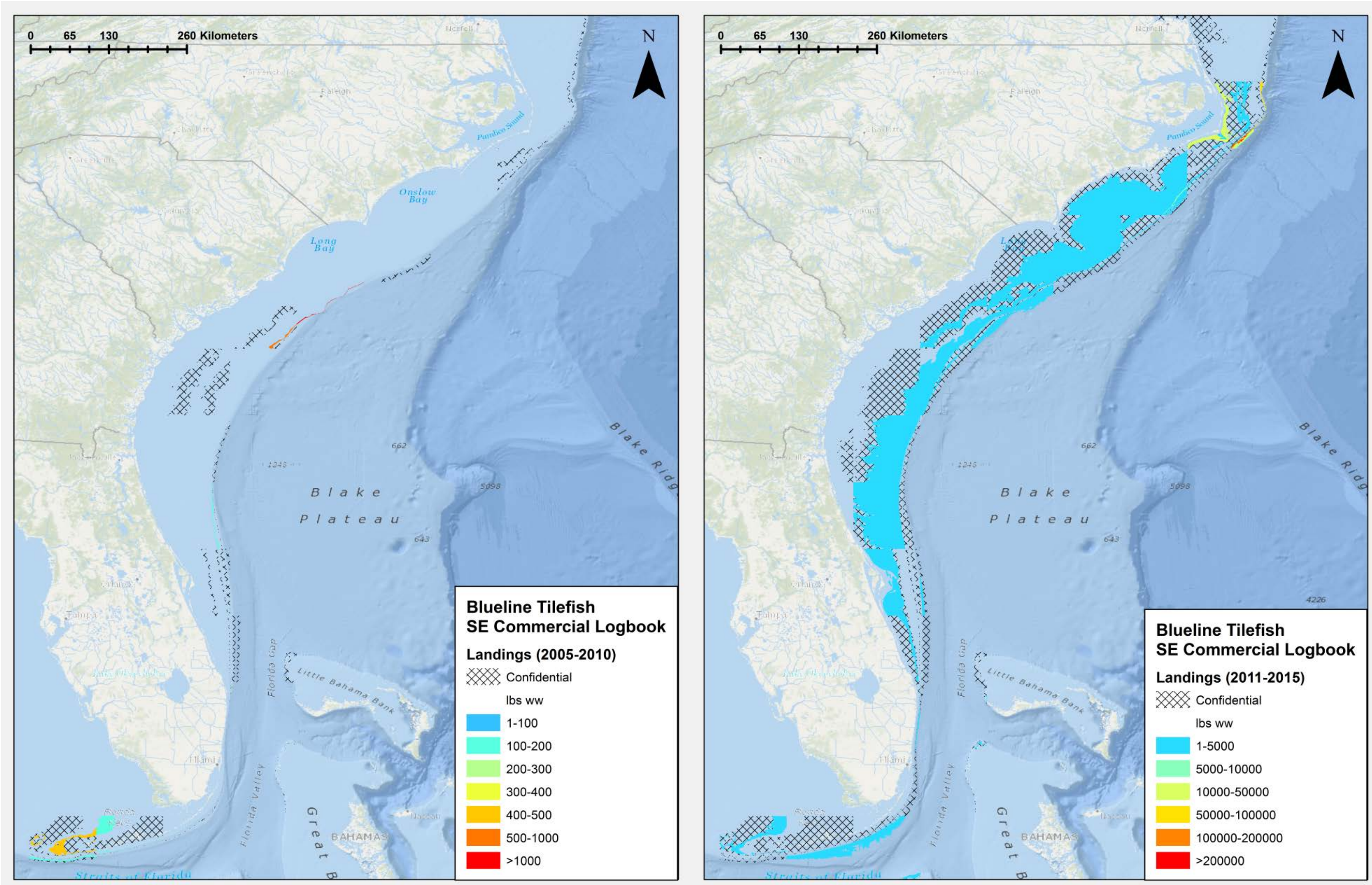

Figure 5. Blueline tilefish commercial landings (lbs ww) reported caught in the SAFMC's jurisdiction by area and depth for 2005-2010 (left) and 2011-2015 (right). Some landings obscured to protect confidentiality. Source: SEFSC Commercial Logbook Program (accessed April 2016).

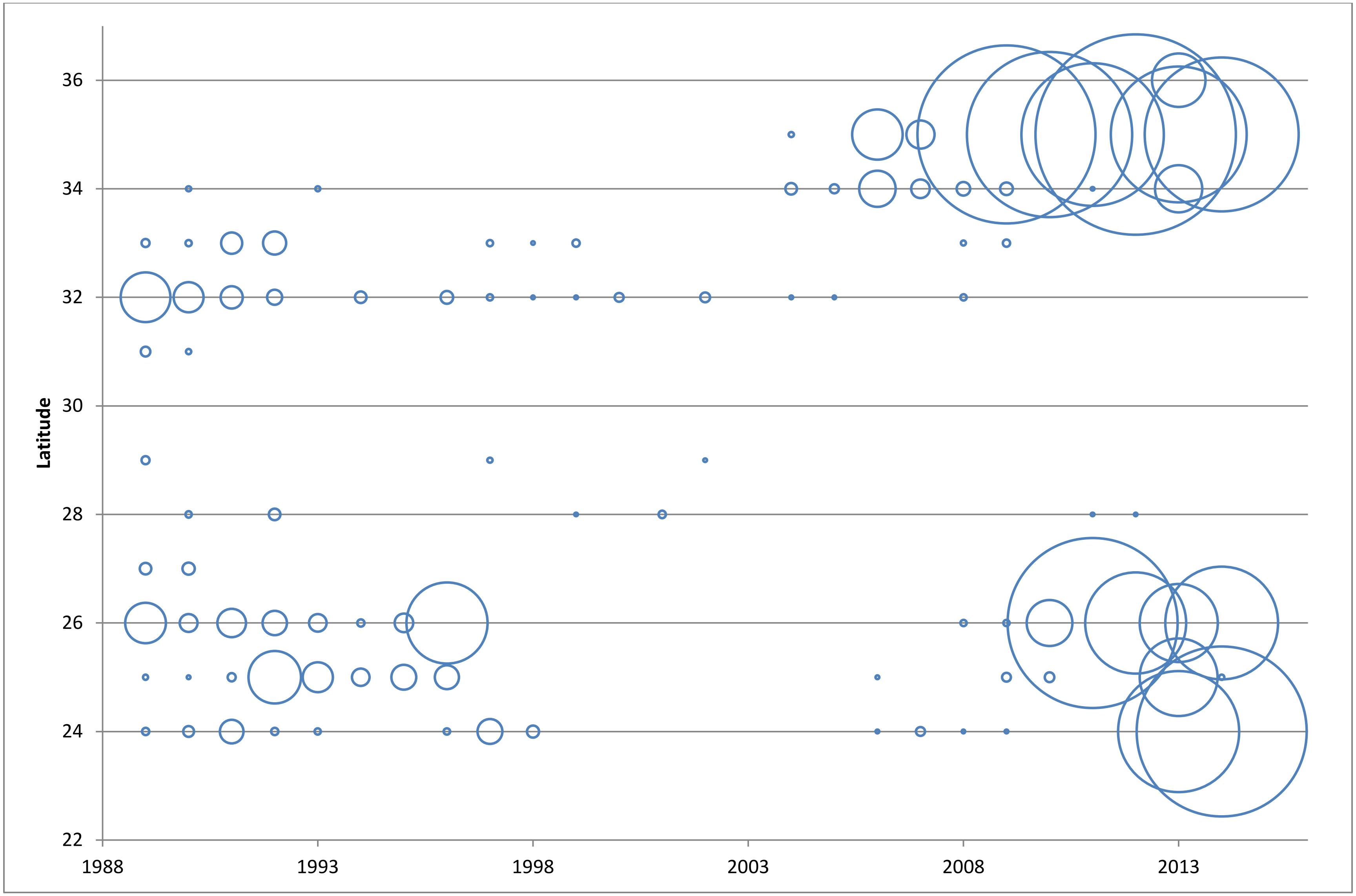

Figure 6. Blueline tilefish headboat landings (N) reported caught in the SAFMC's jurisdiction by latitude and year. Bubble sizes scaled to annual mean for time series to protect confidentiality. Source: SEFSC Southeast Region Headboat Survey (accessed April 2016).

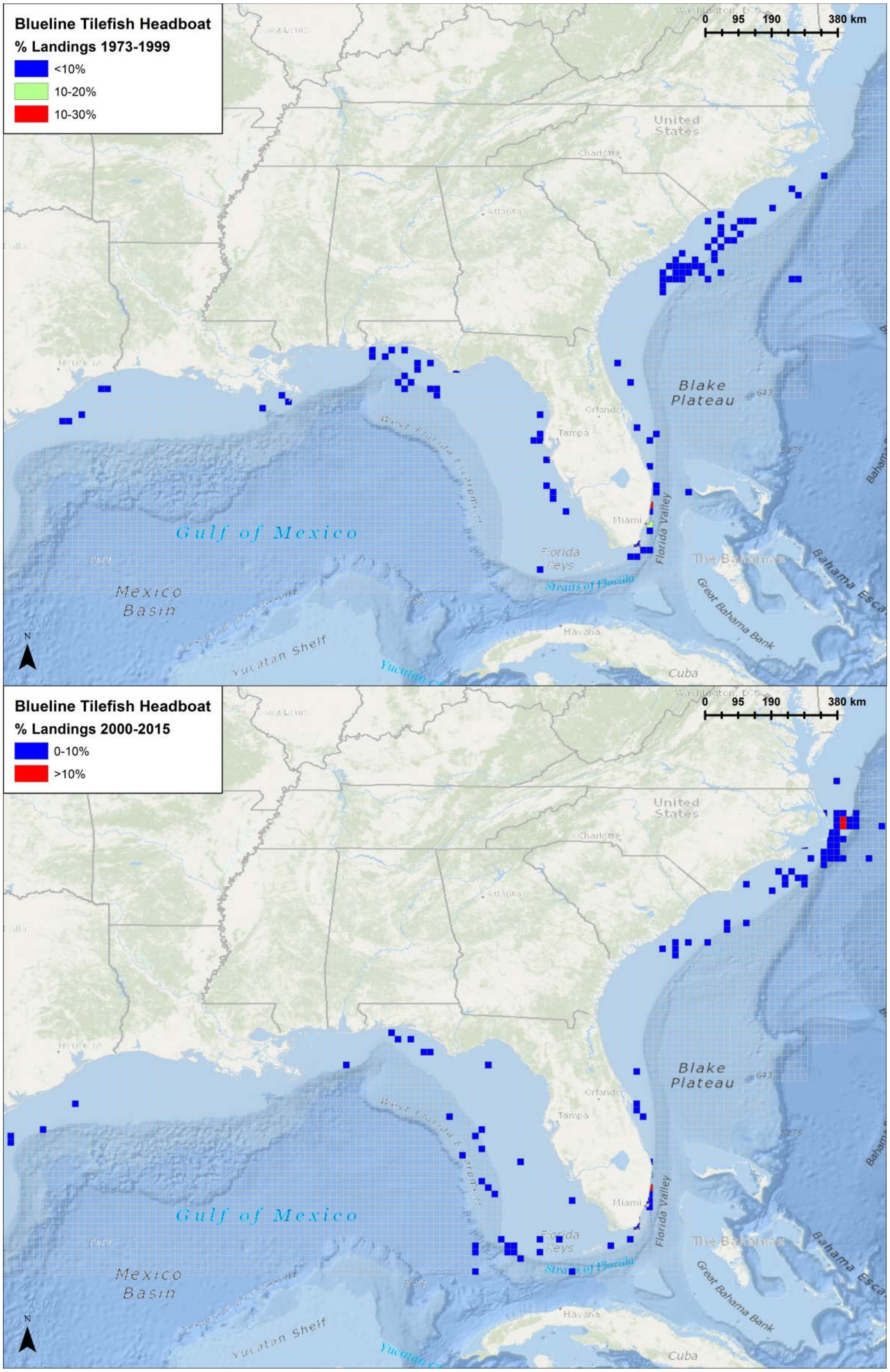

Figure 7. Blueline tilefish headboat landings (N) in the SAFMC's jurisdiction pre- and post-2000. Source: Southeast Region Headboat Survey (April 2016).

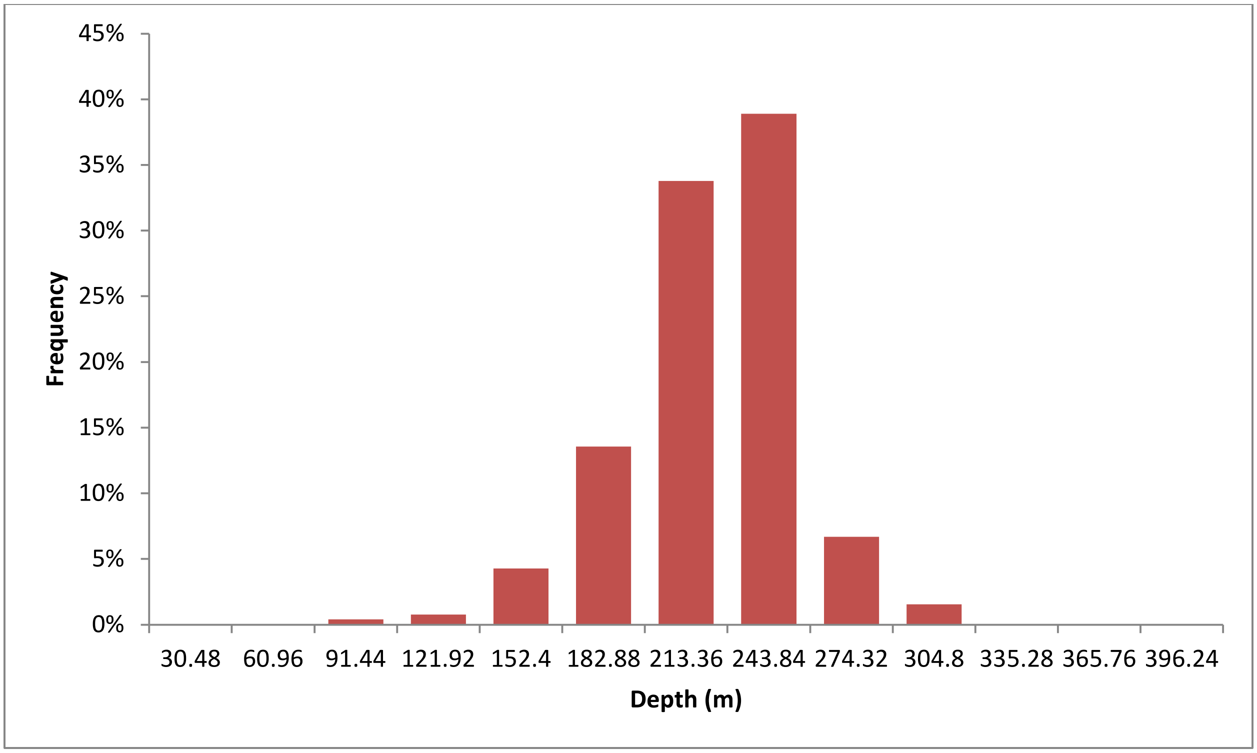

Figure 8. Histogram of depth of landing for blueline tilefish (n=11,813) reported to the RFOP.

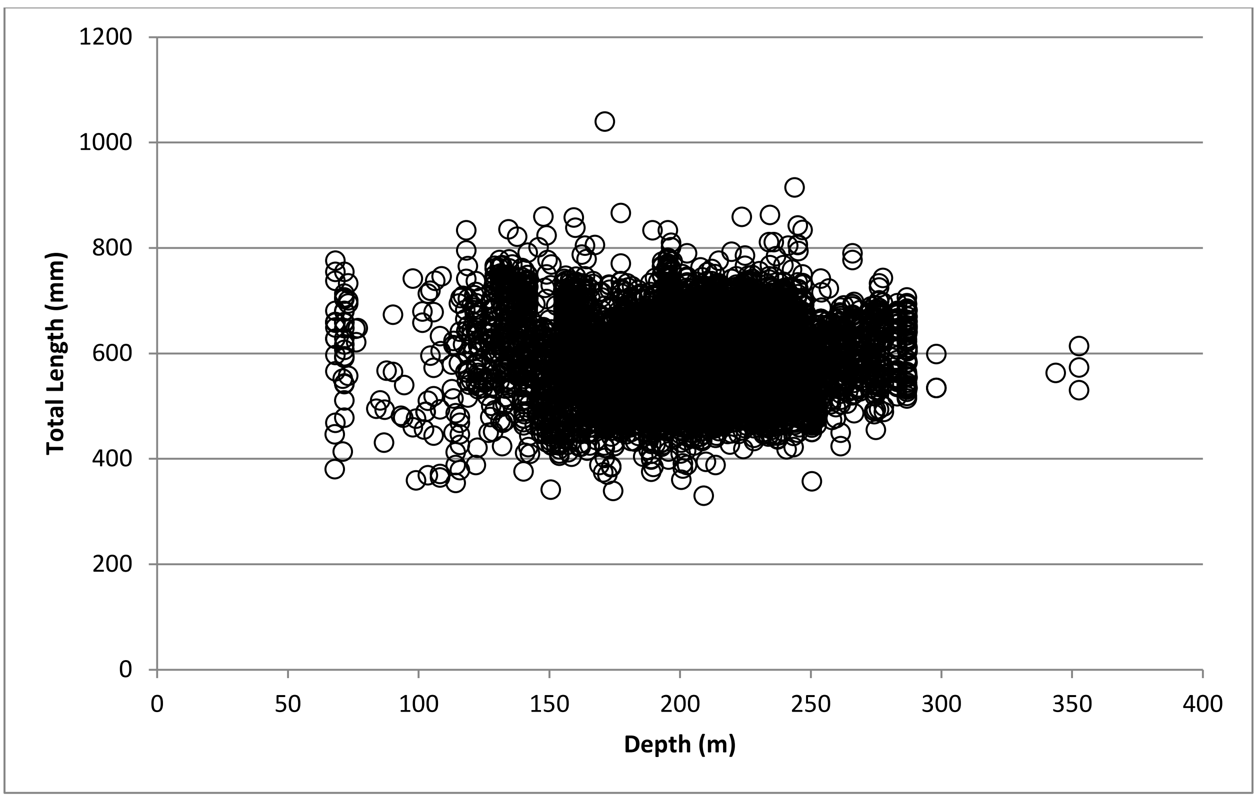

Figure 9. Observed sizes of landed blueline tilefish (n=11,615) versus depth reported by the RFOP.

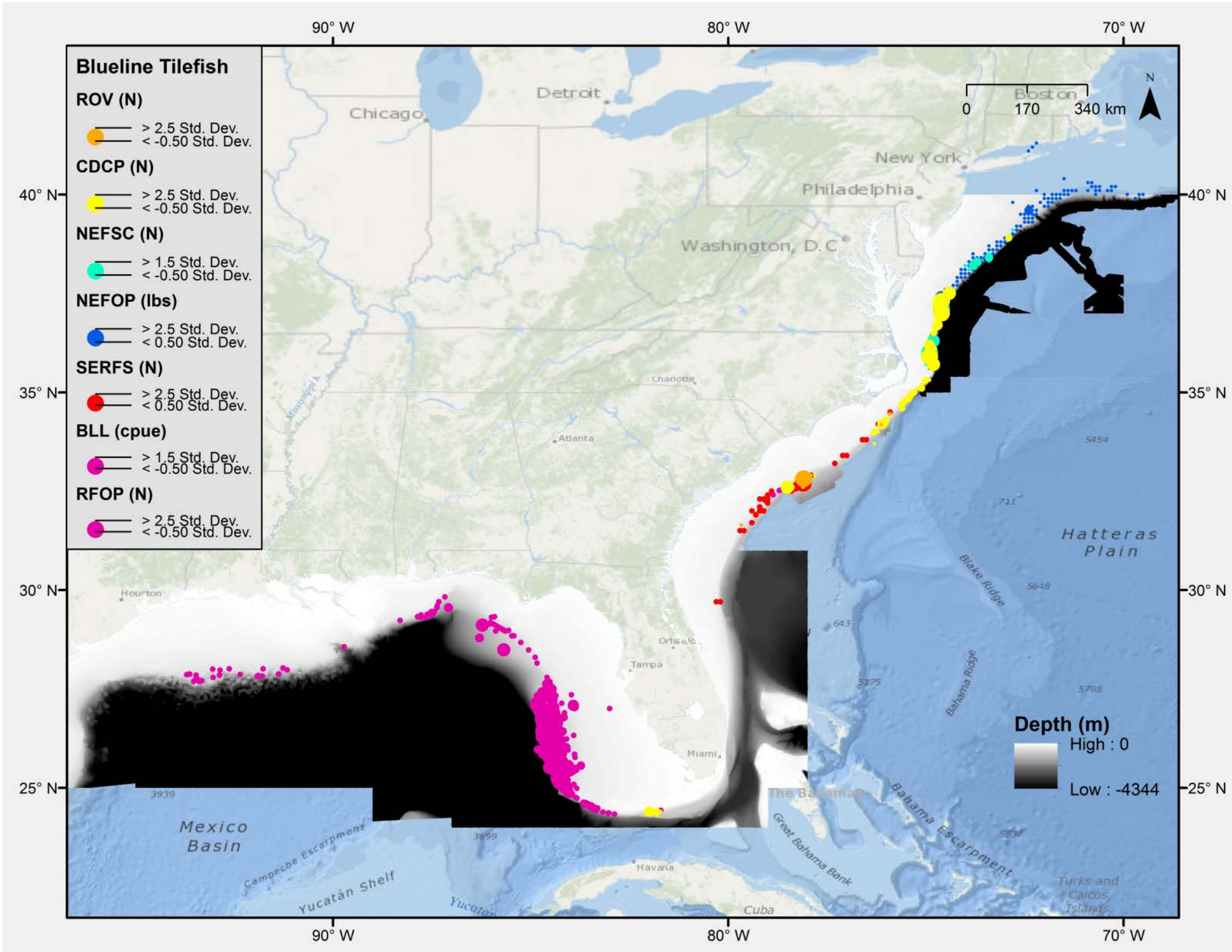

Figure 10. Positive encounters (circles) of blueline tilefish by various sampling programs from the Gulf of Mexico to the Gulf of Maine relative to bathymetry from the Coastal Relief Model. NMFS-BLL and RFOP encounters with blueline tilefish are presented under the same color scheme to protect confidentiality.

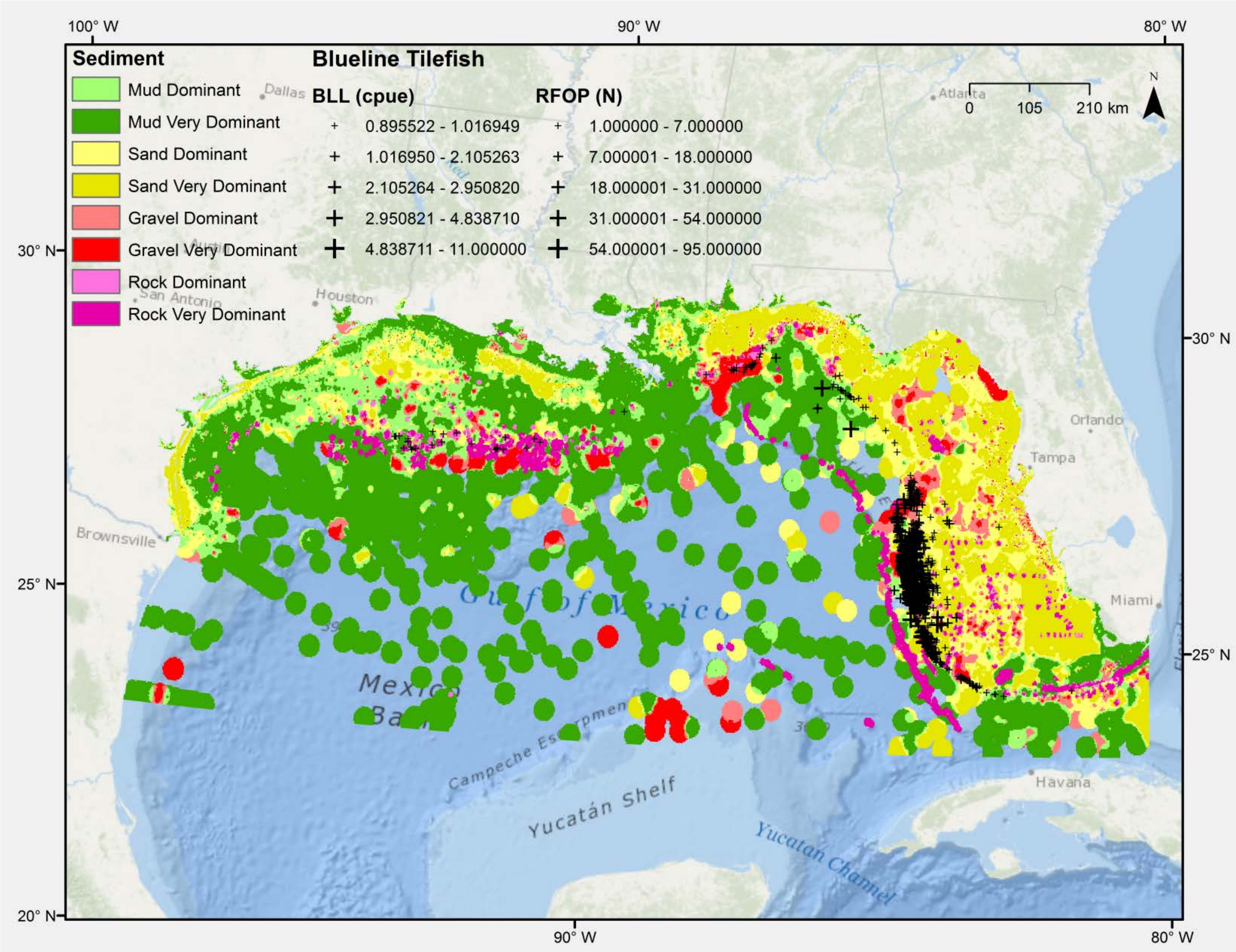

Figure 11. Positive encounters (circles) of blueline tilefish by various sampling programs in the Gulf of Mexico relative to 400,000 sediment pulls from the dbSEABED project. NMFS-BLL and RFOP encounters with blueline tilefish are aggregated to protect confidentiality.

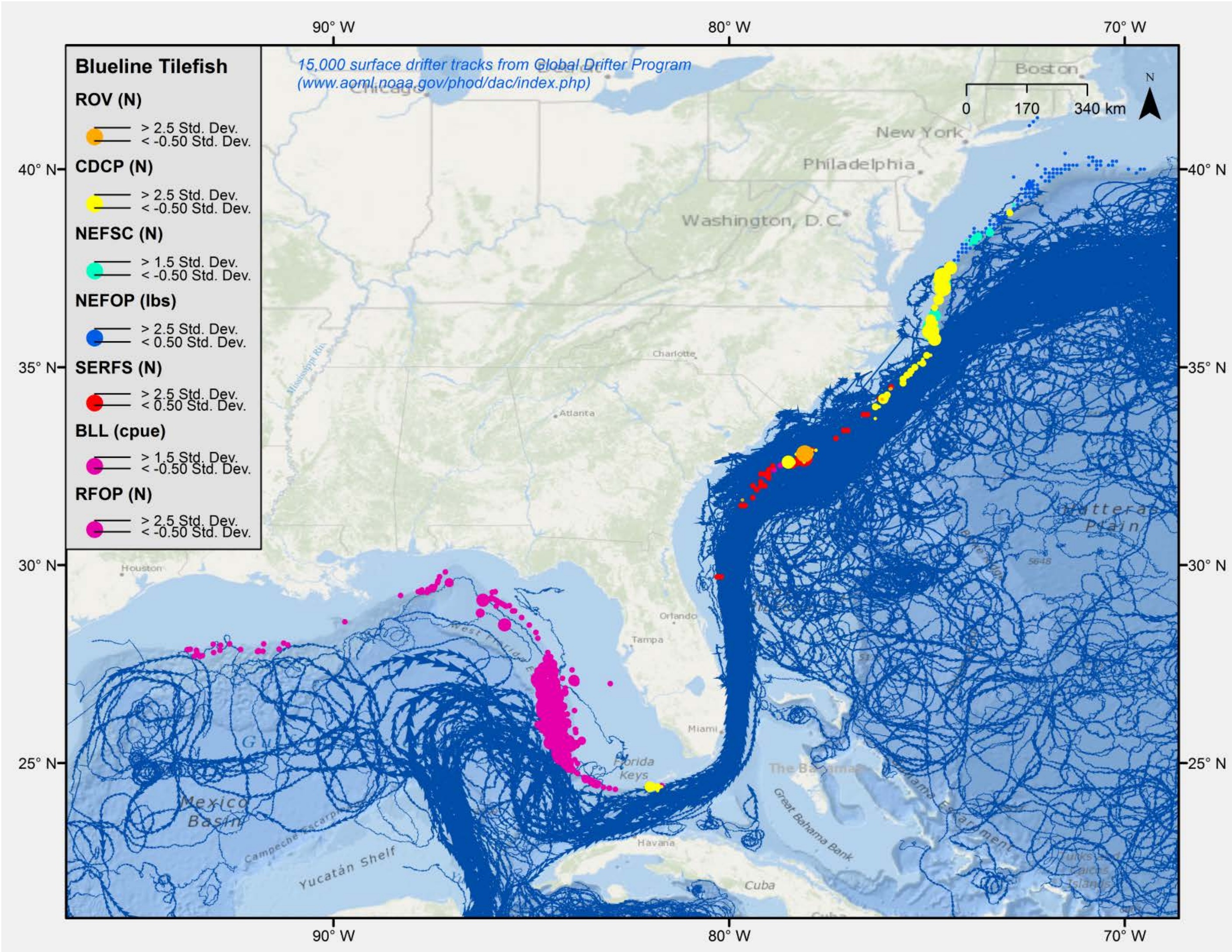

Figure 12. Positive encounters (circles) of blueline tilefish by various sampling programs from the Gulf of Mexico to the Gulf of Maine relative to 15,000 surface drifter buoy tracks from the Global Drifter Program. NMFS-BLL and RFOP encounters with blueline tilefish are presented under the same color scheme to protect confidentiality. Drifter arrow sizes correspond to speed of movement.

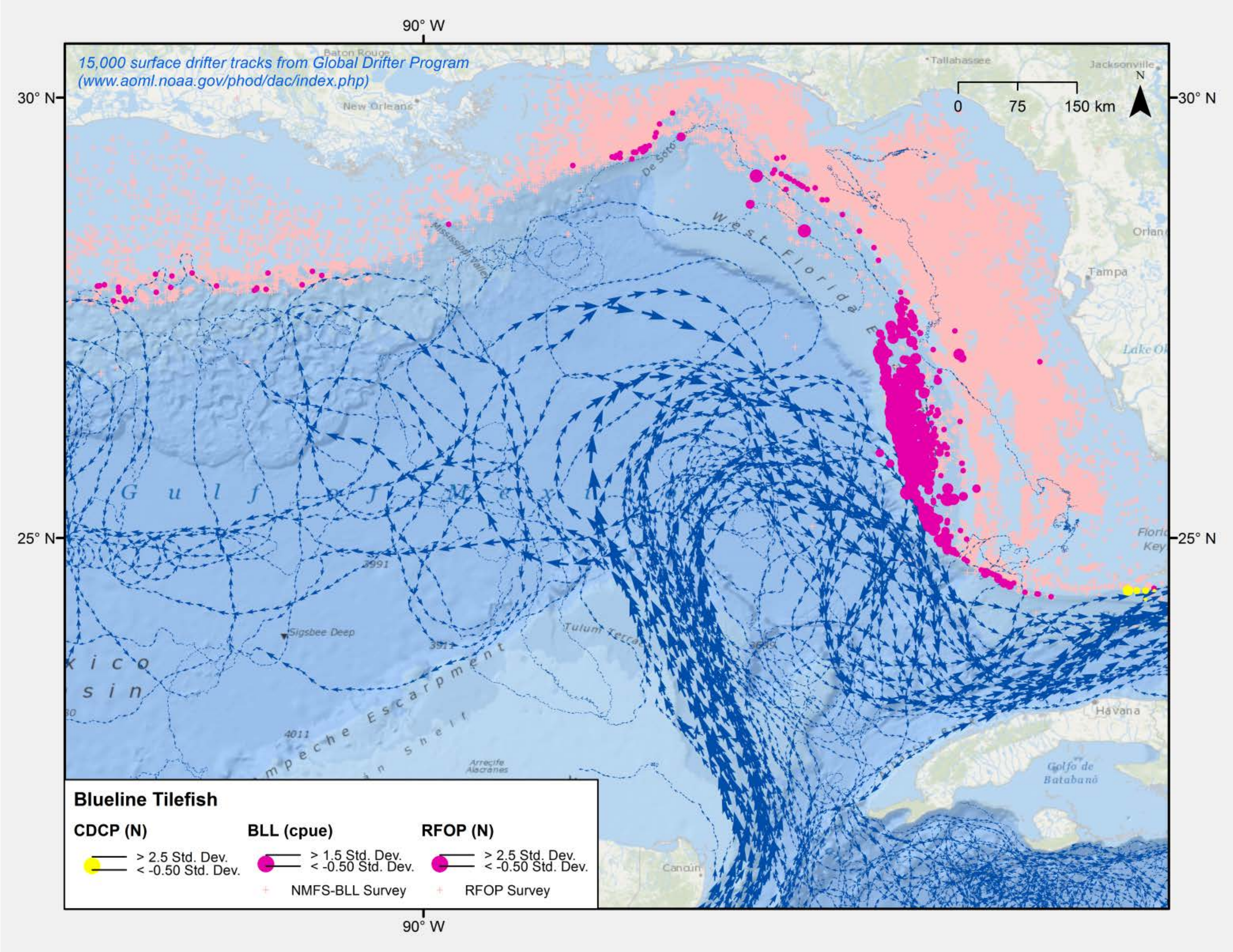

Figure 13. Positive encounters (circles) of blueline tilefish by various sampling programs in the Gulf of Mexico relative to 15,000 surface drifter buoy tracks from the Global Drifter Program. NMFS-BLL and RFOP encounters with blueline tilefish are presented under the same color scheme to protect confidentiality. Drifter arrow sizes correspond to speed of movement.

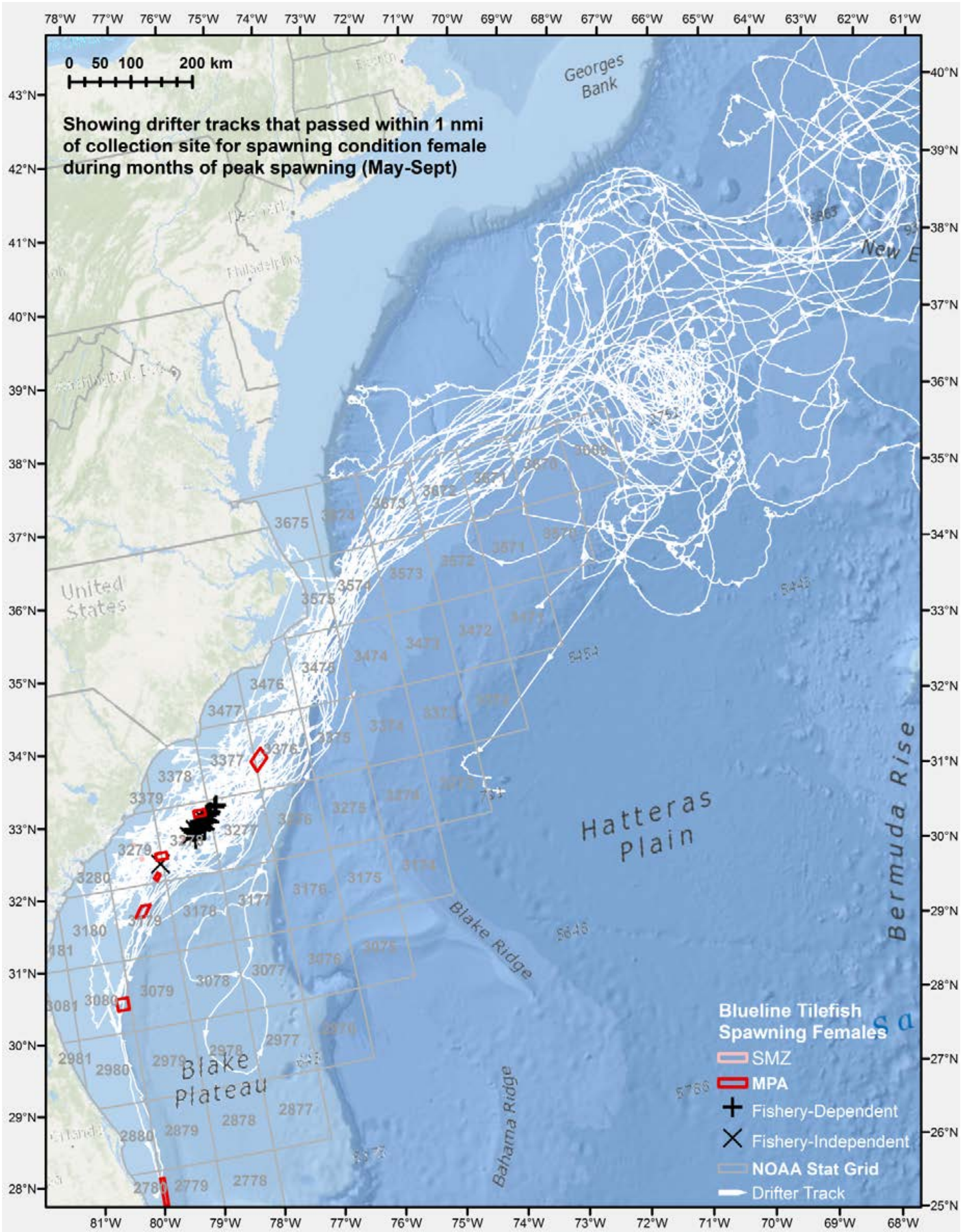

Figure 14. Spawning condition female blueline tilefish observed by SERFS with SC-DNR drifter tracks (G. Sedberry, unpublished data) that came within 1 nautical mile of a spawning site during peak spawning months May-Sept. 32 drifter tracks intersected fishery-dependent samples and 21 tracks intersected fishery-independent samples.

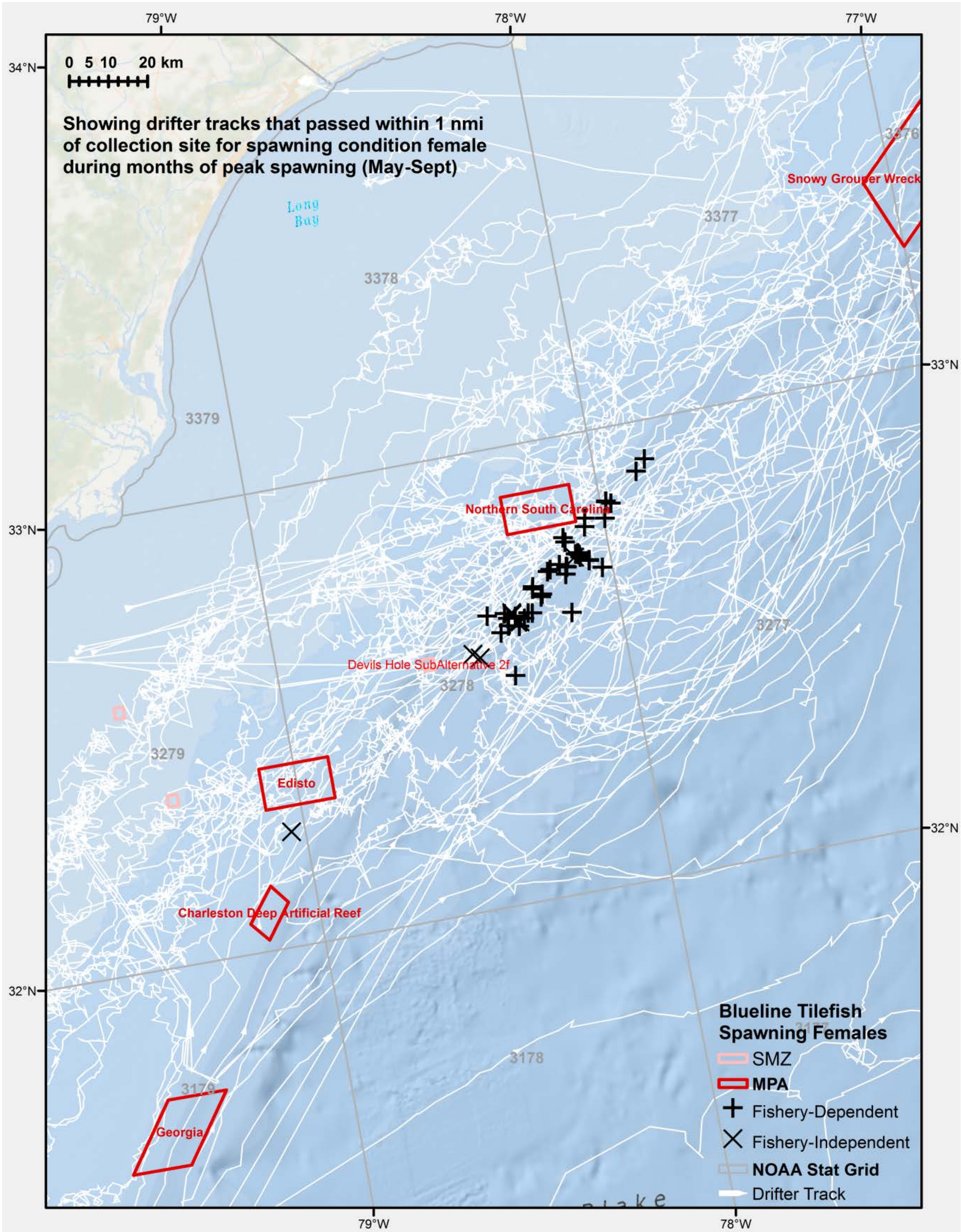

Figure 15. Close-up of current patterns around locations where spawning condition female blueline tilefish were observed by SERFS. Surface currents based on SC-DNR drifter tracks (G. Sedberry, unpublished data) that came within 1 nautical mile of a spawning site during peak spawning months May-Sept.