

## Molluscan Wood-Borers of Chilika Lagoon, East Coast of India and Their Control Measures

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**Abstract:** The aim of the present study is to know the occurrence and distribution of molluscan wood-borers from Chilika lagoon in relation to some physico-chemical parameters. The samples were collected from three stations during May 2010 to April 2011. Six wood-borers belonging to Family Pholadidae and Teredinidae namely *Martesia striata* and five borers, namely, *Bankia brevis* (Deshayes), *Bankia campanellata* (Moll and Roch), *Bankia* sps., *Lyrodus pedicellatus* (Quatrefages) and *Teredo furcifera* were observed. The physico-chemical parameters like air temperature, surface water temperature, pH, salinity, and dissolved oxygen were studied from these stations. The air temperature varied 28.5 to 35.4°C. The surface water temperature was lowest being 27.5°C in post-monsoon at station-3 and the highest surface water temperature was 32.8°C during pre-monsoon at station -1. The highest and lowest pH was observed to be 8.9 during monsoon in station-1 and 7.5 during post-monsoon in station -1. Similarly the highest and lowest value of salinity was observed to be 19.5‰ at station -3 during pre-monsoon and 14.26‰ at station-2 during monsoon. Likewise the highest and lowest dissolved oxygen were observed to be 11.5 mL/L during pre-monsoon at station -1 and monsoon at station-2.

**Key words:** Chilika lagoon, east coast, measures, molluscan, wood-borers

### INTRODUCTION

Sea water is a biological medium for the origin and sustenance of life. Marine environment supports both living and non living resources. Man has been taking advantage of these resources and other benefits e.g. transportation. Whenever manmade structures were erected or launched in marine waters, they are subjected to deterioration. Deterioration of marine timber by biological agencies is an age-old problem that has descended upon mankind from the very day man ventured out in the sea on a primitive wooden craft. The problem has defied a solution ever since. Of course, considerable progress has been made in research aimed at tackling this menace, right from probing the causes of biodeterioration to the use of several scientific preventive measures. But, the magnitude and vastness of the problem are such that when one aspect appears to have been solved, new ones crop up under emerging situations with advancing technology. The problem is too severe in developing countries, where wood is still the prime constructional material and due to uniformly high temperature, the activities of injurious organisms are spectacular with their depredations continuing almost throughout the year. Marine wood borers are extremely specialized group of organisms invading wooden structures deployed in seas,

estuaries and backwaters, etc. Wood boring organisms generally belong to two groups namely:- molluscan borer and crustacean borers. Family teredinidae and pholadidae come under molluscan wood borers while limnoriidae, sphaeromatidae and cheluridae belong to crustacean wood borers are seen in India. Teredinids commonly known as shipworms, pholadids as piddocks, limnoriids as gribbles, sphaeromatids as pill bugs and chelurids as chelurians. Borers physically damage wooden structures like jetties, rafts, craft, aquaculture structures, etc. affecting their strength and efficiency. Wood borers also are known to destroy mangrove vegetation along the Indian coast (Santhakumaran, 1994). In India, according to the latest estimates there are 2, 80,491 fishing craft. Of these, 1, 81, 284 are traditional craft, 44,578 are motorized craft and 53,684 are mechanized craft (Edwin *et al.*, 2005). Few research work has been carried out in this line the most notable one along east coast are Ganapati and Rao (1959), Ganapati and Rao (1960), Nair (1954), Nair (1963), Nagabhushanam (1955), Das and Dev Roy (1980), Pachu *et al.* (2008), Rao *et al.* (2008) and in west coast are Erlanson (1936), Palekar and Bal (1955), Pillai (1955), Nair and Dharmaraj (1983). Purushotham and Satyanarayana Rao (1971) have studied many wood borers from both the coast on India. The first study on the wood boring organisms of Orissa was done by Subba Rao

(1968). The second study on wood borers of Orissa coast was carried out by Nayak (1996). As we know Fisherman communities have been exploiting the fishery resources using these catamarans. They have also set up many aquaculture structures like Gheries, Khanda Jal, etc. which use several tones of bamboo and *Casuarina* plant material. These materials are generally attacked by the marine boring organisms and they damage these materials to a great extent. Orissa's poor fishermen are not aware of the veracity of wood borer and their extent of damage to the wood or bamboo. Due to lack of knowledge, they are using vast quantity of wood blindly without caring their future with lot of expenses. With this background it is an attempt to take up a systematic study of marine wood boring organisms from Chilika lagoon, which will be helpful for planning, monitoring and protecting strategies for the future. The main objective of the paper is to survey the occurrence of the wood-borers from Chilika lagoon to identify the molluscan wood-borers and the other objective is to correlate the distribution of wood-borers with the physico-chemical parameters.

#### MATERIALS AND METHODS

**Study site:** The present study area Chilika lagoon (19°28'-19°54' N and 85°05'-85°38' E) (Fig. 1) is a brackish water lagoon situated on the east coast of India. It extends from the southeast corner of Puri district to Ganjam. The lagoon is separated from the sea by a sand bar formed by the waves and wind in the fore-shore area. The sand bar acts as a barrier island between the lagoon and the sea. The lagoon is connected to the sea by a narrow, zigzag channel which opens into the Bay at Arakhakuda. Recently, one artificial mouth has been opened near Sipakuda by Chilika Development Authority in September 2000 and another mouth has naturally opened during August 2008 near Gabakunda. The study area was surveyed in different seasons, viz., monsoon, post-monsoon and pre-monsoon from 3 selected station, namely mouth of Palur canal lies in southern sector is the first station. The second station is located near Krushna Prasad Gada which is located in central sector and third station is located at Janhikuda which is located near outer channel.

**Methodology:** Wood borers were collected from aquaculture structures such as bamboo and *Casuarina* poles (Fig. 2) at different site. Wooden materials were cut opened with the help of chisel and hammer and borers were extracted carefully from these structures. After collection, wood borers were preserved in glycerin modified 70% ethyl alcohol and dried pallets without animals were dry preserved. Identification was done

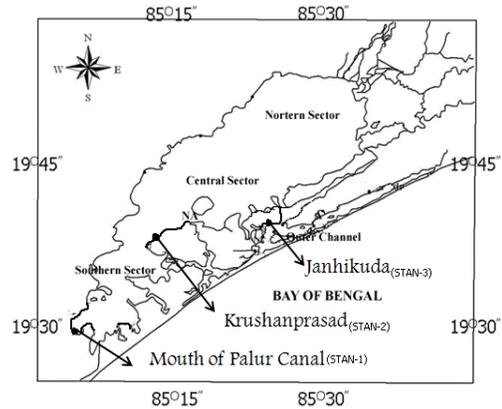


Fig:1 Map of Chilika lagoon showing the stations

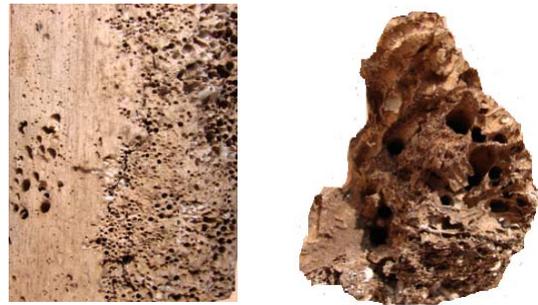


Fig: 2: Casuarine timber pole attacked by Teredinids and Pholadids and showing Terredind tunnels

following standard literature (Turner, 1971; Turner and Santhakumaran, 1989). The physico-chemical parameters such as surface water temperature, pH, salinity and dissolved oxygen of the water from three selected sites were measured in monsoon, post-monsoon and pre-monsoon seasons following standard method APHA (2005).

#### RESULTS

A total of six wood borers could be collected. Among these one borer, namely, *Martesia striata* (Linnaeus) belongs to family pholadidae and five borers, namely, *Bankia brevis* (Deshayes), *Bankia campanellata* (Moll and Roch), *Bankia* sp., *Lyrodus pedicellatus* (Quatrefages) and *Teredo furcifera* (von Martens) belongs to family teredinidae of phylum mollusca. The distribution of these species is presented in Table 1. *M. striata* found to be present at all the sites and all the seasons except in the monsoon and post-monsoon seasons at Krushna Prasad Gada. It is dominant particularly in pre-monsoon season. *B. brevis* was found only at mouth of Palur canal during monsoon and post-monsoon season.

Table 1: The average values of the physic-chemical parameters of three different stations from Chilika Lagoon during May 2010 to June 2011

Stations	Seasons	Atmospheric temperature (°C)	Surface water temperature (°C)	pH	Salinity (‰)	Dissolved oxygen (mL/L)
Mouth of palur canal	Monsoon	31.5	30.7	8.9	8.21	6.7
	Post-monsoon	33.2	28.6	7.5	14.56	8.1
	Pre-monsoon	34.6	32.8	7.7	18.67	11.5
Krushna prasad gada	Monsoon	30.2	32.5	7.9	14.26	2.8
	Post-monsoon	31.5	27.9	7.8	9.48	7.4
	Pre-monsoon	33.5	32.3	8.6	16.89	10.6
Janhikuda	Monsoon	33.1	32.7	8.7	7.26	5.6
	Post-monsoon	28.5	27.5	8.2	12.54	8.0
	Pre-monsoon	35.4	30.2	8.3	19.5	13.4



Plate-1



Plate-2



Plate-3



Plate-4



Plate-5



Plate-6

Fig. 3: Different species of wood-borers

*B. campanellata* was present at all the sites and in all the seasons. One unidentified species of *Bankia* was found only in monsoon season at Janhikuda. *L. pedicellatus* was present in all the months at mouth of Palur canal and during pre-monsoon season at Janhikuda but totally absent at Krushna Prasad Gada. *T. furcifera* was also a dominant borer found at all the stations and all the seasons except in monsoon season at Krushna Prasad Gada. The systematic position, synonyms, of each species mentioned above are presented as follows (Fig. 3):

**Phylum:** Mollusca

**Class:** Bivalvia

**Order:** Myoida

**Family:** Pholadidae

*Martesia (Martesia) striata* (Linnaeus) 1758 (Plate-1)

**Synonyms:** *Pholas striata*: Linnaeus 1758, *Martesia (Martesia) striata*: Melvill and Standen 1907, *Martesia fluminalis*: Annandale 1923, *Martesia (Diploplax) americana*: Nagabhushanam, (1955).

**Family:** Teredinidae

*Bankia brevis* (Deshayes) 1863 (Plate-2)

**Synonyms:** *Teredo brevis*: Deshayes 1863

*Bankia campanellata* Moll and Roch 1931 (Plate-3)

**Synonyms:** *Bankia campanellata*: Moll and Roch 1931

*Bankia (Liliobankia) katherinae*: Clench and Turner 1946

*Bankia (Bankia) bengalensis*: Nair 1956

*Bankia* sp. (Plate-4)

**Synonyms:**

**Bankia:** Gray

*Lyrodus pedicellatus* (Quatrefages) 1849 (Plate-5)

**Synonyms:**

*Teredo pedicellatus*: Quatrefages 1949

*Teredo (Teredo) madrasensis*: Nair 1956

*Teredo (Bankia) indica*: Nair 1958

*Teredo furcifera* von Martens 1894 (Plate-6)

**Synonyms:**

*Teredo furcifera*: von Martens 1894, *Teredo (Teredo)*

*parksii*: Bartsch 1921, *Teredo (Teredo), parksii*

*madrasensis*: Nair 1955, *Teredo furcillatus*: Miller 1924,

*Teredo astralasiatica*: Roch 1935,

*Teredo furcata*: Moll 1935, *Teredo krappei*: Moll 1935,

*Teredo laciniata*: Roch 1935, *Teredo (Teredo) bensoni*:

Edmondson 1946.

The physico-chemical parameters (surface water temperature, pH, salinity and dissolved oxygen) of the water at selected stations are presented in Table 1. There was negligible differences between air temperature and surface water temperature. Surface water temperature varied from 28.6 to 32.8°C at mouth of Palur canal, 27.9 to 32.5°C at Krushna

Prasad Gada and 27.5 to 32.7°C at Janhikuda. pH values varied from 7.5 to 8.9, 7.8 to 8.6 and 8.2 to 8.7 in

station 1,2,3, respectively. The salinity value varied from 8.21 to 18.67‰ at station-1, 14.26 to 16.89‰ at station 2 and 7.26 to 19.50‰ at station 3, respectively. The dissolved oxygen varied from 2.8 to 13.4 mL/L (Table 1).

## DISCUSSION

The warm tropical water of India provides excellent support for the development, growth and survival of varied animal life (Nagabhushanam and Alam, 1988). The physico-chemical parameters study showed noticeable seasonal as well as spatial variation which may be attributed to the local climatic conditions and water exchange mechanism between lagoon and the sea. The average temperature ranged from 28.5 to 35.4°C corresponding to post monsoon and pre monsoon month respectively. The average seasonal value of each station revealed that slightly higher value were observed near station 2 which is located in central sector. Nayak and Behera (2004) have studied on the seasonal variation of some physico-chemical parameters of Chilika lagoon after opening of the new mouth near sipakuda. They have observed that the temperature varied from 22.8 to 35°C in the present study. The higher range temperature is quite similar with the result of Nayak and Behera (2004) and the lower range temperature is slightly difference from the result of Nayak and Behera (2004) which may be due to some environmental changes in this region. The species *B.companellata* observed in all stations in all seasons which may be due to high temperature and this result is in agreement with the result of Nagabhushanam (1961a) in Visakhapatnam harbour which has witnessed high temperature favour the breeding of the species. *L. pedicelatus* prefer little higher salinity so it was found at mouth of Palur canal and at Janhikuda in pre-monsoon season this result is in agreement with the result of Karande *et.al.* (1968) on Bio-assay of candidate toxin against *teredinid* wood-borers that the organism remain active at salinity from 15 to 35‰ and it has no effect on normal activity of larvae. The species *T. furcifera* was found in all the season but absent in monsoon season at Krushna Prasad Gada and it may be due to low salinity in this particular area and this result is in partial agreement with the result of Nagabhushanam (1961a) that the salinity level of 6‰ as lethal to *Martesia striata* in Visakhapatnam harbour. High dissolved oxygen concentration was observed during pre-monsoon which may be due to over growth of weeds and sea grasses inside the Chilika lagoon. This result is strongly in agreement with result of Nayak *et. al* (2004). Though all the species reported during study are new to Chilika lagoon, they are commonly found in all Indian waters. The three species namely *M. striata*, *B. campanellata* and *L. pedicellatus* have been reported by Subba Rao (1968) from Mahanadi estuary.

**Control measures:** The destruction of timber structure in Chilika lagoon is very much intensive by the wood-borers which pose serious threat and make immense loss to the fisher men. Therefore, it is important to evolve and use some methods to protect the wood and the other structure from the attack of molluscan wood-borers in Chilika lagoon. Some of the important methods are suggested below.

- The wooden structure and boats require periodically exposure to the sun for desiccation which is fatal to the wood-borers.
- The wooden structure should be coated with coal tar from time to time depending on the requirement. The wooden structures are to be sheeted completely or partially with metal concrete or any such suitable warping to protect the wood from the attack of wood borers.
- The wooden structure used in boat building can effectively be protected from biodeterioration by pressure impregnation of a creosote-coal tar mixture 1:1 at a retention of 320 kg per cubic meter.
- The designed injection of chemicals which sterilize the water has been found to be beneficial in preventing the fouling in salt-water pipe system. The use of Sodium Pentachlorophenate in concentration of 1 ppm has been found to be more efficient in preventing fouling of steel pipes without increasing the rate of corrosion as suggested by Nair (1968).
- A bituminous compound, containing high and low boiling asphalt, creosote-coal tar mixture and Arsenic trioxide may be effective to protect the wood from wood-borers as suggested by Purushotham *et al.* (1959).
- The electrocution protection is another device to demolish the wood-borers which can be achieved by passing the current of high amperage and voltage with special device.
- Exposure to fresh water is lethal for typical marine species, therefore mooring the boat or vessel in low salinity area has also been recommended by Nair (1965) to protect the wooden structure from the attack of wood-borers.

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