# Overgrazing of Seagrasses by a Regular Urchin, *Lytechinus variegatus*

Massive destruction of an offshore seagrass bed has occurred in a large area off Dixie County, Florida, in the Gulf of Mexico as a result of overgrazing by aggregates of the regular urchin, *Lytechinus variegatus* (Lamarck). Such dense concentrations of *L. variegatus* and resultant large-scale denudation of seagrass beds have not previously been reported. We investigated this phenomenon in August, September, and October 1971. This report presents the results of these preliminary investigations. Destruction of seagrass beds is of particular concern because they afford shelter and food for the young of numerous species (D. Moore 1963).

The grassbed overgrazed by *L. variegatus* extends southward from Steinhatchee River to Horseshore Point, a distance along the coast about 26 km, and extends offshore as far as 5.5 to 9.25 km in depths of 0.3-3 m (mean low water). It is composed primarily of thick stands of turtle grass, *Thalassia testudinum* König, mixed with varying proportions of manatee grass, *Syringodium filiforme* Kützing, and shoal grass, *Diplanthera wrightii* Ascherson. Measurements of the standing crop of seagrasses, exclusive of rhizomes and epiphytes, during August 1971 in an area unaffected by *L. variegatus* yielded a mean value of 220 g/m$^2$ (S = 8.6) (oven-dried weight).

Approximately 20% of this grassbed has been damaged by urchin overgrazing. The most intensive damage has occurred off Pepperfish Keys (Fig. 1), resulting in a bare, sandy area (once covered by grasses) paralleling the coast in a north-south direction for approximately 6-10 km. The western side of this denuded area is about 7 km offshore, where depth is 3 m at mean low water, and the eastern side is about 6 km offshore. Numerous strips of damaged grasses extend as far as 0.5-0.8 km shoreward from the eastern side of the offshore denuded area. During our investigations in August and September 1971, aggregates of urchins occurred at the shoreward end of each damaged strip (Fig. 2).

Less extensive damage to seagrasses occurred north and south of the large offshore denuded area defined above. In these locations, long strips of damage run from west to east through the grassflat, and range from narrow bands of thinned-out grasses less than a meter wide to broad bands of completely denuded substrate several meters across. Some strips originate from the shoreward side of potholes otherwise completely surrounded by unaffected grasses. Urchin aggregates also occurred at the shoreward end of these strips.

Aggregates of *L. variegatus* off Pepperfish Keys extended from 0.5 to 9 m or more across the generally convex leading edge. Scores of aggregates were in the area and were often adjacent to one another. Urchin density at the front of one aggregate averaged 636/m$^2$ (S = 47.4), individuals being piled upon each other 2-8 deep and completely covering the substrate. Density decreased gradually toward the trailing end of the aggregate until several meters behind the leading edge, density averaged only 5.6/m$^2$. On the large offshore denuded area, where there were no aggregates, density was less than 3/m$^2$. The most dense population of this species previously reported was 250/m$^2$ (H. Moore et al. 1963).

Measurements showed that an aggregate moved through the grass 7.6 m in 33 days, an average rate of about 1.6 m/week. Thus, an aggregate 9 m wide could have denuded an area of about 14 m$^2$ in one week.

Sizes of *L. variegatus* in an aggregate were relatively uniform (mean test diameter = 40.1 mm, S = 4.75) (Fig. 3), suggesting that a single year class composed most of the population. Extrapolation of our size data to growth curves and spawning information for *L. variegatus* at Bermuda and Miami (H. Moore et al. 1963) indicates that urchins were approximately one year old, probably having been spawned in the spring and summer of 1970. This is supported by analyses of growth rings on the test plates which also indicated an age of one year. Individuals two years of age or older (test diameter greater than 50 mm) (H. Moore et al. 1963) were relatively rare, and no specimens approaching the maximum reported size of the species (92.0 mm) were found.

Damaged grassflats and urchin aggregates were first noticed during summer, 1970,[1] but were not reported to our laboratory until August 1971. Considering the data above, it is possible that overgrazing of seagrasses during 1970 was accomplished primarily by urchins spawned in 1969, whereas overgrazing in 1971 was primarily by the urchins spawned in 1970.

Many factors may have been responsible for the *L. variegatus* "explosion." However, organic pollution, important for large sea urchin populations in California (North and Pearse 1970), is not

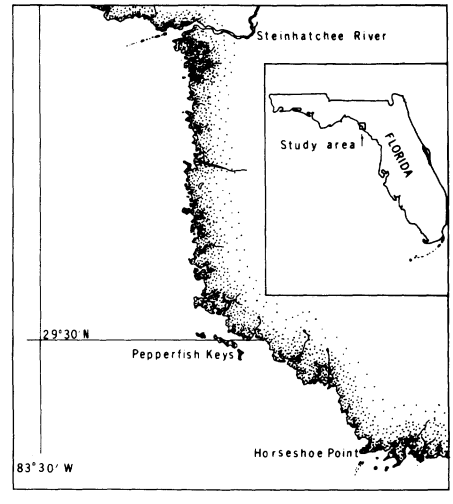


**Fig. 1. Location of study area. Heaviest damage to seagrass occurred off Pepperfish Keys.**

[1]Nevin Stewart, Steinhatchee, Florida, personal communication.

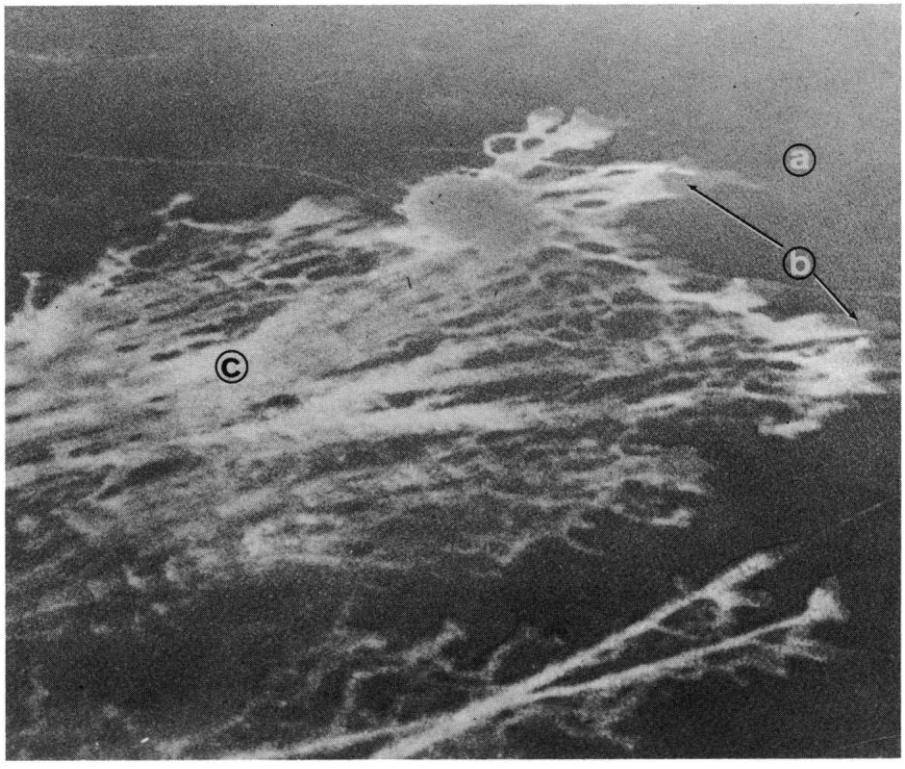


**Fig. 2. Oblique aerial photograph (altitude = 304 m) of a portion of damaged offshore grassflats. Unaffected grasses (a) are being approached by several aggregates (b) of *L. variegatus*, which leave denuded substrate (c) behind. The large offshore denuded area mentioned in the text occurs outside the photograph to the left. Top of picture points approximately NNE.**

considered to be involved here, since the Steinhatchee area is very sparsely populated by humans.

Another survey during October 1971, showed that all aggregates had disappeared. Many urchins died; hundreds of dead were observed at the shoreward end of damaged strips where aggregates were located in September. Most surviving urchins had dispersed into undamaged grassy areas closer to shore, while others had moved onto the denuded areas farther offshore. Urchin density on inshore grassy areas was thus greater than during September, and small groups of less than 50 urchins were often observed.

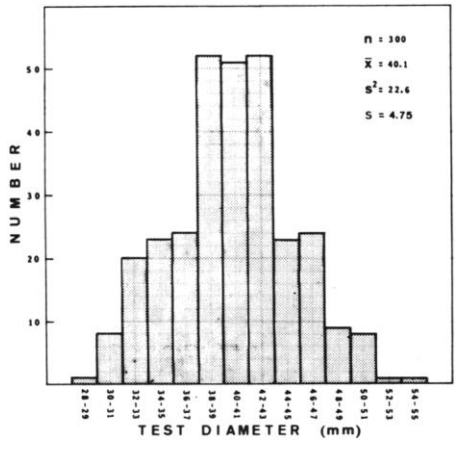


**Fig. 3. Histogram of *Lytechinus variegatus* test diameters. Urchins were taken from a single aggregate in August 1971.**

The prime concern resulting from overgrazing by *L. variegatus* is possible permanent denudation of grassflats. It has been shown that areas within dense *Thalassia* beds experimentally denuded of leaves and rhizomes were not subsequently recolonized (Phillips 1960, Kelley et al. 1971). Inspections of denuded areas directly behind an aggregate during August and September showed that leaves of all species of seagrasses were cut off at the substrate, rhizomes were left intact, and old mainly upon meristematic activity of these existing apexes. This is apparently failing since rhizomes of damaged grasses in the massive offshore denuded area are in various stages of decay. Siltation is also greater in denuded areas, often covering damaged shoots and causing increased turbidity over much of the grassflat. Local residents short-shoots were macerated to such an extent that formation of new rhizomes was unlikely. Several meters farther behind the aggregate new leaves 3-4 cm tall were observed, indicating that some regrowth was occurring. This new growth was sparse, however, sprouts being 0.3-1 m apart with rhizomes not connected. New short-shoots were forming near the apexes of existing rhizomes, and regrowth will depend pointed out that the offshore bare area became more denuded with time, even though aggregates of urchins had since moved away from it. Consequently, it is doubtful that early regrowth of dense grass beds will occur.


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