

Ecology of Seagrass Bed of *Halophila beccarii* (Aschers) in Mandovi Estuary, Goa

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H. beccarii which prefers soft and silty substratum showed salinity tolerance from 0 to 33‰. High nitrate (7.02 µg at/litre) and phosphate (2.21 µg at/litre) were recorded in July and November respectively in the substratum of seagrass bed. Maximum average biomass of 26.44 g/m² was recorded in October followed by a flowering period of the seagrass. Protein content was maximum (393.12 mg/g) in August while carbohydrate was maximum (476.18 mg/g) in May and August. Maximum organic carbon (30.8%) was recorded in July and September while C:N ratio ranged from 3 to 7.

Submerged seagrass beds in shallow, sheltered coastal regions are very productive¹⁻³ and serve⁴ as feeding, spawning and nursery grounds for marine organisms. Largest part of the seagrass production enters into the food chain^{5,6} and also acts as food for certain herbivores.

From India 6 genera consisting of 9 species of seagrasses have been reported⁷. Eight species of *Halophila* Thouars have been recorded⁸ in the coastal waters of both temperate and tropical seas. In India, *H. ovalis* Hook f., is observed along the coasts of Goa, Madras, Okha, Dwaraka and other places in Kathiawad. However, *H. ovata* Gaud is found along Madras coast and *H. stipulacea* (Forsk) Aschers, along the Gulf of Mannar⁹. *H. beccarii* Aschers has been reported^{10,11} from the mangrove swamps of Central West Coast, which prefers lateritic soil rich in nutrients. The present paper deals with some ecological aspects and seasonal changes in the major metabolites in *H. beccarii* from mangrove swamps at St. Pedro, Ribandar, Goa.

Various parameters like atmosphere, water and substrate temperatures, salinity, dissolved oxygen, pH, and biomass (Fig. 1) and nutrients (PO₄-P, NO₃-N; Fig. 2) were studied at monthly intervals from Oct. 1977 to Sept. 1978. For biochemical analysis plant samples alongwith rhizome and rhizoides were collected at ebb tide, washed thoroughly to remove adhering material, dried in an oven at 80°C, powdered and used.

Total sugars were analysed by the method of Dubois *et al.*¹² while nitrogen and organic carbon were estimated using methods of Johnson¹³ and El Wakeel and Riley¹⁴ respectively. To calculate the calorific value of each metabolite as well as the total energy, the standard factors 5.65 for protein (calculated as N × 6.25) and 4.15 for carbohydrate were used. However, calorific values from organic carbon were estimated

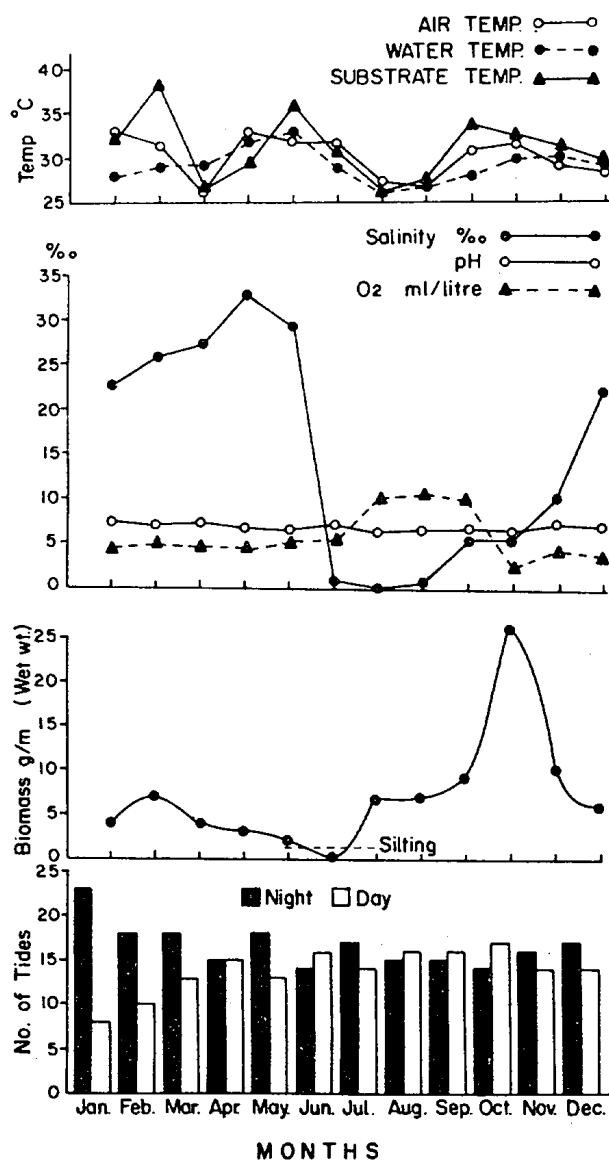


Fig. 1—Environmental data of the area studied

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using the equation suggested by Platt *et al.*¹⁵ The results are presented in Table 1.

H. beccarii grew luxuriantly in the temperature range of 26° to 33°C. During the flowering season of *H. beccarii* in September and October, the biomass showed an increase up to 26.44 g/m² wet weight (Fig. 1).

The number of low tides during day time plays an important role as the exposure increases the photoperiod. Maximum low tides during the day (0600 to 1800 hrs) are recorded in August to October (Fig. 1), when the seagrass gets exposed for considerable period. Flowering in *Halophila* cultured in synthetic sea water (37‰) has been reported¹⁶ under 14, 16 and 24 hr photoperiods but not under 12 hr. Incidentally, *H. beccarii* plants are seen in open areas where they can get maximum sunlight. Generally the estuarine waters are of turbid nature. This is more true in mangrove swamps where constant accretion and erosion are going on. *H. beccarii* generally grows in the intertidal zone along the central west coast. During high tide the turbid water does not allow much light to penetrate up to the seagrass level. So naturally whatever light these

plants get for their photosynthesis is during low tide exposure only. Accordingly, it has been observed that maximum growth of *H. beccarii* is attained during the months when more number of low tides are during day time (Fig. 1).

Salinity at Ribandar, where *H. beccarii* grows, shows gradual increase from October when monsoon almost ends. There seems to be no harmful effect of the wide variation in salinity (0 to 35‰) on the growth of *H. beccarii*. Growth and survival of seagrass¹⁶ depend on factors like salinity, temperature and light. New growth is observed in July when salinity is reduced to minimum by precipitation. Flowering in *H. beccarii* is noticed in October when salinity of the water is 5.38‰, with low phosphates and high nitrates as indicated earlier (Fig. 2). The dissolved oxygen is also more which can be because of enhanced photosynthetic activity during this period. Long exposures and low salinity during August to October may be influencing factors for the flowering in *H. beccarii*.

Major metabolites like protein, carbohydrate and organic carbon show seasonal changes in *H. beccarii*. However, definite pattern of these fluctuations is not observed. Similar studies have been undertaken earlier^{17,18} on the mangrove foliage. Both mangrove and *H. beccarii* grow in the same environment so it is of interest to compare the biochemical constituents in them. In mangrove there is a significant variation in the protein with very high carbohydrate content^{17,18}. The calorific values in mangrove^{17,18} foliage also show a range from 4.9 to 6.7 kcal/g. In the present investigation on *H. beccarii*, it is observed that protein content is more but the carbohydrate and calorific values are comparatively less than in mangrove foliage. Marine algae on an average show lower¹⁹ values of protein and carbohydrate than seagrass. However, the calorific

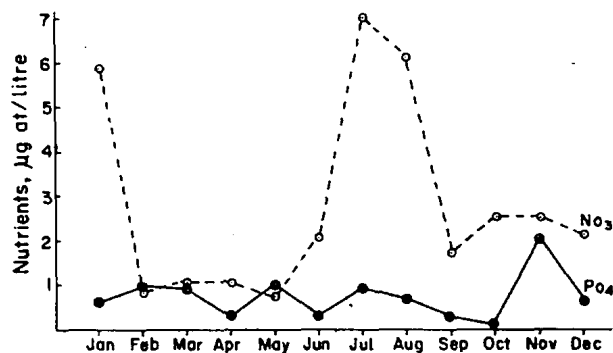


Fig. 2—Nutrient (PO₄-P and NO₃-N) data of the area studied

Table 1—Biochemical Composition and Energy Values of *H. beccarii*

[All values are expressed on dry wt basis. No data are available for June]

	Nitrogen	Protein		Carbohydrate		Organic carbon %	Cal/g dry wt from organic carbon	C:N
		mg/g dry wt (× 5.65)	Cal/g dry wt	mg/g dry wt (× 4.15)	Cal/g dry wt			
Jan.	3.77	235.6	1331.28	262.85	1090.83	12.60	1688.20	3.34
Feb.	3.43	214.4	1211.36	365.70	1517.65	15.60	2144.20	4.54
March	4.57	285.9	1615.33	289.59	1201.80	13.40	1809.80	2.93
April	4.57	285.9	1615.33	384.75	1596.71	15.00	2053.00	3.28
May	3.47	214.4	1211.36	476.18	1976.15	12.40	1657.80	3.50
July	5.72	357.5	2019.87	297.13	1233.10	30.80	4454.60	5.38
Aug.	6.29	393.12	2221.16	476.18	1976.15	30.00	4333.00	4.77
Sept.	6.06	378.84	2140.45	281.89	1086.84	30.80	4454.60	5.08
Oct.	3.09	192.94	1090.13	441.89	1833.84	13.80	1870.60	4.47
Nov.	2.52	157.2	888.35	281.89	1086.84	17.20	2387.40	6.84
Dec.	4.00	250.12	1413.21	346.66	1438.64	12.20	1627.40	3.05
Average	4.29	269.63	1523.40	351.34	1438.64	18.50	2647.72	4.29

values in *H. beccarii* and *Ulva lactuca* show similarity. The seasonal changes in the metabolites²⁰ may be attributed to the various physiological processes of the plants. Several factors like hydrological, biochemical and environmental, are responsible for the variation in the metabolites and the calorific values obtained. No significant correlation is observed between these metabolites ($r=0.017$). However, significant correlation has been observed between nitrogen content and the organic carbon ($r=0.81$).

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