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## Notes on the Migration and Growth of Pink Shrimp (*Penaeus duorarum*)

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PINK SHRIMP, *Penaeus duorarum*, of the Tortugas grounds in the Gulf of Mexico support an intensive and valuable fishery prosecuted by the United States and Cuba. As in the case of any renewable resource, its management requires knowledge of population distribution and growth. Systematic mark-recovery experiments being conducted by the U. S. Bureau of Commercial Fisheries are proving a practical means for obtaining such information. The shrimp-marking techniques involve the use of biological stains and were described by Dawson (1957) who pioneered their development. A preliminary mark-recovery experiment to test the field use of biological stains was executed in Biscayne Bay, Florida, in early 1958 (Costello 1959).

In seeking to define nursery grounds necessary in the life history of Tortugas pink shrimp, it was noted that Iversen and Idyll (1960) gave evidence that inshore waters along the south Florida coast potentially represented such areas. These authors also report the recovery of a shrimp on the Tortugas grounds which was tagged and released at Coot Bay in the Everglades. Tabb (in press), in describing this extensive estuarine system, pointed out that juvenile pink shrimp are commonly found here in great abundance. This suggested that the periphery of Florida Bay afforded the most logical sites from which to conduct large-scale mark-recovery experiments to delimit the habitat of shrimp contributing to the Tortugas fishery.

From October 1958 to March 1959 three groups of juvenile pink shrimp were stained and released at three locations in Florida Bay (Figure 1). Shrimp catches from the Dry Tortugas and Sanibel grounds were examined for possible recoveries and checks were made of shrimp taken from the Tampa area, Biscayne Bay, and the fishery south of Marathon. Experiment specifications and results are given in Table 1.

### **Migrations**

Recoveries of stained shrimp show that shrimp from the Flamingo nursery area contribute to the Tortugas commercial catch. The first verified<sup>1</sup> recovery had moved at least 90 miles in 85 days. However, the route of these shrimp to the Tortugas grounds is open to conjecture. The Fish and Wildlife Service sta-

<sup>1</sup>Verified recoveries include shrimp taken in the fishery, returned, and identified as shrimp stained with a biological stain; unverified recoveries include stained shrimp noted by fishermen and reported but not returned for identification and verification.

TABLE 1

SHRIMP MARK-RECOVERY DATA: FLORIDA BAY - TORTUGAS AREA, 1958-1959

Release Information	Tortugas Grounds Recovery Information	Sex
Flamingo		
Date: 10/24/58 to 10/31/58	N of "B" Buoy in 14 1/2 fms.	M
No. released=7,264	NW of "D" Buoy in 13 fms.	F
Carapace length=13.2 - 21.6 mm	NW of Wreck Buoy in 17 ms.	F
Mean=16.7 mm	1 1/2 mi. NE of Pulaski Light in 17 fms.	M
Peterson Keys		
Date: 1/29/59	1-1 1/2 mi. N of Smith Shoals Light	F
No. released=1,729	W of "C" Buoy in 13 fms.	F
Carapace Length=15.4 - 26.7 mm	10 mi. NW of Wreck Buoy in 12 2/3 fms.	M
Mean=19.7 mm	NE of "C" Buoy in 12 2/3 fms.	M
	NE of "C" Buoy in 12 fms.	F
	NW of Wreck Buoy in 13 fms.	F
	NNW of "A" Buoy in 15 or 15 1/2 fms.	F
	Between "A" & "B" Buoys in 15 fms.	F
	3-4 mi. ENE of "A" Buoy in 14 fms.	M
	N of "A" Buoy in 16 fms.	M
	NW of "D" Buoy in 10 1/3 fms.	F
Lower Matecumbe Key		
Date: 3/6/59		
No. released=1,672		
Carapace length=17.3 - 26.4 mm		
Mean=20.5 mm		

No recoveries to date

tistical agent at Key West reported that a shrimp stained<sup>2</sup> blue had been "definitely" caught in Hawk Channel, in the Atlantic Ocean southwest of Marathon, Florida, in January 1959. This might indicate that shrimp from the Flamingo area move south through the Keys into Hawk Channel, and then westward to the Tortugas grounds. Higman (1952) reported that large catches of shrimp were made from the Keys' bridges, caught on the outgoing night tides, generally during the winter months. These catches suggest that quantities of shrimp leave Florida Bay by passing through the Keys to the Atlantic Ocean. Once outside, it is only a short distance to Hawk Channel, certain parts of which support a seasonal commercial shrimp fishery.

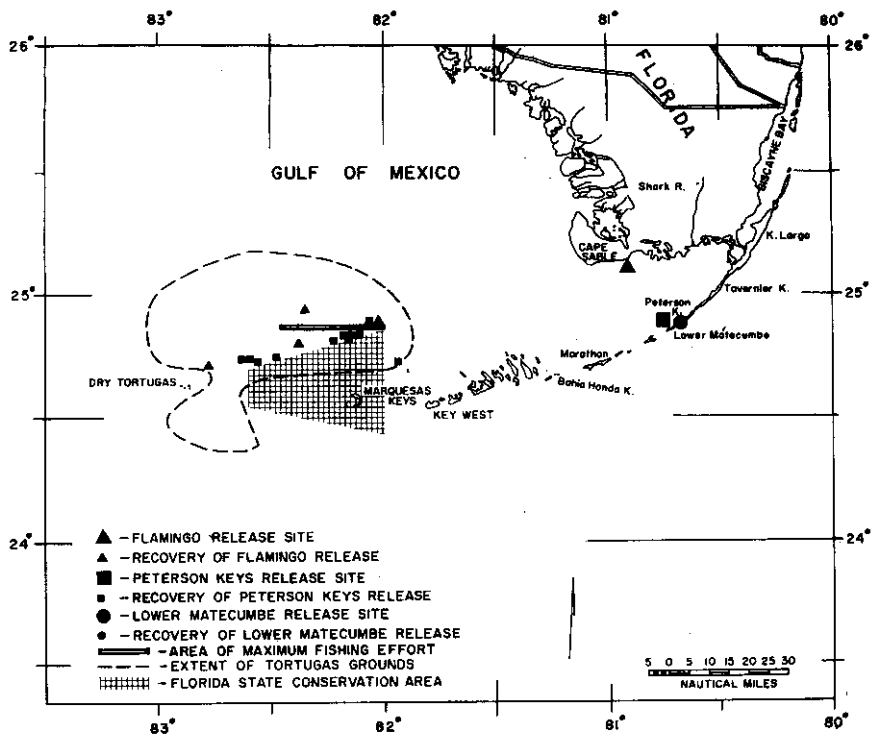


FIGURE 1. Migration of pink shrimp as shown by marking experiments.

Shrimp marked and released at Peterson Keys were also recovered on the Tortugas grounds. The first Peterson Keys recovery was made on the Tortugas grounds 47 days after release compared with 85 days for the first Flamingo recovery. The four verified recoveries of shrimp released at Flamingo averaged 99 days "out time" whereas the eleven recoveries of shrimp released at Peterson Keys averaged 69 days "out time." These release sites are, roughly, equidistant from the center of the area in the Tortugas grounds where all the stained shrimp were recaptured. This difference in "out time" suggests the possibility that

<sup>2</sup>Blue color was used on shrimp released at Flamingo.

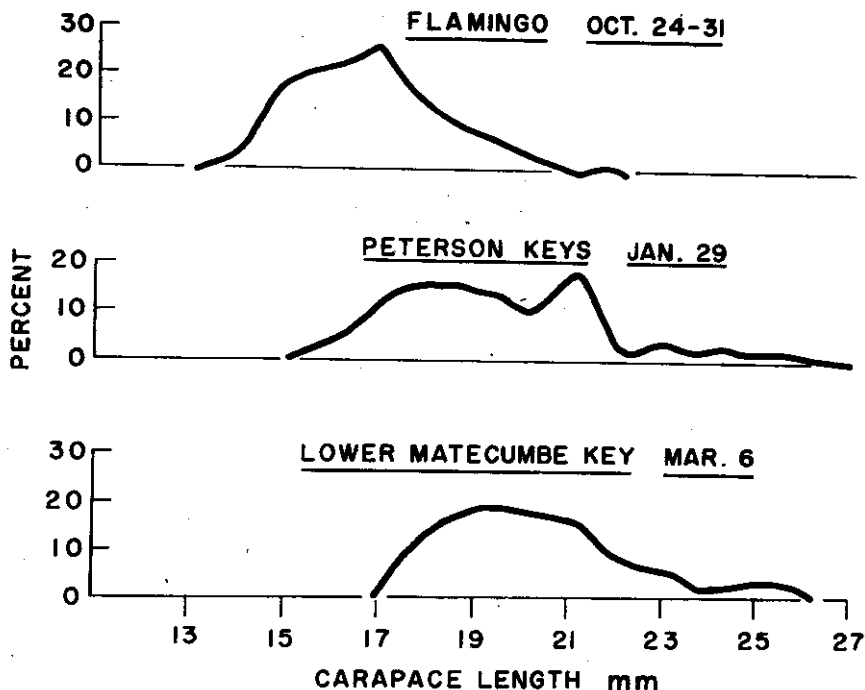


FIGURE 2. Size range of stained shrimp.

shrimp released at Flamingo did not move directly off-shore, but perhaps moved southward, and followed a migration route similar to that of shrimp passing through the Keys.

The Lower Matecumbe Key release site is located about three miles southeast of the release site at Peterson Keys (Figure 1). Approximately the same number of shrimp were released in both locations, but the Lower Matecumbe Key releases were made 36 days later. No shrimp released at the latter site have been recovered.

#### **Growth**

Estimation of growth rates requires knowledge of the size composition of the stained shrimp released. Equipment was devised and used to separate shrimp lying within the size range chosen for staining. "Random" samples of shrimp being stained were measured to determine the size composition of the group released. Figure 2 depicts the size composition of stained shrimp released at each of the three Florida Bay sites.

Recoveries are still too few to accurately determine growth rates of juvenile pink shrimp as they move offshore. In view of the scarcity of other growth data for Tortugas shrimp, the accompanying information may be of value. Growth is calculated from the mean carapace length<sup>3</sup> at release. For the Flamingo

<sup>3</sup>Carapace length is a head-length measurement taken from the orbital notch inside the orbital spine in a line parallel to the lateral rostral sulcus to the posterior margin of the cephalothorax.

release (four recoveries) mean growth in terms of carapace length was 3.5 mm per month, a decrease from 240 to 108 count per pound, heads off. For the Peterson Keys release (eleven recoveries) the mean growth per month was 1.9 mm, representing a decrease from 138 to 96 count, heads off. These figures indicate respectively winter and early spring growth and therefore may approach minimum expected growth. Williams (1955) found that pink shrimp in North Carolina estuaries grew slowest in winter. For shrimp having an initial mean total length of approximately 42.5 mm, he estimated growth in terms of increasing total length to be 7.5 mm per month, for the period November to April. Converted to carapace length, this represents growth of approximately 1.6 mm per month from an initial mean carapace length of 9.2 mm.

#### **Discussion and Summary**

Fifteen verified recoveries of marked shrimp released in Florida Bay suggest the relative importance of certain areas as nursery grounds for the heavily exploited Tortugas pink shrimp. Previously, the only evidence linking the Florida Bay estuaries to the Tortugas grounds was the single tagged shrimp recovery reported by Iversen and Idyll (1960).

The useful information obtained attests to the utility of marking shrimp with biological stains. The method appears particularly suited to experiments which require observations over periods of several months.

Though the data on migrations and growth are preliminary in nature, they will serve as the basis for more extensive investigations. The three mark-recovery experiments reported comprise a first step in delineating the areas which contribute to the maintenance of the Tortugas shrimp population.

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