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The ascidian fauna of a Jamaican lagoon: Thirty years of change

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Resumen: Se evaluó las poblaciones de ascidias en una laguna de manglar (Jamaica) por treinta años. Ocho especies desaparencieron y dos colonizaron el lugar. Posiblemente estos cambios se debieron a la eutroficación. Las comunidades actuales no alcanzan el estadio climax por la acción de los recolectores de ostras. Predominan las especies de estrategia r.

Key words: Ascidian, community, mangrove, monitoring, disturbance.

The Fort Rocky Lagoon is part of a mangrove complex lying east of Port Royal, Jamaica (see Goodbody 1961 for location maps). It is 0.75 km in length and approximately 0.15 km^2 in area; maximum depth is 6 metres and approximately 50% of the lagoon has a depth in excess of 3 metres. The lagoon is flushed by interchange with Kingston Harbour through the main entrance to the lagoon and interchange with the Port Royal Harbour through a system of lagoons and channels. Apart from horizontal mixing taking place through these connections, vertical mixing occurs during periods of strong diurnal winds which prevail from east-south-east along the length of the lagoon. Sulphurous muds occur in the deep eastern half but in general the wind driven circulation is adequate to ensure complete vertical mixing.

The entire lagoon is fringed by mangrove forest from which roots of *Rhizophora mangle* depend into marginal waters offering substrate for sessile communities. The original climax community was similar to that described by Goodbody (1963, 1965) in which sponges, anemones, bivalves and stolidobranch ascidians were the principal components. This climax is frequently interrupted by freshwater flooding following heavy rains which kills off elements of the fauna; recolonisation is rapid and the climax can be restored in 9 to 12 months (Goodbody 1961).

As part of a wider study of ascidians in the Port Royal area the ascidian fauna in the *Rhizophora* root community has been followed on an opportunistic basis between 1963 and 1992. During this time several events took place which contributed to overall changes in the lagoon and concomitant changes in the ascidian fauna; the major events are:

1) Increasing pollution of Kingston Harbour with resultant eutrophication commencing around 1965 (Goodbody 1970; Wade 1976).
2) The construction in 1968/69 of a causeway across the western end of Kingston Harbour; this appears to have altered circulation patterns in the harbour (Sherwin and Deeming 1980).
3) Clear felling in 1965 of 80 acres of mangroves at the eastern end of Fort Rocky giving rise to increased leaching of peat deposits into the lagoon.
4) The development of an artisanal oyster fishery in the Fort Rocky Lagoon commencing around 1980/81 in which *Crassostrea rhizophorae* and *Isognomon alatus* are collected from *Rhizophora* roots. The collecting technique results in stripping other organisms off the root creating a

disturbance situation which maintains primary colonisers and inhibits restoration of the climax community.

The information on which this paper is based was obtained by visual surveys conducted by swimming along the shoreline, supplemented by collecting. The principal surveys were in April 1963, April 1966, April 1968, August 1977, March 1984, March 1987, May/June 1991 followed by regular monitoring from June 1991 to June 1992.

Twenty-five species of ascidians have been recorded from the Fort Rocky Lagoon; three of these as follows are considered no further. *Didemnum conchyliatum* (Sluiter, 1898) is recorded from only the northern entrance to the lagoon over the entire period and is not considered as a component of the main lagoon. *Polyandrocarpa tincta* (Van Name, 1902) was recorded only once on a piece of floating bamboo carried into the lagoon as an adult colony. *Styela plicata* (Lesueur, 1823) was recorded once only (1963) as a single specimen and was not a normal component; at that time it was common elsewhere in Kingston Harbour.

Of the remaining twenty-two (22) species eight (8) have disappeared since 1963 and two additional species have colonised; four other species have shown change in status. These changes are outlined below.

(a) *Species disappearing from the lagoon*

Didemnum psammathodes (Sluiter, 1895) has not been recorded since 1966. Prior to that time it was confined to a narrow strip of mangrove in the north-west of the lagoon, just inside the entrance.

Clavelina oblonga Herdman, 1880 has not been recorded since 1966. It was formerly common but not abundant along the south shore of the lagoon and occurred until 1973 in one or two other places in the mangrove complex.

Distaplia bermudensis Van Name, 1902 has not been recorded since 1968. Up to that time it was common in a single cluster of roots hanging over deep water and projecting so as to permit a very free flow of water through them. It also occurred less commonly elsewhere on the south shore and at the entrance. *D. bermudensis* still occurs today in parts of Port Royal Harbour where relatively clean water persists and conditions are less stressed than in Fort Rocky Lagoon.

Ascidia interrupta Heller, 1878 has not been recorded in the lagoon since 1968, prior to which it was a common inhabitant, preferentially living buried in the peat bank (Goodbody 1966). *A. interrupta* is a common inhabitant of some reefs living either under stones or embedded amongst coral heads, zooanthids, etc. It still occurs in a few places in Port Royal Harbour.

Rhodosoma turcicum (Savigny, 1816) is a small solitary ascidian which was never common and often difficult to locate. I have no record of its occurrence in Fort Rocky since 1968 and have only one recent record (1992) from elsewhere in the Port Royal area.

Symplegma rubra Monniot, 1972. This species and *S. brakenhielmi* appear to replace one another ecologically. In 1963 only *S. rubra* was recorded from the lagoon, usually as bright pink or yellow colonies, but only sparsely. From 1966 onwards only *S. brakenhielmi* has been recorded and it has become increasingly abundant since oyster picking started; it has been a key species in the lagoon from 1984 onwards. *S. rubra* remains common in parts of Port Royal Harbour but *S. brakenhielmi* does not occur there.

Herdmania momus (Savigny, 1816) is normally an inhabitant of the sea floor rather than on *Rhizophora* roots and occurs commonly in *Thalassia* beds in the Port Royal area. It has not been recorded in Fort Rocky since 1966.

Polycarpa spongiabilis Traustedt, 1883. Although this species occurs elsewhere on *Rhizophora* roots it does not normally do so in the Port Royal area. Up to 1967 it was common in the Fort Rocky lagoon as a sea floor species, frequently being embedded in sediments. I have no record since that time and it appears to have disappeared from several localities in the Port Royal area where it was formerly found.

(b) *Species colonising the lagoon*

Ascidia curvata (Traustedt, 1882) was first recorded in the 1984 survey but colonised earlier as it appears in collections in 1980. It is now an abundant species living preferentially

[illegible] surface at the top of the *Rhizophora* root community. It is not common elsewhere in the Port Royal area and it is not a replacement for *A. interrupta* which preferentially lived in the peat bank.

Symplegma brakenhielmi (Michaelsen, 1904) is already referred to above as colonising after 1963 and becoming abundant from 1984 onwards.

(c) *Species whose status has changed*

Lissoclinum fragile (Van Name, 1902) was common throughout the lagoon in 1963 and 1966 but thereafter became rare and only very occasionally are colonies now seen. It remains a common species in other parts of Port Royal where water circulation is good.

Eudistoma olivaceum (Van Name, 1902). Large colonies were abundant along the north shore prior to 1963 but subsequently became reduced both in the size of the colonies and in numbers. It is now widely distributed but nowhere common and colonies are always low cushions.

Perophora multiclathrata Sluiter, 1904. A small species of *Perophora* was common throughout much of the lagoon in 1963 and 1966; its identity is not certain but was probably *P. multiclathrata* (Goodbody in preparation). The species subsequently declined and today *P. multiclathrata* is confined to a few sheltered localities in the lagoon.

Ecteinascidia styeloides also was abundant up to 1966 and later declined so as to occur in only a few sheltered localities. It is abundant elsewhere in the mangrove complex.

(d) *Species whose status has not changed*

There are seven species of ascidian whose status does not seem to have altered significantly since 1963, and in some cases may have increased in abundance. These are *Polyclinum constellatum* Savigny, 1816, *Diplosoma listerianum* (Milne-Edwards, 1841), *Ecteinascidia turbinata* Herdman, 1880, *Ascidia nigra* (Savigny, 1816), *Botrylloides nigrum* Herdman, 1886, *Styela canopus* Savigny, 1816, *Microcosmus exasperatus* Heller, 1878.

The long term status of *Ecteinascidia minuta* (Berrill, 1932) is uncertain.

The disappearance of so many species from the lagoon after the 1966 and 1968 surveys suggests that significant environmental changes occurred around that time. Two events in particular occurred which are difficult to separate as causal factors. On the one hand the attempt to develop the wetlands for housing in 1965/66 caused erosion of peat into the lagoon with a consequent increase in suspended particulate matter. On the other hand the completion of the causeway in 1968 (Goodbody 1968, 1970; Wade 1976; Sherwin & Deeming 1980) altered the circulation in the harbour and accelerated the pace of eutrophication of the whole system. Land clearance in the Fort Rocky mangroves stopped in 1966 and some regeneration has occurred. If the disappearance of ascidian species had been due solely to land clearance and increased turbidity one would expect these species to have returned in subsequent years. They did not return even though seed populations of most species are found in the Port Royal area, hence it seems most likely that the decline in species number is a result of overall eutrophication in the harbour system. Port Royal Harbour where seed populations occur, receives regular daily flushing from the open sea (Shurland 1988) thus preventing eutrophication in that particular area. I conclude therefore that the overall changes occurring after 1966-68 are the result of harbour pollution and eutrophication and not the result of short term land clearance events in the mangrove.

The present composition of the ascidian fauna is a patch disturbance phenomenon (Pickett & White 1985) resulting from oyster picking and in which each root is considered as a single patch in the whole system. The climax community is prevented from developing and r-selected species prevail (i.e. *Botrylloides nigrum, Diplosoma listerianum, Symplegma brakenhielmi, Ascidia curvata and Ecteinascidia turbinata).*

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