A Continuation of Results in the Spatial Distribution and Occurrence of Red Snapper, *Lutjanus campechanus*, Sampled off the Louisiana Coast During Nearshore Trawl Sampling Efforts

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A Continuation of Results in the Spatial Distribution and Occurrence of Red Snapper, *Lutjanus campechanus*, Sampled off the Louisiana Coast During Nearshore Trawl Sampling Efforts

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Background

The estimate of juvenile red snapper bycatch as a direct result of the commercial shrimp fishery has been a controversial subject since the initial Southeast Data Assessment and Review (SEDAR) of red snapper (Nance 2004, Nichols 2004a, Nichols 2004b, Helies et al. 2014). Since SEDAR 7 in 2004, there have been more federal observers on commercial vessels recording shrimping effort and bycatch directly to reduce reliance on statistical models. Although more data have been collected by observers and electronic logbook programs, estimates of red snapper bycatch from the commercial fishery are made on broad spatial scales (i.e., eastern and western Gulf of Mexico; Linton 2012, Nichols 2004a, Nichols 2004b, Helies et al. 2014). Empirical evidence suggests that bycatch rates for trawling gear, similar to that used in the commercial shrimp fishery, vary throughout the western Gulf of Mexico (Switzer et al. 2015). The objective of this project was to document the catch rates of juvenile red snapper in trawls similar to those used in the commercial shrimp fishery among statistical grids in nearshore waters along the Louisiana coast. This report is a continuation of the work documented in Adriance and Sweda (2012).

Methods

Gulf of Mexico waters off Louisiana were divided into three zones: Western, Central, and Eastern. Each zone was 90-120 miles wide with depths ranging from 5 to 40 fathoms. The geographic boundaries of each zone are listed below.

Eastern Zone: $88^{o}0'0"$ W - $89^{o}59'59"$ W

Central Zone: $90^{o}0'0"$ W - $91^{o}59'59"$ W

Western Zone: $92^{o}0'0"$ W - $93^{o}59'59"$ W

Each zone was demarcated by four sample corridors corresponding to 30-minute longitudinal intervals within the zone boundaries. One longitudinal transect was selected at random within each of the sample corridors. Zones, longitudinal transects within sample corridors, and the starting corridor were selected at random. Sampling within a zone proceeded in a systematic fashion from either corridor 1 to 4 or from corridor 4 to 1. The next time a particular zone was sampled, the corridors were sampled in reverse order. A sample was collected at each of eight depth strata along the longitudinal transect line year-round (all seasons) from 2011 through 2015. Depth strata were separated by increments of 5 to 40 fathoms. One 30-minute tow was conducted on the seafloor at each depth stratum. Trawl measurements and specifications were as delineated in Southeast Area Monitoring and Assessment Program (SEAMAP) protocol for the Gulf of Mexico (Adriance and Sweda 2012). All individuals captured by the trawl were identified to species and counted. A random subsample of 50 conspecific individuals were measured (total length; TL) to the nearest millimeter (mm) and weighed to the nearest gram (g).

Length measurements were used to assign ages based on growth model parameters from SEDAR 31 and a catch at age matrix, which was created as outlined in Haddon (2001). Ages were only assigned to individuals with a recorded length.

Results and Discussion

A total of 868 samples were collected with nearshore trawling gear in 2011(n=201), 2012 (n=288), 2013 (n=118), 2014 (n=177), and 2015 (n=84). A total of 3,257 red snapper were collected in 2011 (n=749), 2012 (n=1,223), 2013 (n=412), 2014 (n=630), and 2015 (n=243; Table 1). Seasonally (with all years combined), there were 1,057 red snapper collected from 244 transects in winter, 797 red snapper collected from 227 transects in spring, 738 red snapper collected from 244 transects in summer, and 655 red snapper collected from 153 transects in fall. Total length ranged from 29 mm to 796 mm.

Every year, the most frequently captured red snapper were less than age 2 and less than or equal to 200 mm TL (Figure 1-5). Transects in Grid 13 had the smallest and youngest fish most frequently, except in 2015 (Figure 5). In every year other than 2014, Grid 17 had the second largest incidence of small, young red snapper (Figure 4). In 2013, there was a peak in red snapper between 150-200 mm TL (age 1) in Grid 16 (Figure 3). Few red snapper were collected in Grids 14 and 15 compared to other areas of the Louisiana shelf.

Seasonal comparisons suggest a peak in the 150 mm TL size class during both fall and winter as a result of the prolonged spawning season (Figure 6). This trend is likely due to the protracted summer spawning season, giving time for some red snapper to grow to a larger size in winter. Spring data indicate a peak in catch size at 200 mm TL, which shows growth from the 150 mm TL peak in fall and winter. Summer has a bimodal peak of age 1 individuals from the previous year-class at around 200-250 mm TL and the newly recruited individuals that were early spawns at 100 mm TL or under. These seasonal changes in size modes display year class and sometimes cohort growth through the year.

Data combined among years suggest that red snapper juveniles exhibit spatially explicit distribution off the Louisiana coast. Grid 13 (Mississippi River mouth) had the highest percentage (42.83%) of red snapper catch and Grid 17 (shelf off Sabine and Calcasieu Lake) had the second highest amount (23.61%) of red snapper catch (Figure 7). Additionally, data between years indicate the same spatial trend. The highest percentage of annual catch was in Grid 13 most years (2011, 2012, 2013, and 2014); however, catch was lower in 2015 (4.53%) as a result of less sampling effort around the mouth of the Mississippi River. Similarly, the second highest annual catch was in Grid 17, except in 2013 and 2014. There was a slight spatial shift from Grid 17 to Grid 16 in 2013 and that was the only year that the percentage of total catch was near 20% in Grid 16. Overall, total catch of juvenile red snapper was lowest in Grids 14 and 15.

Although the reasons for the spatial selectivity are unclear, finer scale estimations of juvenile red snapper bycatch may be a more accurate representation of true conditions. Switzer et al. (2015) indicated that hypoxic zones may influence juvenile red snapper settlement, but we could not infer such conclusions based on the information collected during this study. Regardless of the reason for spatial selectivity, data from the Louisiana trip ticket program indicate that that the number of commercial shrimping trips from 2011-2015 are consistently higher in Grid 15. Information collected during this study suggests that total percentage of juvenile red snapper collected in near shore trawls was lowest in Grid 15. With Grid 15 yielding the lowest proportion of juvenile red snapper bycatch currently according to the results of this study, the large amount of shrimping effort in Grid 15 may yield a smaller amount of juvenile red snapper bycatch than previously thought. In conclusion, spatial distribution of red snapper is a large factor in commercial shrimp bycatch of the species.

Acknowledgements

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References

Adriance, J.W. and M.T. Sweda. 2012. Spatial distribution and occurrence of red snapper, *Lutjanus campechanus*, sampled off the Louisiana coast during nearshore trawl sampling efforts. SEDAR31-DW16. SEDAR, North Charleston, SC. 12pp.

Haddon, M. 2001. Modelling and Quantitative Methods in Fisheries. Chapman & Hall/CRC Press LLC Boca Raton, FL. 406pp.

Helies, F.C., J.L. Jamison, and B. Gallaway. 2014. Continuation of a project to augment the data collection of an electronic logbook system used within the Gulf of Mexico shrimp fishery. NA11NMF4540118 (GSAFF #120).

Linton, B. 2012. Shrimp fishery bycatch estimates for Gulf of Mexico red snapper, 1972-2011. SEDAR31-DW30.

Nance, J. 2004. Estimation of effort in the offshore shrimp trawl fishery of the Gulf of Mexico. NOAA Southeast Fisheries Science Center, Galveston Laboratory. SEDAR7-DW24.

Nichols, S. 2004a. Some Bayesian approaches to estimation of shrimp fleet bycatch. NOAA Southeast Fisheries Science Center, Pascagoula Laboratory. SEDAR7-DW03.

Nichols, S. 2004b. Update for the Bayesian estimation of shrimp fleet bycatch. NOAA Southeast Fisheries Science Center, Pascagoula Laboratory. SEDAR7-DW54.

SEDAR. 2005. SEDAR7-Gulf of Mexico Red Snapper Stock Assessment Report. SEDAR, North Charleston SC. 480pp.

SEDAR. 2013. SEDAR31-Gulf of Mexico Red Snapper Stock Assessment Report. SEDAR, North Charleston SC. 1103pp.

Switzer, T.S., E.J. Chesney, and D.M. Baltz. 2015. Habitat use by juvenile red snapper in the northern Gulf of Mexico: ontogeny, seasonality, and the effects of hypoxia. Transactions of the American Fisheries Society. 144(2): 300-314.

Table 1. Number of transects (#Tran) sampled and red snapper (*Lutjanus campechanus*) caught (#RS) by a 12.8 meter trawl by year and Gulf of Mexico federal statistical grid.

	2011		2012		2013		2014		2015	
Grid	#Tran	#RS	#Tran	#RS	#Tran	#RS	#Tran	#RS	#Tran	#RS
11	30	22	58	157	8	5	22	52	16	44
13	48	527	65	419	30	157	35	281	10	11
14	35	35	16	27	16	51	27	93	16	37
15	35	31	22	41	32	43	37	66	10	9
16	23	23	61	173	16	81	32	86	16	17
17	30	111	66	406	16	75	24	52	16	125
Total	201	749	288	1223	118	412	177	630	84	243

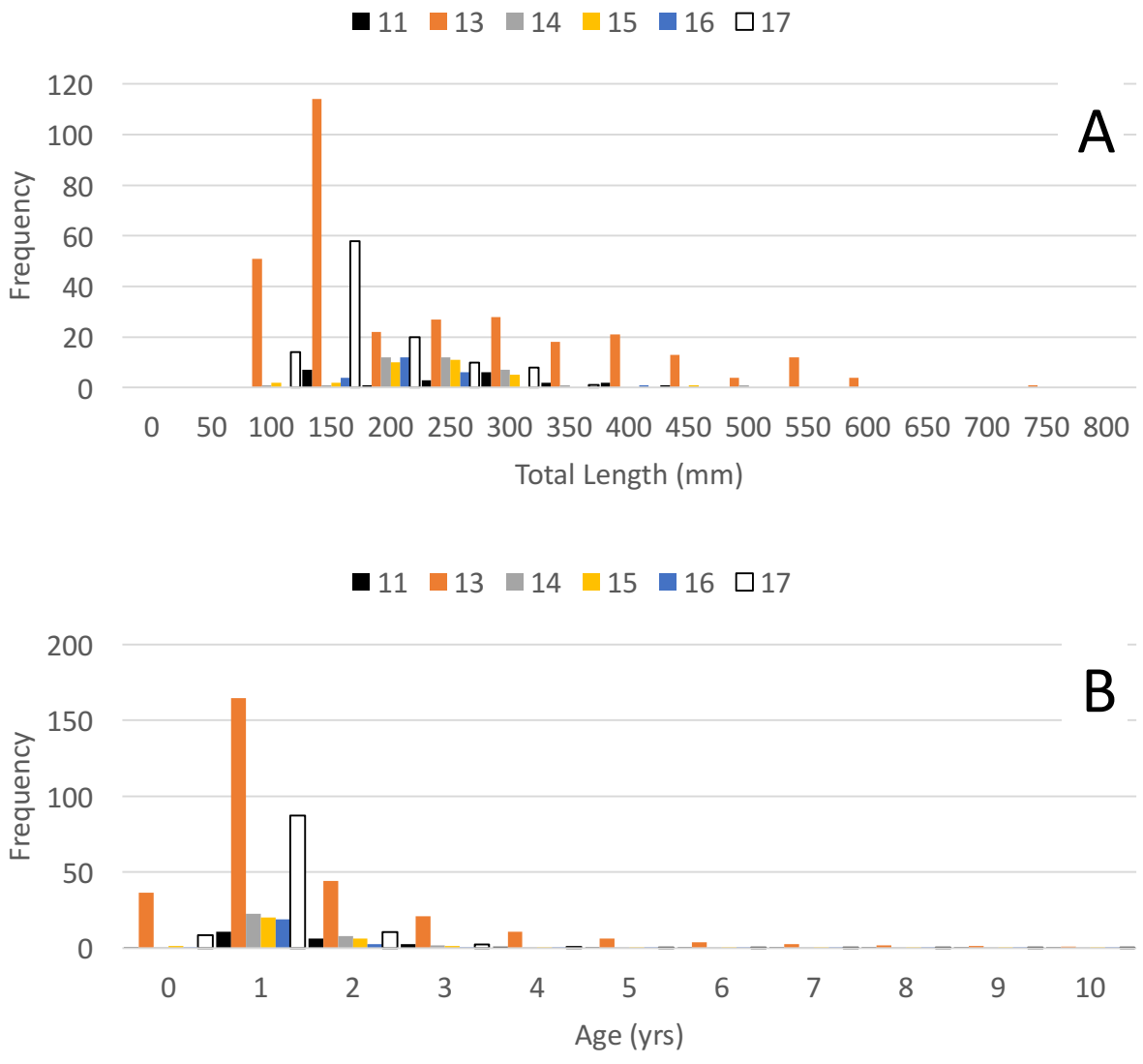

Figure 1. Length (A) and age (B) distributions of red snapper (*Lutjanus campechanus*) caught in a 12.8 meter trawl off the Louisiana coast within Gulf of Mexico federal statistical grids in 2011.

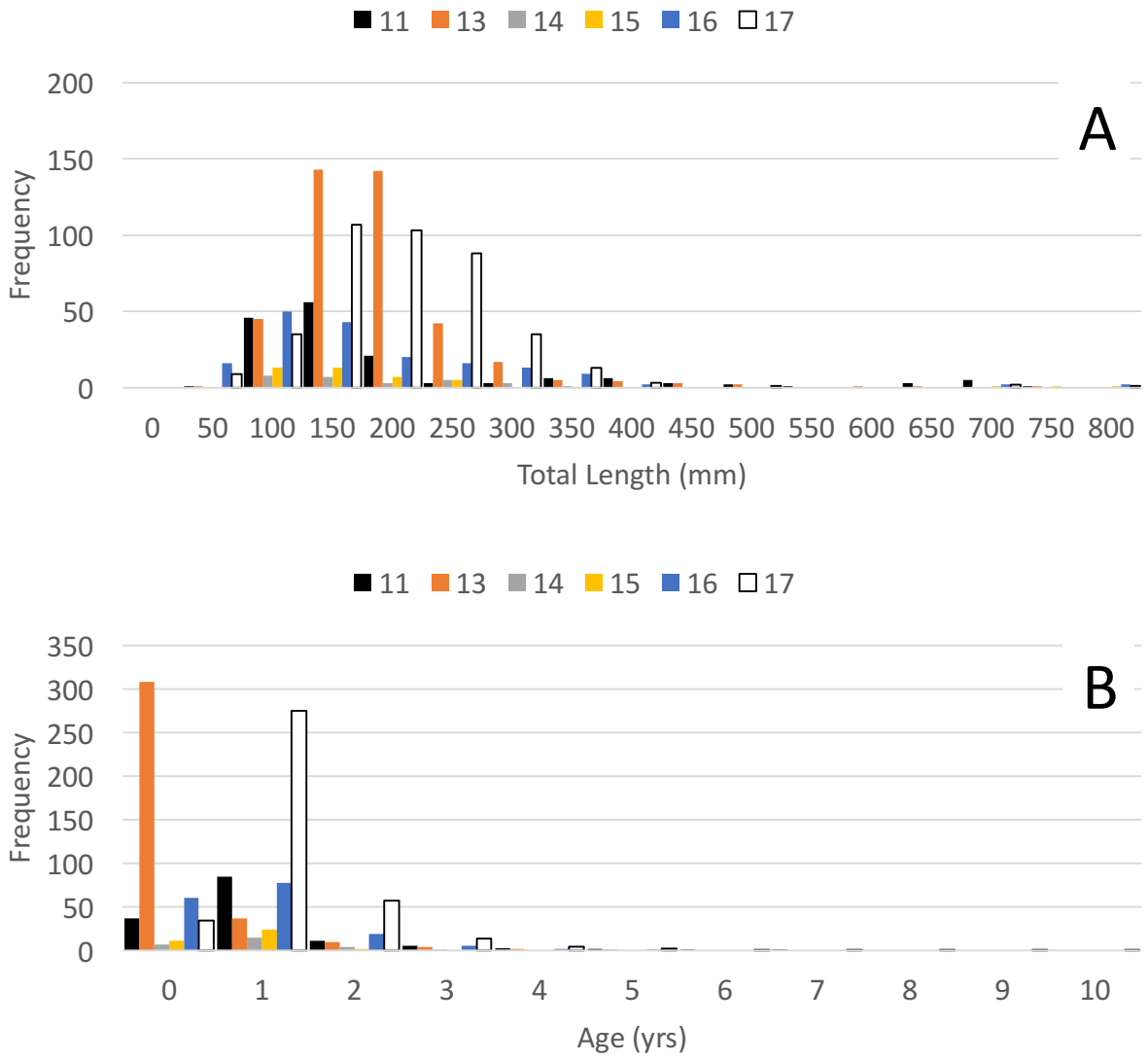

Figure 2. Length (A) and age (B) distributions of red snapper (*Lutjanus campechanus*) caught in a 12.8 meter trawl off the Louisiana coast within Gulf of Mexico federal statistical grids in 2012.

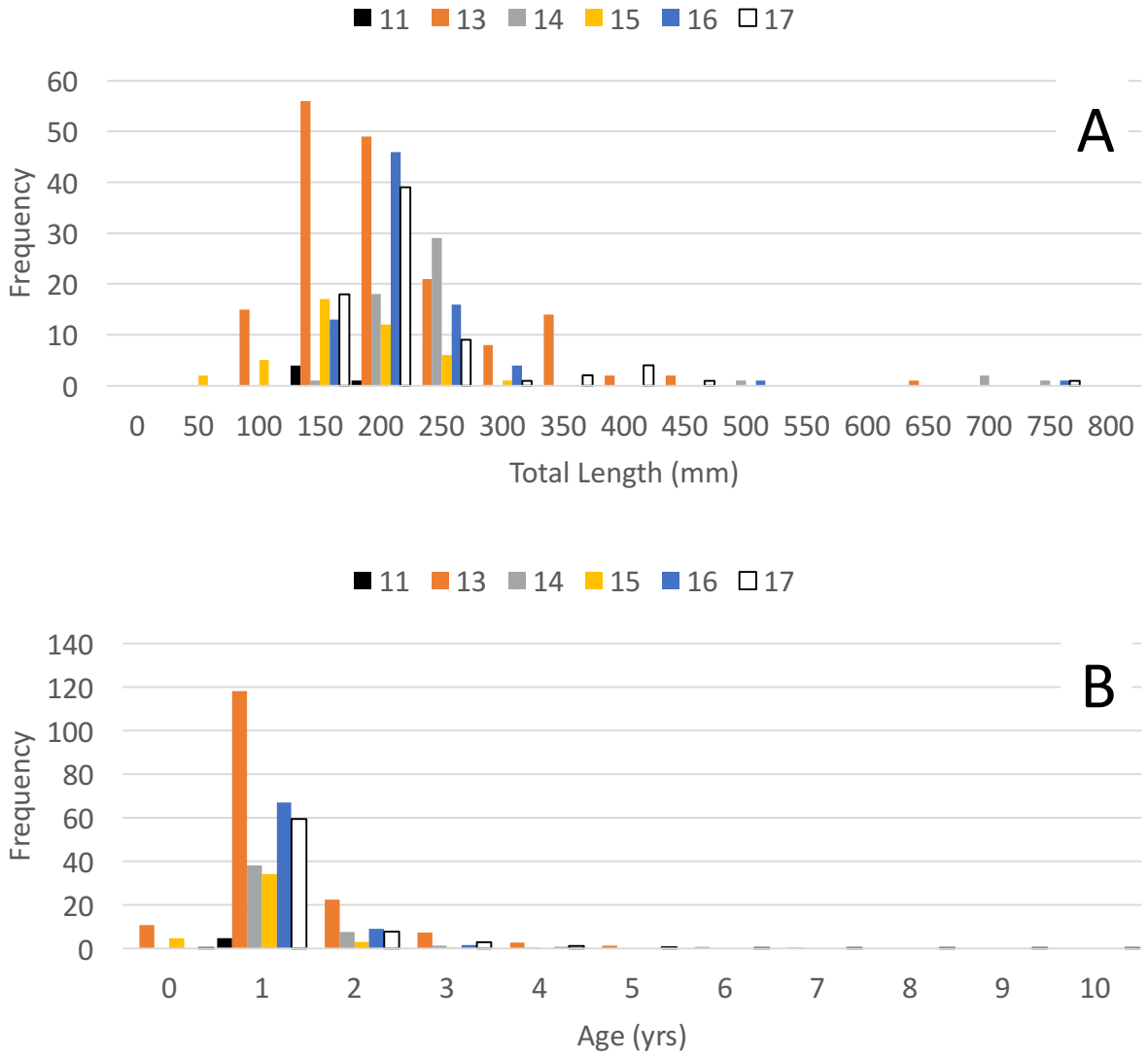

Figure 3. Length (A) and age (B) distributions of red snapper (*Lutjanus campechanus*) caught in a 12.8 meter trawl off the Louisiana coast within Gulf of Mexico federal statistical grids in 2013.

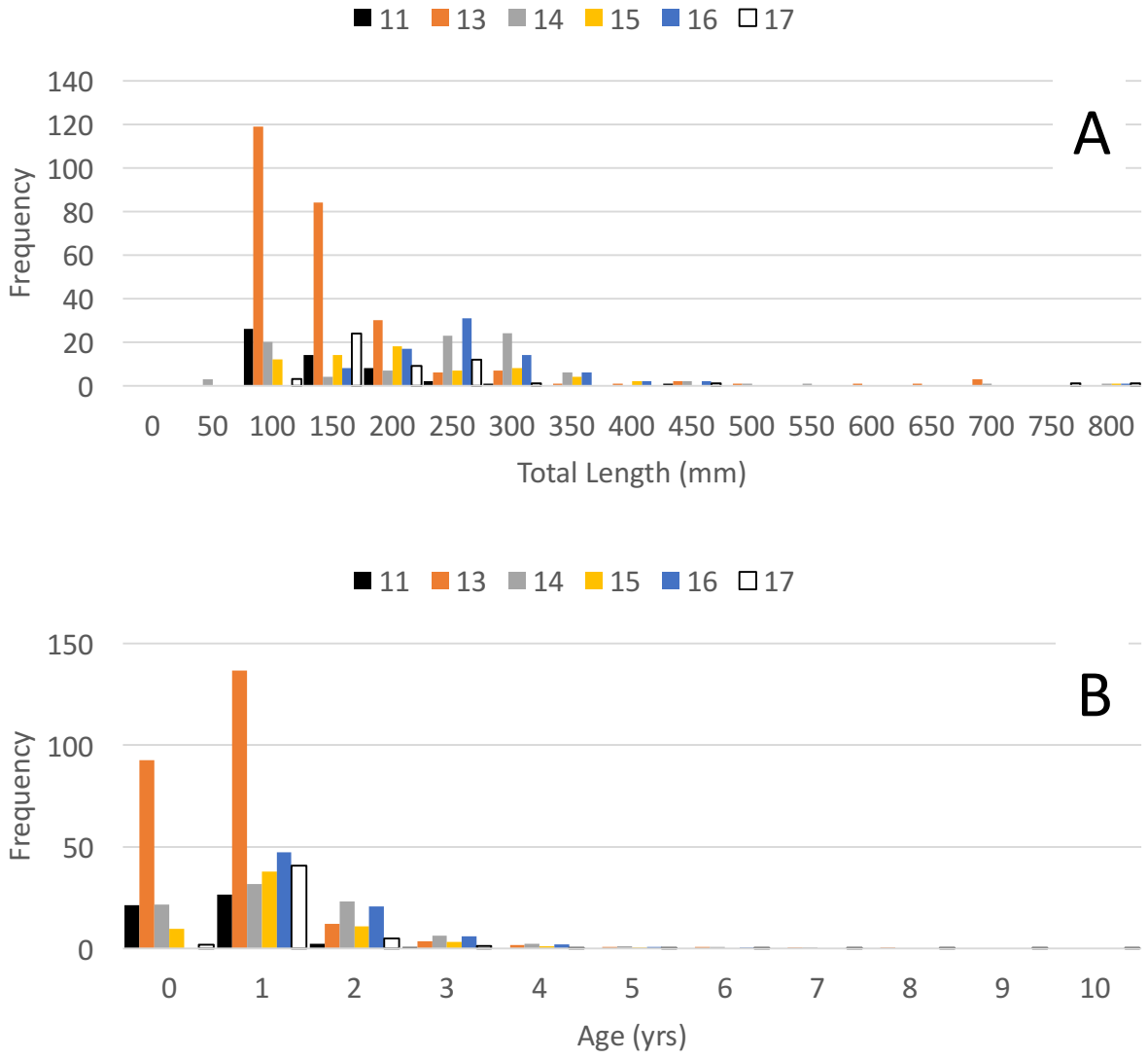

Figure 4. Length (A) and age (B) distributions of red snapper (*Lutjanus campechanus*) caught in a 12.8 meter trawl off the Louisiana coast within Gulf of Mexico federal statistical grids in 2014.

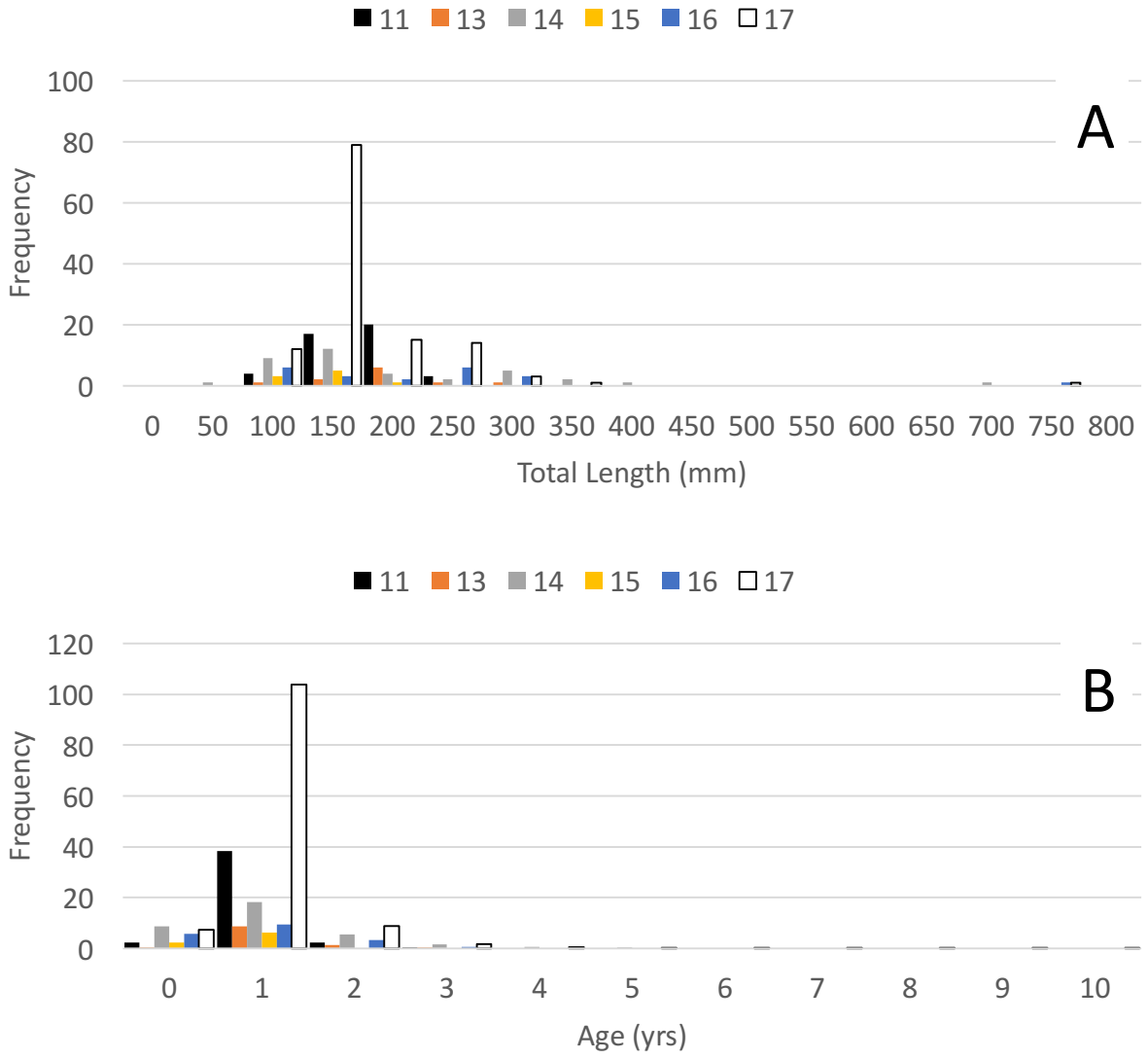

Figure 5. Length (A) and age (B) distributions of red snapper (*Lutjanus campechanus*) caught in a 12.8 meter trawl off the Louisiana coast within Gulf of Mexico federal statistical grids in 2015.

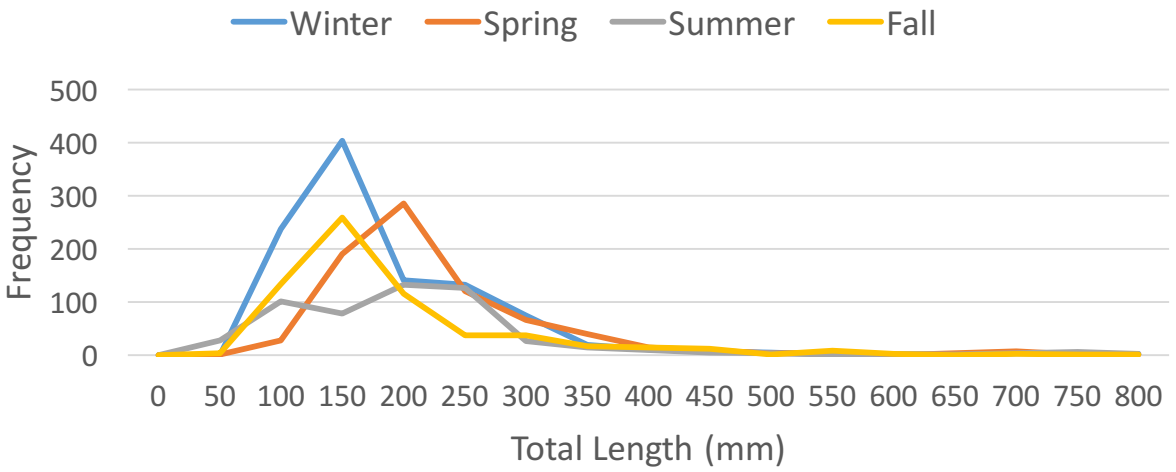

Figure 6. Combined length distributions of red snapper (*Lutjanus campechanus*) collected in a 12.8 meter trawl off the Louisiana coast seasonally between 2011-2015.

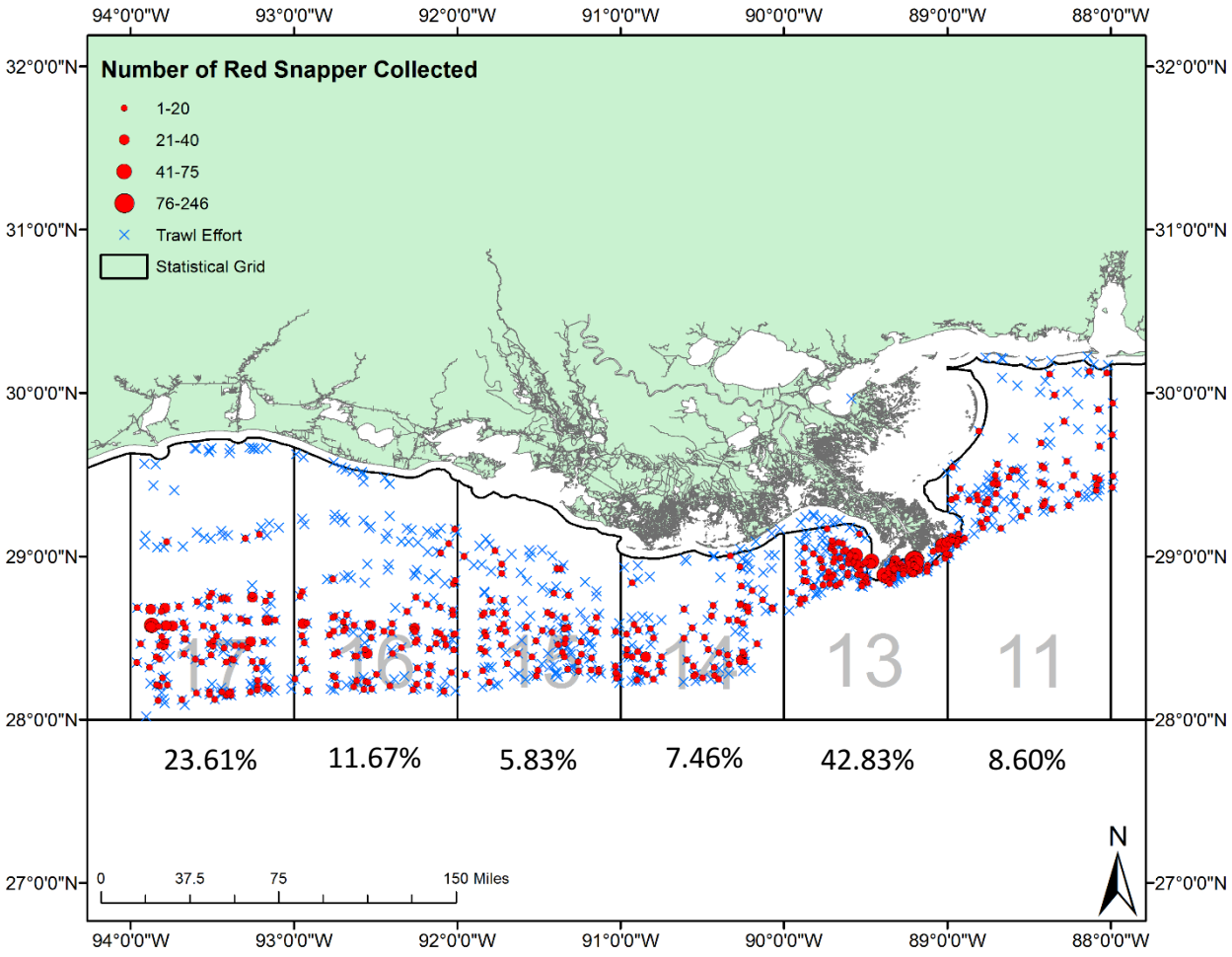

Figure 7. Percentage of red snapper (*Lutjanus campechanus*) caught (●) in a 12.8 meter trawl from sampling transects (X) throughout Gulf of Mexico statistical grids 11-17 in 2011-2015. If no red dot is present then red snapper were not sampled at that transect. The percentage of total catch contributed by each grid is displayed below that respective map grid.

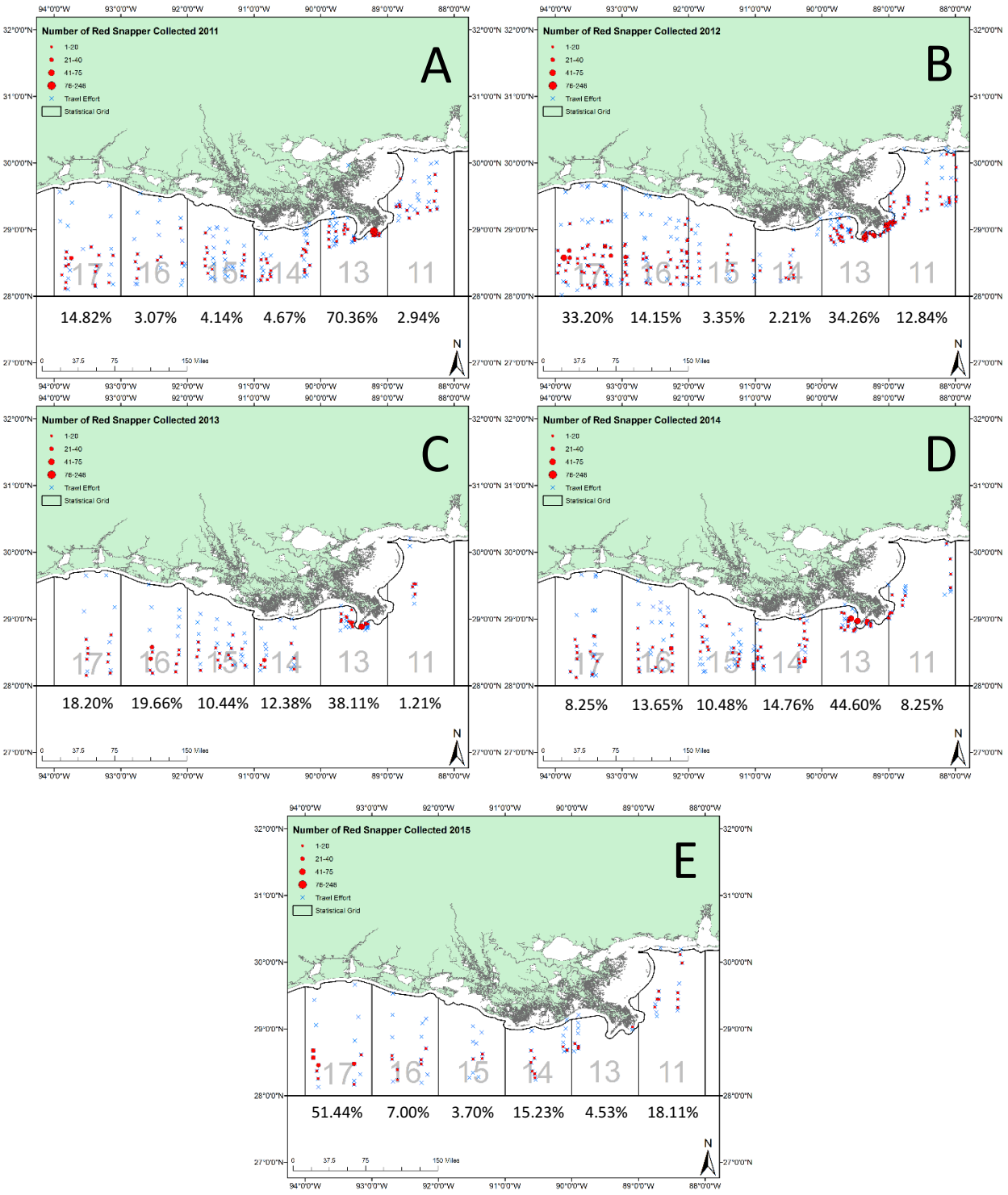

Figure 8. Percentage of red snapper (*Lutjanus campechanus*) caught (●) in a 12.8 meter trawl from sampling transect (X) throughout Gulf of Mexico statistical grids 11-17 in years 2011 (A), 2012 (B), 2013 (C), 2014 (D), and 2015 (E). If no red dot is present then red snapper were not sampled at that transect. The percentage of total catch contributed by each grid is displayed below that respective map grid.