Hydrobiology of some solar salt works in India

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Abstract

The hydrobiology of two Indian solar salt works was investigated. A salient feature was variability in physico-chemical and biological characteristics. The filamentous cyanophyceans Lyngbya majuscula and Oscillatoria salina and the chlorophycean Xenococcus acervatus were the major primary producers. Significant fauna were protozoans, rotifers and copepods. Artemia was present in only one set of solar salt pans, where it was dominant. The study illustrates the importance of Artemia in the biological management of solar salt works.

Introduction

The large number of coastal solar salt works is an important feature of much of the Indian coast. The tropical climate and the ready availability of sea-water have promoted the growth of a large salt industry providing employment to many. In Tamil Nadu alone, the area for salt production (according to 1983 data) is 14,892 ha. The salt is used for domestic, medicinal and industrial purposes; it is now one of the most important raw materials for the chemical industry. Solar salt works in India consist of small, privately owned salt fields and large industrial salt works. In a typical salt works, sea-water enters the primary pond from where it flows into a series of ponds until the water becomes saturated by solar evaporation. The saturated brine is pumped into crystallizer ponds. In traditional salt fields, sea-water is pumped directly into crystallizers.

1This paper is dedicated to Thiru. K. Ayyaru Vandayar, Member, Governing body, A.V.V.M. Sri Pshpam College (Autonomous), Poondi, on his sixtieth birthday.
The most salient feature of ponds is their physico-chemical and biological variability. In extreme conditions, only a few organisms survive, the most tolerant being Artemia. However, Artemia does not occur in all salt ponds; in some, lack of food precludes its occurrence. Although solar salt ponds offer many opportunities for research, much of which is important in pond management, the extent of research is limited. The investigation reported here is a response to this situation.

Materials and Methods

Study sites. Two types of salt works were studied, a large industrial one and a small, local one (Fig. 1). The former had a series of evaporators, reservoirs and crystallizers and was located at Kelambakkam, Madras (12°08' N, 80°02' E). The latter was a small traditional salt pan at Eripurakkara, Adirampattinam (10°06' N, 79°68' E). The Kelambakkam salt pans have a total area of 526 ha. Sea-water in a tidal creek is pumped into series of evaporators, each 0.4 ha in area, and to a depth of 75–90 cm. The brine is then stored in reservoirs from where it is transferred to the crystallizers. The Eripurakkara salt works have a total area of 4 ha and produce only edible salt. Sea-water is from the Palk Strait and enters a feeder canal by tidal action. From there, it is directly pumped into crystallizers to a layer of 10–15 cm. Salt harvesting begins after 6 or 7 days. Production of salt is seasonal in both salt works, from January to September. The north-eastern monsoon prevents salt production from October to December. Both salt works have a similar climate, with a mean annual rainfall of 10.6 cm and air temperature of 30.9°C.

Sampling and methods. Monthly samples were collected at 9 a.m. for one year (except January at Eripurakkara because of operational requirements). Collections began in October 1989 at Eripurakkara, and in November 1989 at Kelambakkam. The sampling station in the Kelambakkam ponds was located 5 km from Kelambakkam, and in the Eripurakkara ponds, 3 km from Adirampattinam. Temperature was recorded with a mercury in glass thermometer, salinity with a refractometer and pH with a portable meter. Standard methods of sea-water analysis were used to determine other chemical parameters (APHA, 1985; Strickland and Parsons, 1972): dissolved oxygen, total alkalinity, and the concentration of magnesium and calcium, total dissolved solids, nutrients (nitrate-nitrogen, phosphate-phosphorus and silicate) and ammonia. Phytoplankton samples were collected by filtering 50 L of water through a net of mesh size 10 μ, faunal samples using a net of mesh size 50 μ. Samples were preserved in 5 per cent neutral formalin. Primary production was estimated by oxygen evolution in light and dark bottles (Strickland and Parsons, 1972). The rainfall data were obtained from local meteorological stations.