

MASS OCCURRENCE OF THE JELLYFISH
STOMOLOPHUS MELEAGRIS AND AN ASSOCIATED
SPIDER CRAB *LIBINIA DUBIA*, EASTERN FLORIDA

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ABSTRACT: *The jellyfish Stomolophus meleagris was collected both randomly and selectively in the Fort Pierce Inlet area of the Indian River Lagoon, eastern Florida on 26 and 28 March 2003. The total number of S. meleagris randomly sampled was 382 of which 16.5% carried an associated spider crab, Libinia dubia. Two S. meleagris carried two crabs each. The male/female ratio of the crab was 0.82. The mean carapace width (CW) of the males was 22.9 mm and the females 20.0 mm. The difference in size was significant between the sexes. Crabs were only found on jellyfish with a bell diameter between 80 mm and 110 mm, while the total size range of the jellyfish was 70–130 mm. More than twice as many females than males were found on jellyfish with a bell diameter of 80 mm, but otherwise the sex distribution was similar regardless of the size of S. meleagris. There was no significant difference between the sexes concerning the relationship between size (CW) and live wet weight.*

Key Words: *Stomolophus meleagris*, *Libinia dubia*, Indian River Lagoon, Florida

STOMOLOPHUS meleagris is one of the most abundant species of scyphomedusae along the southeastern and Gulf coasts of the United States (Mayer, 1910; Kraeuter and Setzler, 1975; Burke, 1976; Calder and Hester, 1978). According to Corrington (1927) *S. meleagris* is by far the most abundant scyphozoan of the South Carolina coast, and one of the more conspicuous planktonic organisms of the littoral zone. The life history has been described by Calder (1982) and the feeding habits by Larson (1991).

The spider crab *Libinia dubia* is found on almost all types of bottom in shallow ocean waters and saltier estuaries from nearshore to ca 50 m depth (Williams, 1984). The known range is from Cape Cod to southern Texas, Bahamas and Cuba. Tabb and Manning (1961) reported that *L. dubia* is common in Florida Bay and

Dragovich and Kelly (1964) reported that it is the most common spider crab in Tampa Bay. The larval development of *L. dubia* has been described by Sandifer and Van Engel (1971).

Jellyfish commonly harbor commensal forms, with certain symbionts being characteristic. For instance, some brachyuran crabs exhibit protective and transporative forms of commensalism with jellyfish (Trott, 1972). The association between *S. meleagris* and *L. dubia* was first reported by Corrington (1927). Williams (1984) also describes the association between *L. dubia* and *S. meleagris*. However, the information on this association is very limited and no detailed observations have been reported. In an earlier study, Weymouth (1910) described the association between *Cancer gracilis* and jellyfish (species not determined), and Trott (1972) described the relationship between *Stomolophus nomurai* and the portunid crab *Charybdis feriatus*. Young blue crabs, *Callinectes sapidus*, have frequently been observed clinging to the umbrellas of the sea nettle, *Chrysaora quinquecirrha* (Jachowski, 1963).

A mass occurrence of *S. meleagris*, some with crabs clearly visible on the body surface, was observed in the Fort Pierce inlet area, eastern Florida in March 2003 that allowed analysis of the association.

METHODS—Random sampling of the *S. meleagris* was performed on 26 and 28 March 2003 from a small boat in the Fort Pierce Inlet area of the Indian River Lagoon (IRL) by using fine mesh dip nets (Figure 1). Each jellyfish was transferred to a container filled with saltwater. The bell diameter was measured with a plastic ruler to the nearest cm, and each specimen was thoroughly examined for *L. dubia*. If a crab was found, it was measured (carapace width) to the nearest mm and sexed. All crabs were then transferred to another container filled with saltwater for further treatment in the laboratory. On 28 March, selective sampling was also performed, i.e., only jellyfish with visible crabs associated with them were collected. On 31 March, all crabs sampled on 28 March were weighed to the nearest 0.1 g in the laboratory. The relationship between the bell diameter of the jellyfish and the crab carapace width and the bell diameter and the sex distribution of the crabs were calculated from the random sampling data.

RESULTS—Twenty-eight males, 34 females and 1 specimen, presumably a juvenile, of *L. dubia* were found when random collections of *S. meleagris* (382 specimens) were performed on 26 March, which corresponds to a male/female ratio of 0.82, and an association rate of 16.5%. The size distribution of *L. dubia* of the randomly collected *S. meleagris* is presented in Figure 2. The mean carapace width of the males was 22.9 mm (SD = 4.8 mm) and the females 20.0 mm (SD = 4.0 mm). The size difference was significant between the sexes ($p = 0.004$, Mann Whitney Rank Sum test).

The crab size distribution of the selectively collected jellyfish is presented in Figure 3. The mean carapace width of the males was 23.2 mm (SD = 4.8 mm) and the females 23.5 mm (SD = 4.0 mm). The male/female ratio of the crab on the selectively collected jellyfish was 2.14 (62 males and 29 females). The size difference was not significant between the sexes ($p = 0.72$, unpaired t-test). The selectively sampled females were significantly larger (CW) than the randomly sampled ones ($p = 0.003$, Mann Whitney Rank Sum test), but there was no significant size difference between the males ($p = 0.561$, unpaired t-test).

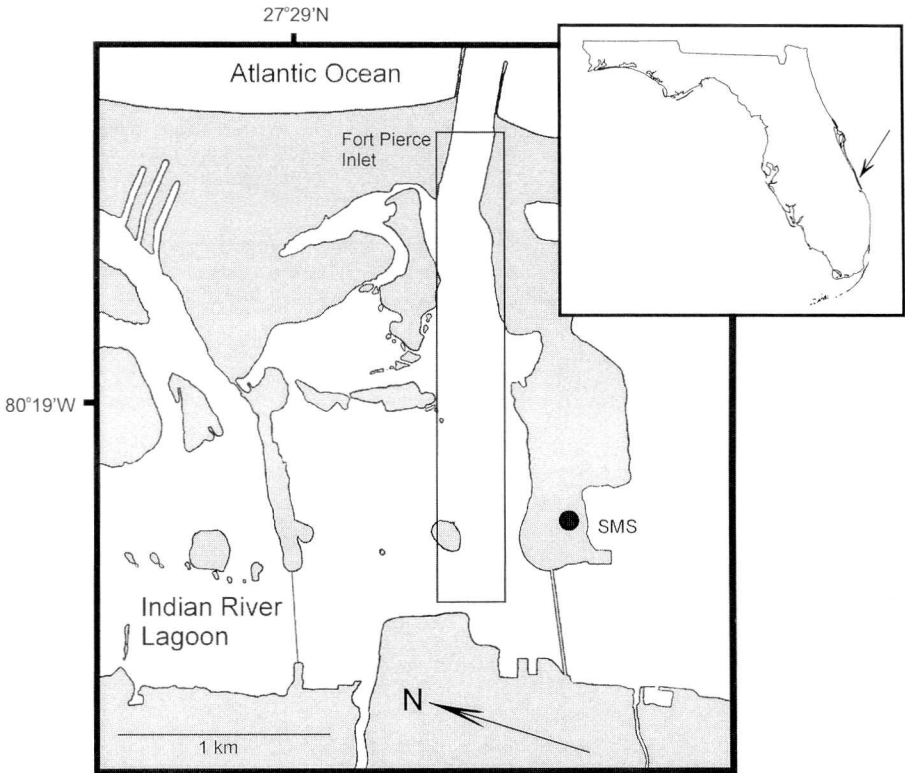


FIG. 1. The Fort Pierce Inlet area of the Indian River Lagoon, eastern Florida. Sampling of *Stomolophus meleagris* was performed on 26 and 28 March 2003 within the area marked with a rectangle. SMS = Smithsonian Marine Station.

The male/female ratio of all crabs combined was 1.43 (90 males and 63 females).

During the selective sampling on 28 March two specimens of *S. meleagris* had two crabs attached, one (bell diam. = 100 mm) with two males (CW = 30 mm and 19 mm) the other (bell diam. = 90 mm) with two females (CW = 28 mm and 19 mm).

The relationship between carapace width and wet weight for males and females is presented in Figure 4. The best fit was achieved by using polynomial regressions. Both regressions were highly significant: $p < 0.001$ (power of performed test with alpha = 0.050: 1.000). There was no significant difference in size or weight between the females and males ($p = 0.114$ and $p = 0.081$, respectively) (Mann-Whitney Rank Sum Test).

The relationship between the carapace width of males and females of *L. dubia* and the bell diameter of *S. meleagris* is presented in Figure 5. There was no significant correlation between bell diameter of the jellyfish and the carapace width for females ($p = 0.115$) and males ($p = 0.469$) (Pearson Product Moment Correlation).

The relationship between bell diameter of the jellyfish and the sex distribution of the crabs is presented in Figure 6. More than twice as many females than males

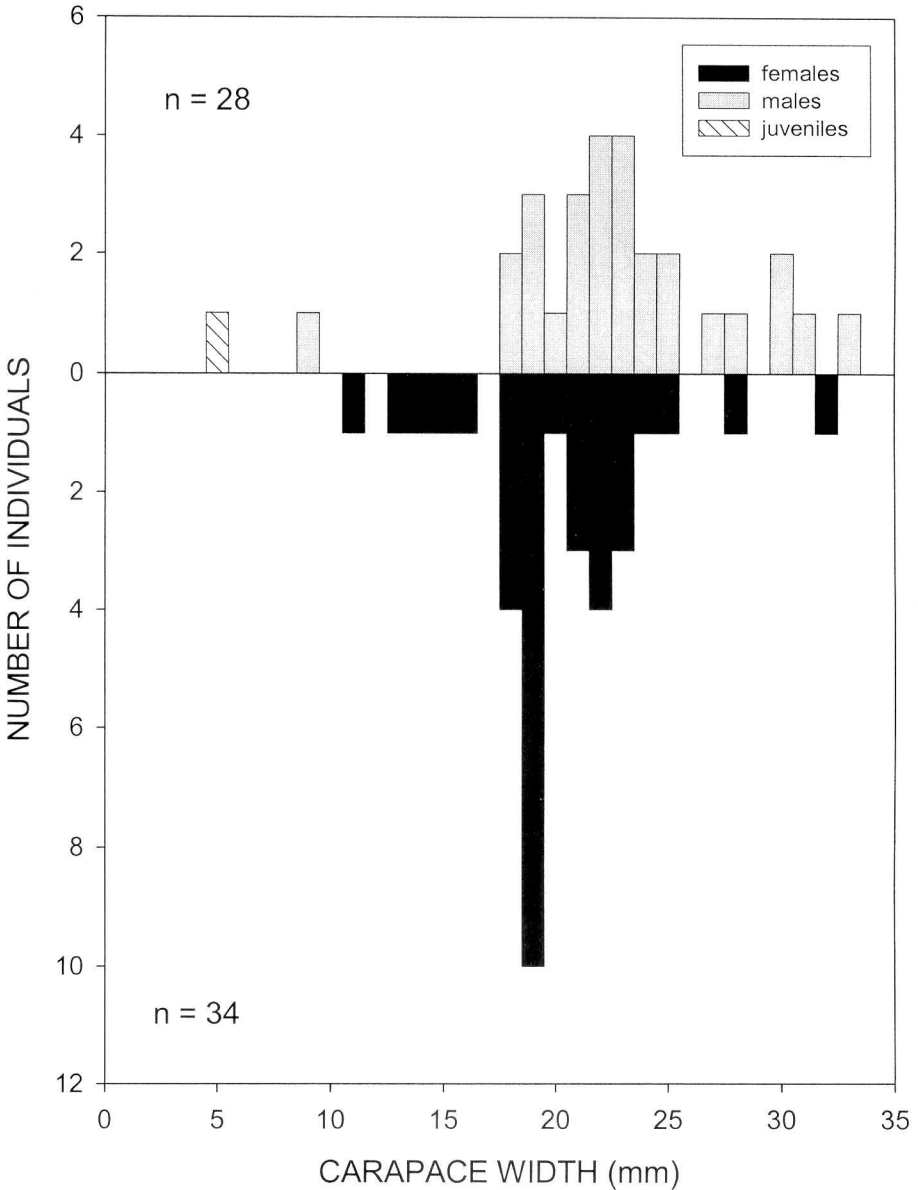


FIG. 2. Size distribution of *Libinia dubia* from *Stomolophus meleagris* collected randomly on 26 and 28 March 2003.

were found on jellyfish with a bell diameter of 80 mm, but otherwise the sex distribution was similar regardless of the size of *S. meleagris*.

Figure 7 shows the number of crabs found on different size classes of *S. meleagris*. As presented earlier, crabs were only found on jellyfish within size

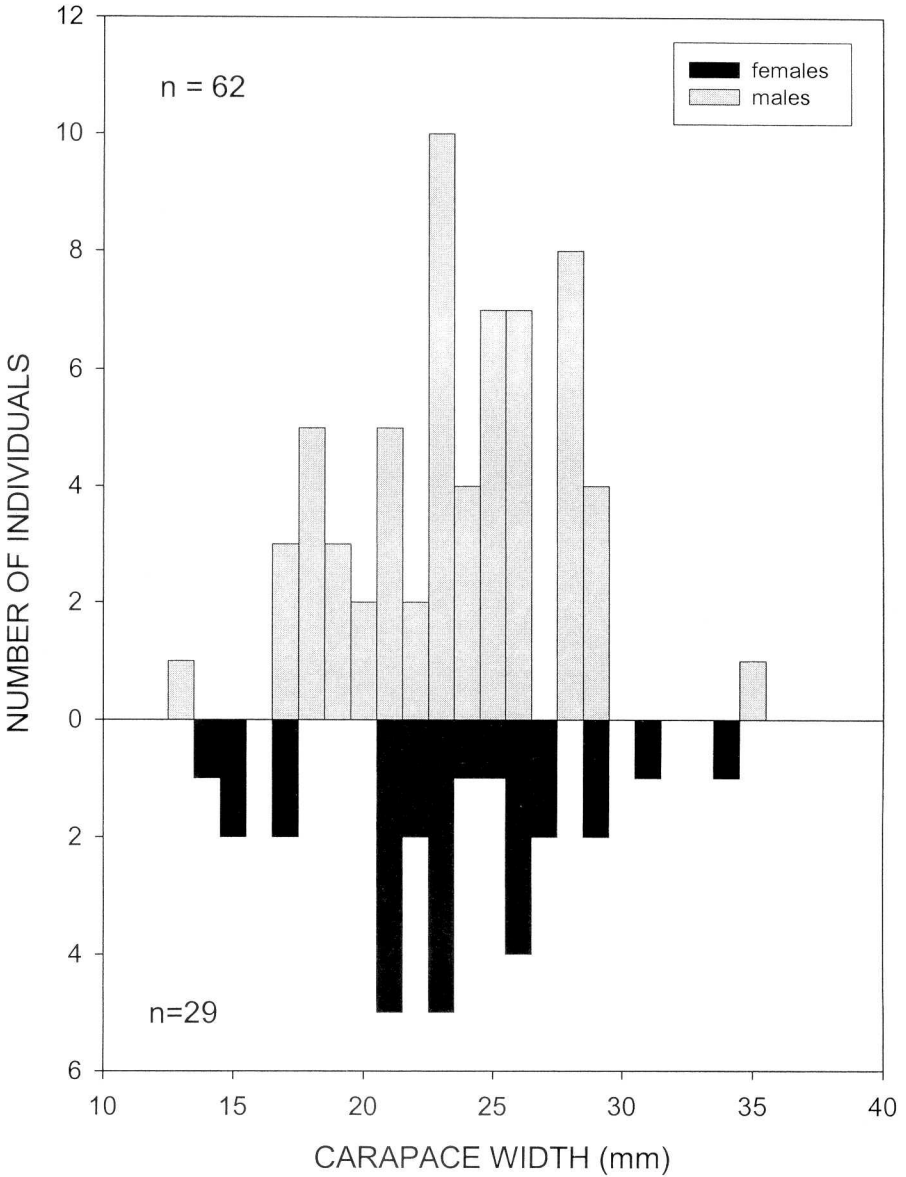


FIG. 3. Size distribution of *Libinia dubia* from *Stomolophus meleagris* collected selectively on 28 March 2003.

classes 80–110 mm. The highest percentage of crab occurrence was recorded on 80 mm jellyfish (22.6%) and the lowest (10.9%) on those measuring 110 mm.

DISCUSSION—Mayer (1910) reported that mature individuals of *S. meleagris* were abundant in winter and spring off the coast from Florida to South Carolina.

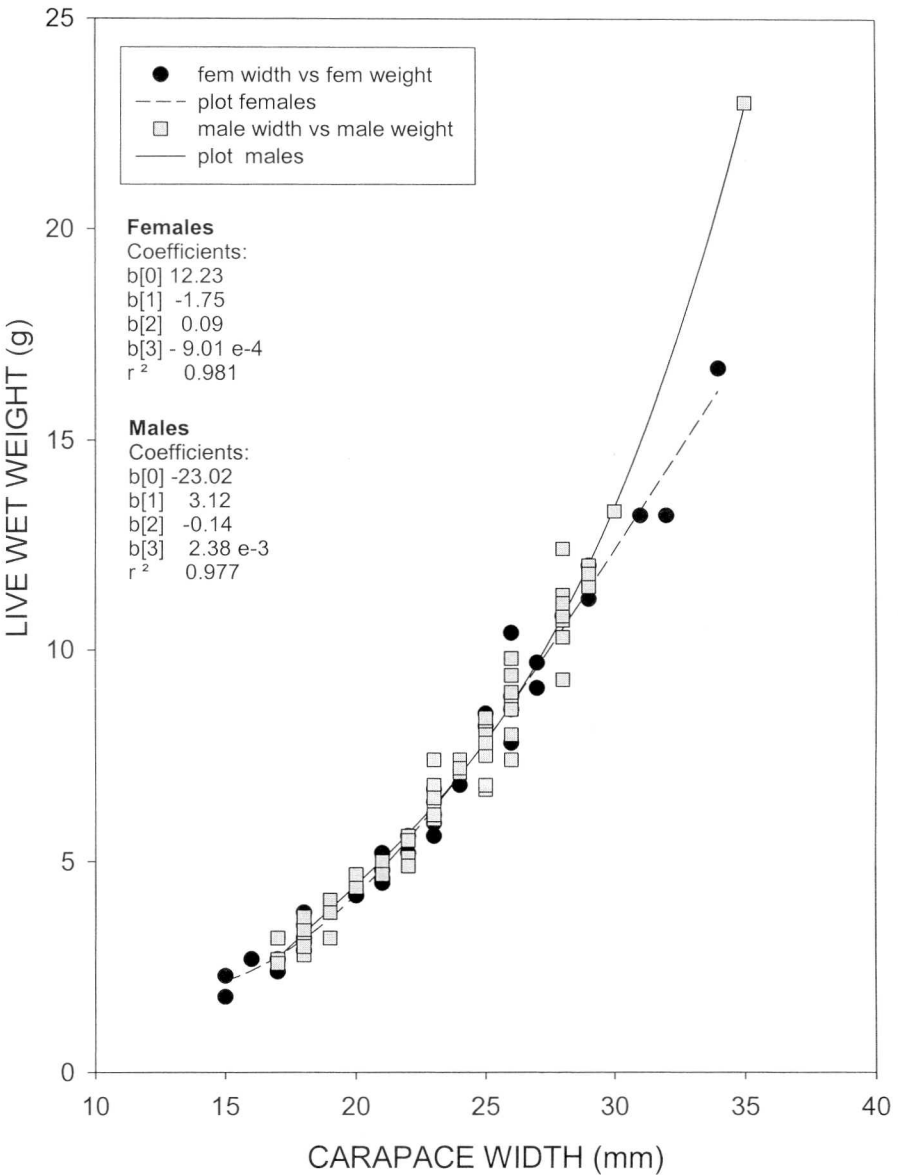


FIG. 4. The relationship between carapace width (CW) and live wet weight of *Libinia dubia*.

It was rarely seen in brackish harbors, and was mostly confined to ocean water off the coast. However, Kraeuter and Setzler (1975) performed studies on *S. meleagris* in Georgia estuaries and concluded that this species does occur offshore in the winter, but that it also spends much of its early life in sounds and estuaries. Large individuals appear offshore in March and apparently move in nearshore in May and June. Small individuals were collected in early July in the estuary. These populations

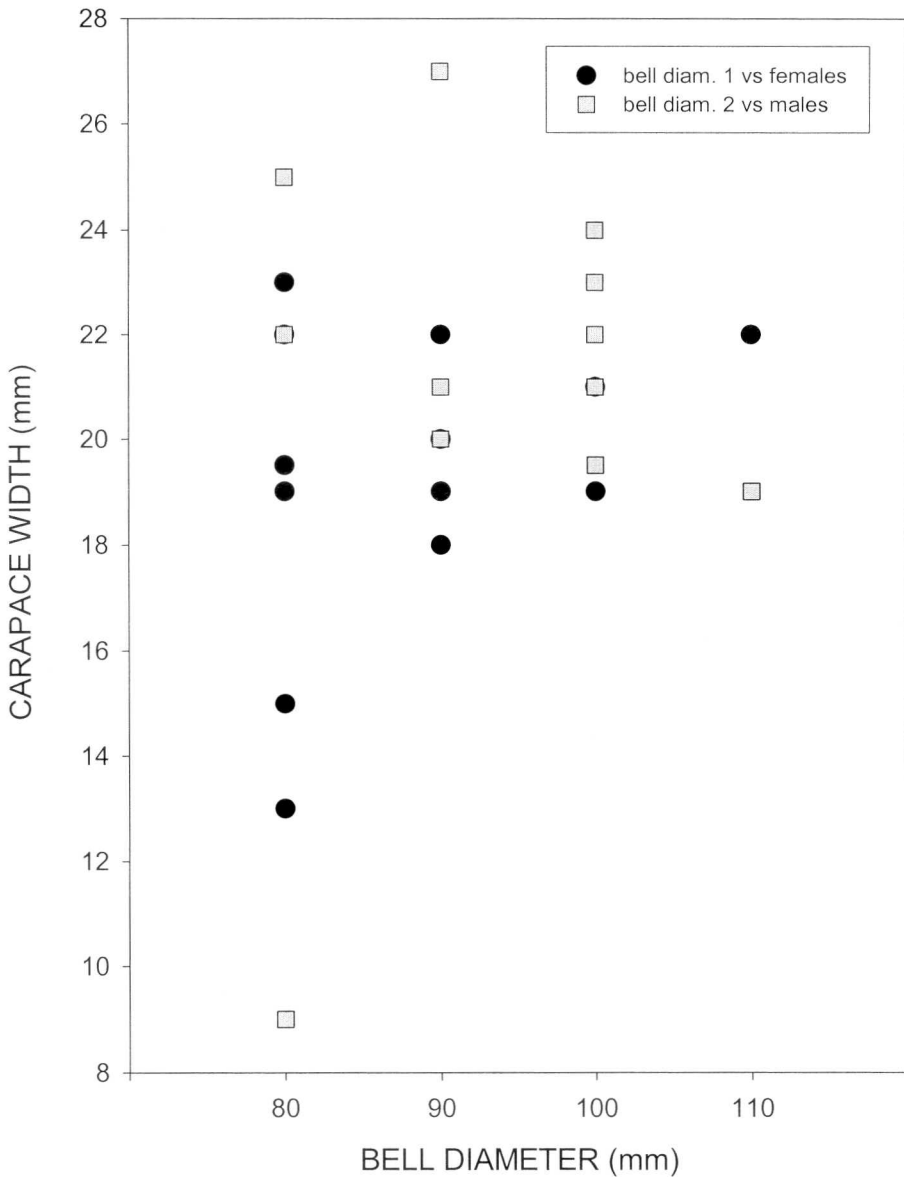


FIG. 5. The relationship between bell diameter of *Stomolophus meleagris* and carapace width of males and females of *Libinia dubia*.

decreased in numbers by August. After mid-October all individuals disappeared until March. According to Larson (1991) in a study performed between June 1986 and October 1987, in the north-eastern Gulf of Mexico, *S. meleagris* was abundant from June to October. Burke (1976) reported that *S. meleagris* was found throughout the year in Mississippi Sound, with the highest abundance during

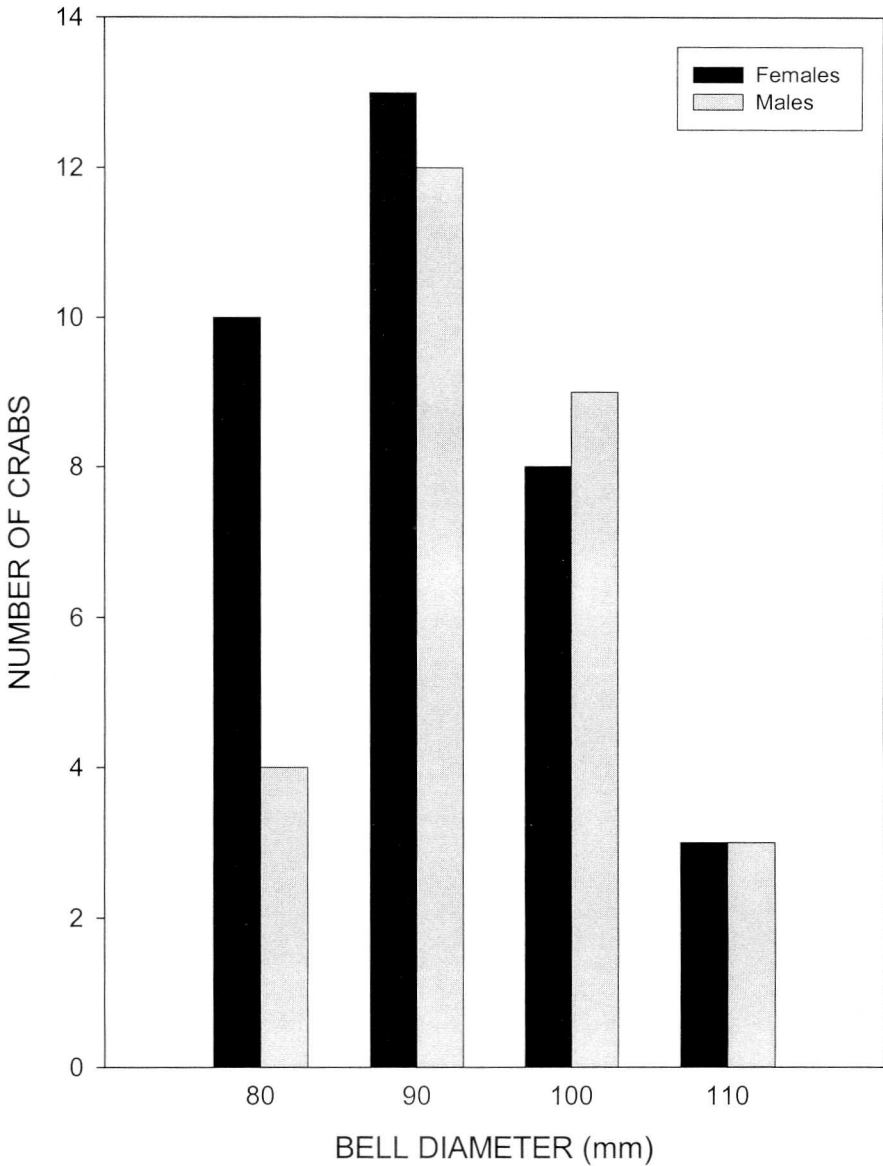


FIG. 6. The relationship between the bell diameter of *Stomolophus meleagris* and the sex distribution of *Libinia dubia*.

midwinter. Specimens collected ranged in size from 3 to 380 mm bell diameter, suggesting that a few of these medusae may survive for longer than a year.

In the Fort Pierce Inlet area, *S. meleagris* is usually most abundant during late summer and early fall (pers. obs.). Even though we observed a few jellyfish far from the inlet in the IRL, the highest abundances were near the Fort Pierce Inlet.

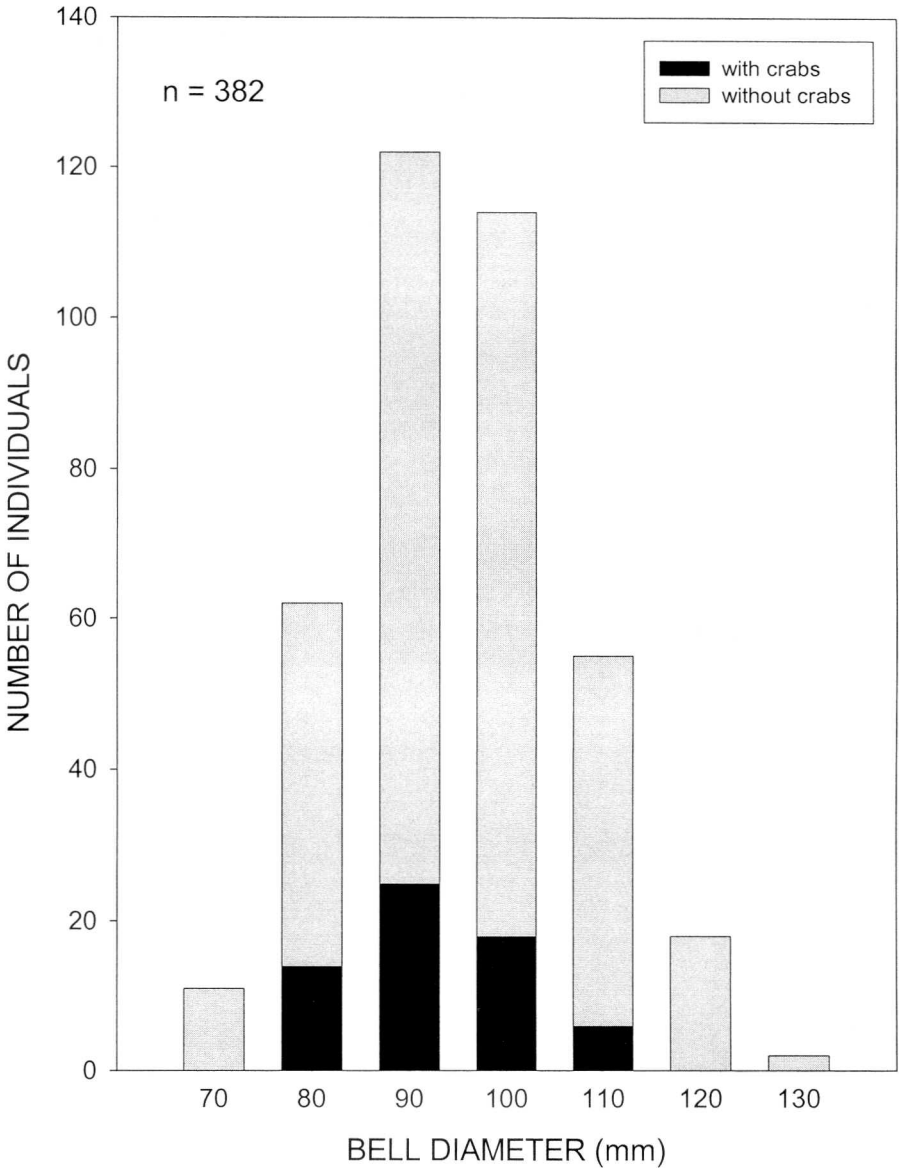


Fig. 7. The relationship between the bell diameter of *Stomolophus meleagris* and the *Libinia dubia* association rate.

Noteworthy is that during this time, many *S. meleagris* were found even in an IRL mosquito impoundment (David, 2003). Large amounts of stranded jellyfish were also recorded on the ocean beaches in St. Lucie and Indian River counties during the sampling period and the following week. The sampling on 28 March started early during the incoming tide, with few specimens found near the surface. However,

massive amounts of jellyfish appeared very rapidly approximately an hour later during the incoming tide. The jellyfish were either transported in large numbers into the estuary with the incoming tide or migrated vertically toward the surface (or a combination of both). Since few specimens were found at the actual mouth of the inlet at the beginning of the incoming tide on 28 March, a vertical migration possibly occurred.

O'Brien and co-workers (1999) sampled *L. dubia* over a seven-year period in the Great Bay estuary (New Jersey). They found a male/female ratio of 1.33, which was very different from the ratio (0.82) of the randomly collected jellyfish in our study. However, when combining our random and selective samples, the male/female ratio was 1.43, which is similar to the one found by O'Brien and co-workers. O'Brien and co-workers (1999) also reported a male maximum size (CW) of 75 mm, and males were slightly larger than females (not significantly). The males also had a greater CW size range than the females. Therefore the mean carapace width of the males of 22.9 mm found during our study clearly suggests that only small *L. dubia* are found on *S. meleagris*. Interestingly, Weymouth (1910) suggested that the relationship between *Cancer gracilis* and jellyfish may be obligatory until the crab reaches a length of 15 to 20 mm.

Gutsell (1928) reported an association between *S. meleagris* and *L. dubia* in a study performed at Beaufort, North Carolina. In one plankton tow, 19 jellyfish and 9 spider crabs were collected, indicating that more than 47% of the jellyfish had an associated crab, a much higher incidence of jellyfish/crab association than that of our study. Gutsell (1928) also reported that with one exception, the jellyfish and crabs were taken in surface tows. The size (carapace lengths) of the crabs during this study varied between 3 and 37 mm. Corrington (1927) collected 17 *S. meleagris* between Sullivan's Island and the Isle of Palms, near Charleston, South Carolina; 16 concealed a *L. dubia*. Corrington (1927) never found more than one crab attached to each medusa. However, in our samples, we observed two jellyfish, each with two crabs. This may be due to our larger sample size.

According to Gutsell (1928), the crab can also enter the subumbrellar space on the jellyfish. We also observed crabs using this space (sex unknown). Consequently, crabs hiding in this space may not have been detected by us when sampling jellyfish selectively. The percentage of females using the subumbrellar space may possibly therefore be higher than for the males.

It is unknown how this benthic crab gets associated with the jellyfish. Corrington (1927) hypothesized: "Since the crab is absolutely confined to the bottom in so far as its own efforts are concerned, there remain but two alternatives: either the medusa must descend to the substratum at least occasionally, and for an obscure purpose, or else one of the larval stages of the crab must seek shelter within the umbrella and then remain attached during a long period of its mature life, for a reason equally difficult to conjecture."

According to Sandifer and Van Engel (1971), the duration of the larval life in *L. dubia* is short, approximately 9 days, compared to other species of *Libinia*. In the Chesapeake Bay area planktonic larvae of *L. spp.* were found from June to October, and were most abundant in July and September (Sandifer, 1973). This is the period

when swarms of *S. meleagris* usually occur in the Fort Pierce Inlet area, and may possibly be the time when the larvae of *L. dubia* attach to the jellyfish.

Jachowski (1963) hypothesized that *L. dubia* attaches to the jellyfish *Aurelia aurita* by chance contact of the jellyfish with the shallow bottom or with aquatic plants where this non-swimming crab usually occurs. Jachowski (1963) further stated that the habits of these two animals are so different that an association in which one of them is dependent upon the other is considered to be unlikely. Because as many as 16.5% of the jellyfish collected during our study were carrying crabs, we presume this to be an important association, most likely of benefit to the crab. Corrington (1927) concluded that it is unquestionable that the crab receives both shelter and transportation by being attached to the jellyfish, but that it seemed unlikely that the crab preyed upon the medusa. Trott (1972) suggested that the relationship is symbiotic, but was uncertain if the relationship is truly commensal. Jachowski (1963) found numerous small *L. dubia* on the jellyfish *Aurelia aurita*. Two individuals of the crab had penetrated into the mesoglea and were feeding upon the medusan tissue. Several crabs also appeared to be feeding on the living medusa when later observed in the laboratory. The crabs pulled fragments of tissue from the exumbrella with their chelipeds and ate them, and none showed ill effect from eating or living in medusae.

In the laboratory, we observed *L. dubia* attacking and eating live *S. meleagris*. However, not having witnessed this behavior *in situ*, it is uncertain whether this is a laboratory artifact or not. Several of the jellyfish collected during our study were damaged both on the bell and on the tentacles, but it is unknown if these injuries had been caused by the crabs.

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