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RONALD C. PHILLIPS

Florida State Board of Conservation Marine Laboratory

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RONALD C. PHILLIPS
Florida State Board of Conservation Marine Laboratory[1]

Large amounts of attached and unattached marine algae were found in Crystal Bay on the Florida west coast. A field study was undertaken when the unusual hydrographic conditions of the area were realized. Even though Crystal Bay is open and completely exposed to the Gulf of Mexico, it was found that water salinities were considerably lower than normal sea water concentration.

Collecting trips were made to Crystal Bay on 17 April 1958 (trip No. 1), on 16 June 1958 (trip No. 2), and on 16 February 1959 (trip No. 3). The algae seemingly endure low salinity here and even flourish in it, if numbers of individuals and vigor of plants are any indication of organisms well suited to their environment. Fresh water from Crystal River emptying into Crystal Bay probably dilutes the sea water. Its origin is from springs and is undoubtedly "hard". Possibly the plants have adapted to some compound in addition to sodium chloride to maintain osmotic pressure (probably calcium or magnesium salts). The algae found in Crystal Bay are not species typically found in an estuary or which might characterize an estuary.

Dawson (1955) found that salinity characteristics were estuarine and recorded a mean salinity of 16.0 0/00 in Crystal Bay from September 1951 through August 1952. He noted the maximum salinity range at any one station to be 19.1 o/oo and observed the maximum salinity range in the bay to be 3.2-28.4 o/oo. The station with the 19.1 o/oo range was located on the dredged channel from Crystal river mouth to the Gulf.

According to Price (1954) the area lies in the drowned karst subsector of the Gulf coast. Vernon (1951) stated that Crystal River, which discharges into Crystal Bay, is almost entirely spring fed. Dawson (*loc. cit.*) observed springs as far downstream in Crystal River as the Salt River branch. He theorized that the total daily flow was probably greater than the mean flow of 120 million

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gallons per day recorded at Homosassa Springs by Ferguson *et al.* (1947). This discharge evidently is mainly responsible for the estuarine condition of the bay. Visher (1954) reported that the area expects 80-90 storm days per year. The first trip to the area was made immediately following two to three days of thundershower activity. Because very low salinities were recorded in the Bay, I concluded that storm activity probably aided in salinity reduction.

Dawson (op. cit.) noted that the waters of Crystal Bay and adjacent backswamps exhibited minimal salinity variation (weekly variation averaged 3.0 0/00). This stabilization is possibly aided by the Crystal Reefs, a series of oyster bars in Crystal Bay which lie in a north-south direction and extend west of the Crystal River mouth approximately three and one-half miles.

Bottom composition of the bay between the oyster bars consists alternately of hard sand, muddy sand, oyster shell, and in some places a three inch deposit of soft mud over hard sand. According to field observations these softer muddy sand areas occur in deeper locations between the oyster bars, approximately in depths of three and one-half to five feet of water. The hard sand bottoms seem to occur in depths up to three feet.

Hydrographic data collected are included in Table I. Abbreviations use are: F—flood tide, E—ebb tide, S—sand, M—mud, Sh—shell, MuS—muddy sand.

Materials and Methods

Six stations were so selected in Crystal Bay as to provide the most effective plant sampling. The arrangement also revealed any salinity gradient in the bay south of the river mouth.

A box type collecting dredge was hauled behind the boat at each station for a period of ten minutes.

A stoppered leaded water bottle was used to collect bottom water samples for salinity determinations. A hydrometer type salinometer was used in these determinations.

A centigrade thermometer was used in field water temperature observations.

On the third trip a 30 cm. white Secchi disc was used to measure light penetration in the water.

TABLE I

HYDROGRAPHIC DATA OF STATIONS

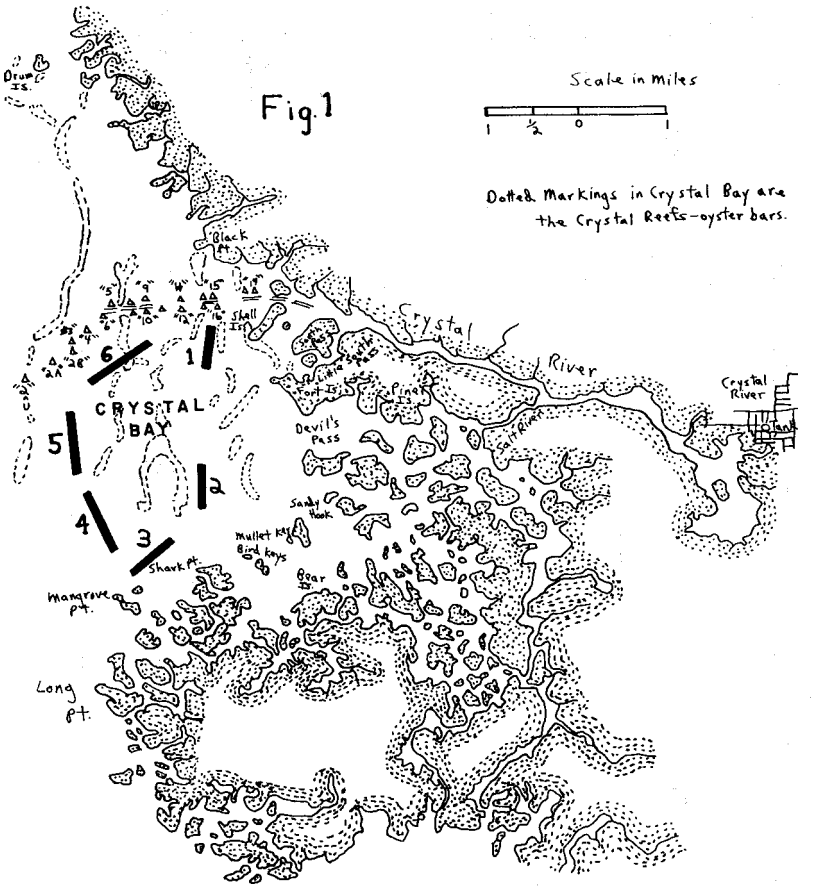
Station	Date	Time	Tide	Water				Bottom	Weather
				Depth	0/00	°C	Turbidity		
1-1	4-XVII-58	1100–1130	low	4 ft.	3.7	18.0		Oyster bars, S & M in spots, in some areas a 3 inch M layer is present over S	
2-1	6-XVI-58	0940	E	7 ft.	12.4	28.5		Sh and S	15 MPH west wind
3-1	2-XVI-59	1000	E	5-6 ft.	9.6	22.7	Can see bottom	Sh and some MuS between oyster bars	15 mph NW wind
1-2	4-XVII-58	1130–1145	low	3-4½ ft.	5.5	17.5		Alternating M to S to Sh	
2-2	6-XVI-58	1000	E	7 ft.	16.0	28.5		Mus	
3-2	2-XVI-59	1015	E	6-7 ft.	12.6	22.7	Can see bottom	Mus	

1-3	4-XVII-58	1200–1215	slack low	4-5 ft.	10.0	17.0		Sh to S with MuS
2-3	6-XVI-58	0700	E	4 ft.	20.5	28.5		Sh to M
3-3	2-XVI-59	1040	E	3-5 ft.	19.7	22.7	Extremely clear	Sh mostly but some soft spots
1-4	4-XVII-58	1230	F	over 6 ft.	9.5	17.0		MuS with scattered Sh
2-4	6-XVI-58	0800	E	4-7 ft.	22.2	29.0		Sh to MuS
3-4	2-XVI-59	1105	E	6-7 ft.	19.7	22.7	Can see bottom	Mostly soft bottom, few Sh spots
1-5	4-XVII-58	1300	F	2-5 ft.	5.7	18.0		Sh in 2 ft.; MuS in 5 ft.
2-5	6-XVI-58	0845	E	10 ft.	23.2	29.0		S
3-5	2-XVI-59	1125	E	9 ft.	22.8	23.2	Can see disc on bottom	S—probably some M in it
2-6	6-XVI-58	0915	E	3-4 ft.; up to 9 ft. in spots.	17.7	29.0		Sh in 3-4 ft., and S in 9 ft.
3-6	2-XVI-59	1140	E	7½ ft.	22.8	23.3	Can just see disc on bottom	Some Sh, mostly S bottom

Plant List

In the following list the station abbreviations are: the first number is the trip number, and the second number is the station number.

Station locations are given in Fig. 1.



Myxophyceae

Calothrix confervicola (Roth)C.Ag. 3-3, 3-4, 3-5; sparse on *Halophila engelmannii* at 3, abundant on *Syringodium* at 4 & 5.

Calothrix pilosa Harv. 3-4; abundant on *Syringodium*.

Hydrocoleum lyngbyaceum Kutz. ex. Gom. 3-3, 3-4, 3-5; abundant on *Syringodium* at 3 & 4 but on *Laurencia intricata* at 5.

Lyngbya mittsii Phillips. 3-4, 3-5; very abundant on *Syringodium* at 4, sparse on *Laurencia intricata* at 5.

Microcoleus chthonoplastes (Fl. Dan.) Thur. 3-1, 3-5; rare at 1, but common at 5; entangled in algae and on shell.

CHLOROPHYCEAE

Caulerpa paspaloides (Bory)Grev. var. *typica* Weber. 1-1, 1-2, 1-5, 2-1, 2-6, 3-2; common to abundant on muddy sand bottom.

Caulerpa prolifera (Førsskal) Lamx. 1-1, 1-2, 1-5, 2-1, 2-3, 2-6, 3-1, 3-2; abundant on muddy sand and sand bottom but at 3-1 was very abundant on oyster shells.

Chaetomorpha brachygona Harv. 3-1; rare; unattached.

Cladophora gracilis (Griff.)Kutz. 3-5; common; entangled in *Laurencia intricata.*

Enteromorpha crinita (Roth)J.Ag. Trip 1; very abundant in fresh water of Crystal River; unattached.

Penicillus capitatus Lamarck. 2-3; common; on muddy sand.

Phaeophila dendroides (Crouan)Batters. Trip 1; sparse on *Ceramium.*

PHAEOPHYCEAE

Ectocarpus elachistaeformis Heydrich. 3-2; very abundant on *Sargassum.*

Ectocarpus sp. 3-5; sparse; entangled in *Laurencia intricata.*

Eudesme zosterae (J.Ag.)Kylin. 1-4; sparse; unattached.

Myriotrichia subcorymbosus (Holden in Collins)Blomquist. 3-3, 3-4, 3-5; abundant to very abundant on *Syringodium* and *Halophila;* these are very large robust plants; with gametangia.

Rosenvingea intricata (J.Ag.)Børgs. At most stations on first trip, 3-1, 3-3, 3-4, 3-5, 3-6; abundant and unattached on first trip, sparse on rock at 3-1, abundant on *Halophila* at 3-3, very abundant on shell at 3-4, and sparse on *Syringodium* at 3-5 and 3-6; with gametangia on third trip.

Rosenvingea sanctate-crucis Borgs. 1-5; rare; unattached.

Sargassum pteropleuron Grun. 1-1, 1-2, 1-3, 1-4, 1-5, 2-1, 2-2, 2-3, 2-4, 3-1, 3-2, 3-3, 3-4, 3-5, 3-6; very abundant on shells at 1-1, 1-2, 1-5, 2-1, 2-2, 2-3, 2-4, 3-1, 3-2, 3-3, and sparse on shell at 1-3, 1-4, 3-4, 3-5, and 3-6; seemed to be more abundant on the second trip than the first and was more abundant on the third trip than on the second.

Sphacelaria furcigera Kutz. 3-2; abundant on old *Diplanthera* leaf; with propagulae.

RHODOPHYCEAE

Acrochaetium flexuosum Vick. First trip, 3-2, 3-3, 3-5; very abundant on *Caulerpa paspaloides* on first trip, abundant at 3-2 on *Sargassum,* common on *Halophila* at 3-3, and abundant on *Laurencia intricata* at 3-5; with monospores on first trip.

Acrochaetium seriatum Børgs. 3-4; common on *Syringodium;* a few monospores.

Acrochaetium sp. First trip; very abundant; epiphyte.

Centroceras clavulatum (C.Ag.)Mont. 3-3, 3-4; common on *Halophila* at 3-3, sparse on *Syringodium* at 3-4.

Ceramium elegans (Ducluzeau)C.Ag. First trip; epiphyte; rarely found.

Ceramium subtile J.Ag. 3-2, 3-3, 3-5; very abundant on algae at 3-2, abundant on *Sargassum* and *Syringodium* at 3-3, and common on *Syringodium* at 3-5.

Ceramium tenuissimum (Lyngbye)J.Ag. 3-1, 3-4, 3-5; abundant on algae at 3-1, common on *Syringodium* at 3-4, and on *Laurencia intricata* at 3-5.

Champia parvula (C.Ag.)Harv. 1-3, 2-3, 3-2, 3-3, 3-4, 3-5; unattached at 3-5 but sparse on *Syringodium* and *Thalassia* at 1-3 and 2-3, commonly found attached at 3-2, very abundant on *Sargassum* at 3-3, rare on *Syringodium* at 3-4.

Chondria dasyphylla (Wood.)C.Ag. 1-3; sparse on *Syringodium.*

Chondria littoralis Harv. 3-2, 3-3, 3-4; abundant at 3-2, very abundant at 3-3, and common at 3-4; all on *Sargassum.*

Dasya pedicellata (C.Ag.)C.Ag. 1-4, 3-3; sparse on shells; tetrasporic on both trips.

Digenia simplex (Wulf.)C.Ag. 1-3, 1-4, 2-3, 2-4, 2-6, 3-3, 3-5, 3-6; commonly found on shells at 1-3, 1-4, 3-3, 3-5, and 3-6 but abundant on shells at 2-3 and 2-4.

Erythrotrichia carnea (Dillw.)J.Ag. 3-5; sparse; on *Laurencia intricata.*

Fosliella lejolisii (Rosanoff)Howe. 1-3, 3-1, 3-2, 3-3, 3-4, 3-5; abundant on all plants except *Dasya* and *Polysiphonia* at 1-3, 3-2, 3-3, and 3-5 but sparse at 3-1 and 3-4; cystocarpic at 3-3.

Gracilaria foliifera (Førsskal)Børgs. 3-3; sparse; on oyster shell.

Gracilaria verrucosa (Huds.)Papenf. 1-1, 1-2, 1-3, 1-4, 1-5, 2-1, 2-2, 2-4, 2-5, 2-6, 3-1, 3-2, 3-3, 3-4, 3-5, 3-6; on the first two trips the species was extremely abundant and unattached but was sparse and on oyster shells on the third trip.

Griffithsia globulifera Harv. 3-5; rare; on *Digenia.*

Hildenbrandtia prototypus Nardo. 3-5; common; on oyster shell.

Laurencia intricata Lamx. 3-5; sparse; attached.

Laurencia papillosa (Førsskal)Grev. 3-1, 3-5; entangled in algae at 3-1, sparse on osyster shell at 3-5.

Laurencia poitei (Lamx.)Howe. 1-4, 2-4, 2-6; abundant; unattached.

Polysiphonia echinata Harv. 1-3, 1-4, 1-5; very abundant; unattached; tetrasporic.

Polysiphonia macrocarpa Harv. 3-5; sparse; entangled in *Laurencia intricata.*

Polysiphonia ramentacea Harv. 1-4, 2-4, 2-6, 3-1, 3-2, 3-3, 3-4, 3-6; sparse at 1-4, 2-4, 3-1, 3-4, 3-5, and 3-6 but abundant at 3-2 and 3-3; unattached at 1-4 and 2-4, on algae at 3-1 and 3-2, on *Sargassum* and *Syringodium* at 3-3, on oyster shells at 3-4, 3-5, and 3-6.

Spyridia filamentosa (Wulf.)Harv. 2-3, 2-5, 2-6, 3-1, 3-2, 3-3, 3-6; sparse and unattached at 2-3 and 2-6, sparse on algae and *Syringodium* at 2-5, 3-1, 3-2, 3-3, 3-5, and 3-6.

Wurdemannia miniata (Drap.)Feldmann & Hamel. 2-3; rare; unattached.

SEAGRASSES

Diplanthera wrightii Aschers. 2-2, 2-3, 3-5, 3-6; abundant at 2-2 and 2-3 but sparse at 3-5 and 3-6; on muddy sand; variation in abundance probably seasonal.

Halophila engelmannii Aschers. 1-4, 2-3, 2-4, 2-5, 3-3; sparse at 2-4 and 3-3, common at 1-4, and abundant at 2-3; on muddy sand.

Ruppia maritima L. 1-1, 1-3, 1-4, 1-5, 2-1, 2-2, 2-3, 2-4; sparse at 1-3, common at 1-1, 1-4, 2-1, and 2-3, abundant at 1-5, 2-2, and 2-4; on muddy sand; flowering at 1-5.

Syringodium filiforme Kutz. 1-3, 1-4, 1-5, 2-3, 2-5, 2-6, 3-3, 3-4, 3-5, 3-6; sparse at 2-6, 3-3, and 3-5, common at 1-3, 1-4, 1-5, and 2-5, abundant at 2-3 and 3-4; on muddy sand.

Thalassia testudinum Konig. 1-3, 1-4, 2-3, 3-3; sparse; on muddy sand; much leaf kill, short leaves on third trip.

DISCUSSION

Salinities were much lower during the first visit than on the remaining two trips. The thundershower activity probably accounted for this. Water salinities in the bay increased progressively south of the river mouth to Mangrove Point, and decreased progressively north of this Point toward marker No. 2; however, salinities at stations No. 5 and No. 6 were higher on all trips than at station No. 1.

Water temperatures in April 1958 were cold (17.0-18.0°C.). This was the winter of record low temperatures. However, in February 1959 water temperatures were relatively warm for that time of year (22.7-23.3°C.). The winter of 1958-1959 was a mild one.

According to field observations neither existing salinities nor water temperatures seemed to exclude growth of marine algae. The algae found there were not brackish water species, and were characteristic of the Caribbean tropical zone flora. An interesting problem in marine algal physiology is present in Crystal Bay.

According to local residents "kelp-grass" is a characteristic feature of the persistent flora. This was noted to be *Sargassum pteropleuron.* I found vast amounts attached to oyster shell in Crystal Bay during all three trips. It appeared that the enormous amounts of oyster shells in the bay directly influenced the abundance and distribution of this species.

Other components of the dominant macroscopic flora were: *Caulerpa prolifera, Caulerpa paspaloides typica, Gracilaria verru-*

cosa, Rosenvingea intricata on the first trip, *Polysiphonia echinata* on the first trip, and *Polysiphonia ramentacea* on the third trip. The most conspicuous of the epiphytic flora were: *Fosliella lejolisii* and *Acrochaetium flexuosum* on trips No. 1 and No. 3; and *Myriotrichum subcorymbosus, Ceramium tenuissimum, Chondria littoralis* and *Ceramium subtile* on trip No. 3.

Caulerpa prolifera was abundant on muddy sand bottom but was found in great abundance on oyster shells on trip No. 3. *Caulerpa paspaloides* seemed to be restricted to muddy sand bottoms. Unattached *Gracilaria verrucosa* was extremely abundant on the first two trips, but was sparsely found on shells during the third visit. Unattached *Rosenvingea intricata* was extremely abundant on the first trip while abundance varied from sparse to very abundant during the third visit. *Polysiphonia echinata* was extremely abundant but unattached on the first trip. *Polysiphonia ramentacea* was found on all three trips, but was only abundant on trip No. 3. The species was attached to algae, *Syringodium,* and oyster shells.

Sargassum seemed to increase from the first trip in April to the second trip in June 1958. The overall biomass of algae, however, seemed to be reduced on the second trip, possibly owing to the disappearance of *Polysiphonia echinata* and *Rosenvingea intricata.* Biomass seemed to be further reduced during the third visit, probably owing to the disappearance of the enormous masses of unattached *Gracilaria verrucosa* previously found. Almost all species found on the third visit were attached to the bottom or were found as epiphytes. The bay is exposed to severe northwesterly cold fronts with accompanying winds in winter which cause turbulent water. It is surmised that unattached algae in shallow water would be moved by this turbulent water.

Forty-six taxa of algae were found in all on the three trips. Five taxa were blue-greens, seven were green algae, eight taxa were brown algae, and 26 taxa were red algae. In addition five species of seagrasses were collected. Of the 46 algal taxa found 25 were epiphytes. Twenty taxa were found on the first trip, 11 were found on trip No. 2, and 35 taxa were collected on trip No. 3. Only seven taxa were found on all three trips. Of the 35 taxa reported for trip No. 3, 23 taxa were reported only on that trip.

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Summary

Three collections were made in Crystal Bay on the Florida west coast in April 1958, June 1958, and in February 1959. The salinity characteristics of the water were estuarine, despite the exposure to the Gulf of Mexico. This was probably a result of dilution from the spring fed Crystal River.

A great amount of marine algae was found in the bay on muddy sand bottom between oyster bars and on oyster shells. Forty-six taxa of algae were reported of which 25 were epiphytic forms. Five species of seagrasses were collected.

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