# Range Extension of *Barnea Candida* (Linnaeus, 1758) and Habitat Loss in a Tropical Mangrove Estuarine System, Bay of Bengal, India

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# Abstract

The most specified wood borer Barnea candida's has been recorded during three consecutive years from 2015 to 2018 as live form in the river belt of Brahmani and Baitarani mangrove dominated areas of Dhamra estuary. The carcasses of the observed wood borer were found in huge number in and around of Dhamra Port. Present study further declared that the range extension of Barnea candida occurred from Subarnarekha estuary to Dhamra estuary by showing a southward migration.

During the survey, other molluscan dead shells were also observed along with the wood borer which could be the consequences of port and harbour related activities. It is well known that Barnea candida is an efficient substrate destructor of wooden boats, shipwrecks, jetty pillars and also cemented structures of fishing harbours in the marine and brackish water ecosystem. Therefore, the observed species might be a threat for the Dhamra ecosystem in future which needs long-term integrated research in future.

**Keywords**: Dhamra port, *Barnea candida*, wood borer, range extension, habitat loss.

# Introduction

Members of the family Pholadidae are well known for their destructive capacity to make severe damage to submerged wood, shipwrecks, wooden boats, jetty pillars, cemented structures, hard clay, lime stone, soft rocks, corals, bivalves and even to plastic<sup>11</sup>. It is comprised of five extant genera of which the genus *Barnea* Risso, 1826 is consisting with 16 existing species<sup>10</sup>. The distribution of *Barnea* species along coastal region of Odisha is highly sporadic and arbitrary<sup>19</sup>. The boring and destructiveness are noticed irrespective of species and severe loss has been observed in the boat structures, hard cemented pillars, woods, mangrove and other equipments designed for fishing and shipping. Major problem associated with boring species is that it directly affects the commercial aspect relating to maintenance and durability of shipping and fishery materials and instruments.

Impact of dredging on habitat stress of aquatic ecosystems has been well documented in many parts of the world<sup>3,4,21</sup>.

Review of literature deciphered that any direct or indirect impact on habitat loss will affect mostly on fish communities<sup>5</sup>. This study is highlighting the significant impact of dredging on the particular wood borer group called *Barnea candida*, Pholadidae along Dhamra Estuary, East Coast of India.

# **Material and Methods**

**Study Area:** Dhamra estuary which is formed due to the confluence of the Brahmani and Baitarani rivers opened to Bay of Bengal having the coordinates 20° 49' 24" N and 86 ° 57' 46" E in Bhadrak district, Odisha (Figure 1). It is regarded as the most sensitive ecosystem of East Coast of India because of its strategic locality. Worlds' largest sea turtle rookery the "Gahirmatha" and India's second largest mangrove forest named as "Bhitarkanika" are located in very close vicinity of it. Both these ecosystems provide excellent habitat support to some rare and vulnerable species of plant and animals described by IUCN. Therefore, the entire estuarine complex of Dhamra is considered as a hotspot of biodiversity in a larger perspective.

Considering the ecological sensitivity and habitat vulnerably, substantial research work has been carried out by Sharma et al<sup>16,17</sup> and Mohapatro et al<sup>6, 7</sup> along estuarine, near shore and offshore waters of Dhamra in relation to water quality and benthic communities. Recently, this ecosystem is being disturbed from anthropogenic source due to the cargo ship movement after the establishment of Dhamra port (Figure 2). Therefore, scientific monitoring became mandatory on regular basis in order to depict any change in the bottom community in respect to time, space and stress.

**Sampling Locations:** Twelve number of sampling locations were fixed on seasonal basis for the estuarine and coastal monitoring for a period of 3 years during monsoon, postmonsoon and pre-monsoon from a tropical estuary (Dhamra estuary) located in South East Coast of India, Bay of Bengal (Figure 1). The sampling area covered a stretch of 9 km from the harbour estuarine side to port marine channel which later meets with the ocean side (20°47'24.09"N - 86°53'32.45"E to 20°47'50.11"N - 86°58'07.34"E).

Out of the twelve (12) stations, seven (7) stations were belonging to estuarine province and other five stations are of marine in nature. Estuarine stations are named as R-1, R-2, R-3, R-4, R-5, R-6 and R-7. Similarly, the marine transect stations are named as T-1, T-2, T-3, T-4 and T-5 respectively. The details of the sampling point containing GPS coordinates are given in table 1.

**Sampling**: Coastal monitoring was carried out on regular seasonal basis for a period of 3 years during monsoon, postmonsoon and pre-monsoon from a tropical estuary (Dhamra estuary) located in South East Coast of India, Bay of Bengal. The sampling area covered a stretch of 9 km from the harbour estuarine side to port marine channel which later meets with the ocean side (Latitude 20°47'24.09"N-Longitude 86°53'32.45"E to Latitude 20°47'50.11"N-Longitude 86°58'07.34"E). The objective of the environmental monitoring was to assess the habitat loss due to anthropogenic activities made by port, harbour and its nearby localities.

During the monitoring programs, the unidentified species were found with huge bulk of dead shell carcasses exclusively nearby port area. However, live organisms were recorded in the riverine belt and estuarine area. Benthic samples were taken with the help of stainless steel Van Veen grab sampler with a surface biting area 400cm<sup>2</sup> to obtain bottom sediments. After the collection of the sample, they were immediately photographed and transferred to the Marine Laboratory of CSIR-Institute of Minerals and Materials Technology, Bhubaneswar. Samples were sieved through a 0.5 mm mesh sieve and then preserved in 10% buffered formalin with rose bengal solution<sup>15</sup> and later on carried to the Marine Laboratory of Department of Marine Sciences, Berhampur University, Odisha, India for further taxonomic identifications. The unidentified specimens were identified by following standard literature<sup>2,18</sup>.

 Table 1

 Detailed of the Sampling Locations of the Study Area

Station Name	Station Code	Latitude	Longitude	Zone
Dhamra	R-1	20°46'54.48"N	86°56'56.20"E	Estuarine province
Dhamra	R-2	20°47'2.26"N	86°56'22.97"E	Estuarine province
Dhamra	R-3	20°47'4.49"N	86°55'49.33"E	Estuarine province
Dhamra	R-4	20°47'8.51"N	86°55'15.02"E	Estuarine province
Dhamra	R-5	20°47'14.39"N	86°54'40.87"E	Estuarine province
Dhamra	R-6 (Fishing Jetty)	20°47'19.38"N	86°54'06.81"E	Estuarine province
Dhamra	R-7	20°47'24.09"N	86°53'32.45"E	Estuarine province
Dhamra	T-1	20°46'40.67"N	86°57'45.99"E	Marine Transect
Dhamra	T-2 (DRDO)	20°46'53.36"N	86°57'55.05"E	Marine Transect
Dhamra	T-3	20°47'11.09"N	86058'01.35"E	Marine Transect
Dhamra	T-4 (PORT)	20°47'31.36"N	86°58'03.69"E	Marine Transect
Dhamra	T-5 (PORT)	20°47'50.11"N	86°58'07.34"E	Marine Transect



Figure 1: Map of Study Area

## **Results and Discussion**

**Species Identification:** The unidentified molluscan specimen has certain morphological features such as shell thin, size up to 65mm, sub-ventricose, rounded in front, ventricose in the middle; posterior attenuated, narrow and simple; sculptured with strong corrugated concentric ridges but less prominent in the anterior part, radial ribs almost throughout the body except a small portion of anterior end. Adductor scars and pallial line are not always clear and pallial sinus U shape. After considering the above identifying characters, the observed species undergoes following classification level.

#### **Systematic Classification:**

Phylum: Mollusca Class: Bivalvia Subclass: Heterodonta Order: Myida (Stoliczka, 1870) Family: Pholadidae (Lamarck, 1809) Genus: *Barnea* (Risso, 1826) Species: *Barnea candida* (Linnaeus, 1758) (Figure 2) Common name: White paddock

**Distribution:** India - Andhra Pradesh, West Bengal, Medinipur, South 24 Parganas, Maharashtra, Odisha, Chandipur, Mahanadi, Subarnarekha, Talsari and Dhamra estuary (present study). Elsewhere: Atlantic Ocean and Indo-Pacific province<sup>9,19,22</sup>.

**Remarks:** The original body colour of *Barnea candida* is white yellow or white grey and turns chalk-white when dead and dried (Figure 3A and figure 3B). The most common resemblance is marked with *Pholas orientalis*.

However, its morphology is different from the presently studied *Barnea candida* in having shell large and white with a narrow posterior end, gradually wider towards umbo and again narrows down rapidly; sculptured with strong, nodular radial ribs crossed by concentric ridge from anterior to middle region but almost smooth posterior part (Figure 3E and figure 3G). The crossing of radial and concentric edges

found on the upper part of the valves contains sharp teeth like structures (Figure 3F, Figure 3H and figure 3I).

Dredging implicates the excavation and relocation of sediment, still, it necessitates for commercial growth and development of the nation. However, severe concern to the health of coastal ecosystem seem to pay in terms of habitat loss. This is widely accepted that dredging activity imposes potential impacts on the coastal environment such as over suspension of sediments, nutrients vis-a-vis sediment dwelling microbes to the water column, furthermore release of toxic contaminants, hydraulic entrainment and noise pollution etc.<sup>8,12-14,21</sup> Excessive load of suspended particulate matters in the water column reduces the transparency and increases the turbidity.

Thus, column primary productivity and benthic primary as well as secondary productivity are found to be disturbed to some extent. In the same way, the food chain of the concerned dredged area will be disrupted which might be the causative factor for mass mortality of both pelagic and benthic faunal community.

Nevertheless, *Barnea candida* itself is a potential borer species which can dig numerous substratum that belongs to marine habitat. The serrated and teeth like structures of *B. candida* help to make furrow in the varied substratum such as mud, sandstone, lime stone clay or the twigs of the mangroves etc. The valves of the *Barnea* species are fragile in nature. Therefore, the shells are usually found broken under the impact of waves or any other physical means of disturbances. This is the reflection of such disturbances felt on the *Barnea candida*.

In the Dhamra port region, bulk congregation of dead and damaged shells of *B. candida* might be ascribed to the above-mentioned fact. Regular dredging activity is needed to make the navigation channel deeper. Being an indicator species for the higher level of organic matter concentration in the sea water, *Barnea candida* is now considered as a sentinel organism to evaluate the ecological status for Black sea<sup>1</sup>.



Figure 2: Dhamra Port Area



Figure 3: *Barnea candida* (A: Dorsal Side; B: Ventral side; C: huge bulk of dead carcasses; D: Gastropods; E-I: Taxonomic Identification)

# Conclusion

Present study is important on two aspects; first it provides the occurrence of range extension to *Barnea candida* in the Dhamra estuarine complex and port areas which has been confirmed after the prolonged scientific expeditions. Secondly, massive number of shell carcasses of *Barnea candida* and other molluscan bivalve spreading near to port area and Dhamra estuarine zone are observed which might be ascribed to the physical disturbances largely due to bottom dredging.

Since, *B. candida* is a well-known borer species but, the quantum loss to the mangroves, shipping industry and fishing crafts by the *B. candida* is hitherto scientifically untouched from the study area. Therefore, a comprehensive study on these aspects should be carried out on priority basis.

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