

Population Dynamics and Migration of the Blue Crab, *Callinectes sapidus* (Rathbun), in the Eastern Gulf of Mexico

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The blue crab, *Callinectes sapidus*, supports one of the largest commercial and recreational fisheries in Florida (Steele 1979) and, indeed, in the entire Gulf of Mexico (Perry *et al.* 1984). Annual commercial landings in Florida have averaged 17 million pounds since 1967, while Gulf landings have increased to approximately 54 million pounds in 1986.

Results of a tagging program conducted in Tampa Bay, Florida during 1982-83 indicated an "alongshore", single-sex migration of significance in blue crab life history. A total of 13,366 crabs was tagged, and overall tag return rate was 24.9% (N=3330). All crabs emigrating from the bay were mature females that moved northward. Several crabs traveled more than 800km in approximately 100 days. The existence of this migration along the Florida west coast had been demonstrated in a previous tagging study by Oesterling (1976). Tag return rate in Oesterling's study was 12.3%, and 55% of recaptured females moved more than 10 miles. In the 1982-83 Tampa Bay study, 29% of all tag returns were recovered more than 765 miles outside of the Tampa Bay system. Of these, 70+% were recovered in the Crystal River-Cedar Key fishery, 25+% in the Fenholloway-Ochlockonee fishery, and the remainder, less than 5%, were recovered westward to Alabama, Mississippi and Louisiana. These returns, together with the concurrent unchanging male:female ratio in the Tampa Bay system, indicated a massive late fall through spring migration of females through the Tampa Bay area.

Results of previous work by Oesterling (1976) and Oesterling and Adams (1979) had been interpreted to indicate that females engaged in massive migration northward along the Florida west coast to a supposed spawning site south of the Apalachicola River drainage system in northwest Florida. Larvae thus released were suggested to be entrained in low salinity Apalachicola River runoff, transported offshore to the Loop Current, and therein moved southward to be redistributed among the estuaries of south Florida where the young crabs developed to maturity and mated before the females of that year class recommenced the cycle.

There are several possible objections to this hypothesis, one being that female blue crabs seek high salinity and avoid low salinity waters during spawning. Costlow and Bookhout (1959) indicated that *Callinectes sapidus* larvae require salinities greater than 22 ppt for survival. Also, spawning to some

extent occurs in appropriate high salinity areas all along the Florida west coast as was well documented during the Tampa Bay tagging study. Finally, very few of the crabs that were tagged in the Tampa Bay tagging program were recaptured in the area immediately south of Apalachicola Bay.

Several alternative hypotheses were suggested by data generated from the Tampa Bay tagging program. In the first hypothesis, female blue crabs do migrate northward and arrive in Apalachee Bay (not Apalachicola Bay) during the season of high freshwater runoff (Jan-May). However, reduced salinity from that runoff acts as a barrier to the migrating crabs, causing them to become concentrated in the Ochlockonee-Panacea-St. Mark's area and thus enriching the Wakulla County fishery. The presence of several dams along the Apalachicola River, which necessitates periodic discharge of freshwater at times other than those associated with heavy seasonal rainfall, may also contribute to the hypothesis by extending the barrier over a greater period. In the second hypothesis, female blue crabs migrate northward and then westward in coastal waters of the eastern Gulf of Mexico and, if not interrupted, would eventually arrive in coastal waters of Alabama, Mississippi, or Louisiana. However, fisheries at Crystal River, Cedar Key, and Apalachee Bay are so intensive that more than 95% of migrating crabs tagged at Tampa Bay are removed before they reach the Apalachicola drainage system, and too few remain to indicate the magnitude of population movement beyond Apalachee Bay. Finally, a third alternative suggests that female blue crab behavior could follow hypothesis one during certain times of the year and hypothesis two during others.

To test these hypotheses, the Florida Department of Natural Resources tagged blue crabs in the western portion of northern Apalachee Bay from January through December 1984. If previously witnessed diminishing tag returns beyond Apalachee Bay were the result of intensive fishing to the south, then tagging at Apalachee Bay should result in increased returns of tagged crabs that moved further to the west. If a barrier exists near the Apalachicola River, it should be evidenced by little movement of tagged crabs westward from Apalachee Bay.

Immigration into Apalachee Bay was verified by the continued presence of large numbers of females tagged and returned from there. Females accounted for approximately 65% of all crabs tagged and 73% of all crabs returned. Results from the Apalachee Bay tagging program revealed that 43.5% (N=2767) of crabs tagged were returned, but less than 5% of those returned were recaptured west of the tagging area. These data support the hypothesis of a barrier near the Apalachicola River that prevents most westward emigration.

The second part of the 1984 tagging program dealt with blue crab populations along the southwest coast of Florida from Sarasota Bay to Key Largo. As mentioned previously, female blue crabs that migrated past Tampa Bay evidently originated in areas to the south. Both the northern Ten Thousand

Islands and Charlotte Harbor areas support important blue crab fisheries whose populations could contribute to migrating stocks. In addition, some blue crabs tagged in Card Sound at Key Largo during Oesterling and Adams' (1979) study were subsequently recaptured along the Florida west coast. To investigate the source of the west coast migration, crabs were tagged at Key Largo, Cape Sable, the Ten Thousand Island, Charlotte Harbor, and Sarasota Bay.

Some females emigrating from the south were thought to enter Tampa Bay, thereby replenishing the local population. This belief was confirmed during 1984-85 by 20 females tagged in Sarasota Bay that were returned from central Tampa Bay. At Charlotte Harbor, approximately 5% of the crabs that were returned moved northward, some as far as Apalachee Bay. Several male crabs tagged at the Ten Thousand Islands were returned from as far north as Apalachee Bay. Several males tagged at Cape Sable were returned from as far north as Charlotte Harbor, and one female traveled as far as Apalachee Bay. Male crabs tagged in the Key Largo area were returned from the Ten Thousand Island on the southwest Florida coast and from upper Biscayne Bay on the southeast coast; several females were returned from Charlotte Harbor, Sarasota Bay, and as far north as Apalachee Bay on the west coast, and as far north as Ft. Lauderdale on the southeast coast.

CONCLUSION

Tag returns from all areas further confirmed the late fall-early spring migration of some females northward from their home estuaries. These migrations may result in part from responses to environmental and/or physiological stimuli such as salinity, temperature, food availability, or reproductive condition. Alternatively, the migration may be simply a behavior pattern that had adaptive significance at some earlier time during the blue crab's evolutionary history.

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