Effect of Dredging on Intertidal Meiofauna Distribution of Tapi River

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ABSTRACT
Human Interference in the form of dredging in the estuary is a harmful activity which ultimately affects distribution of benthic community which may be caused due to change in sediment composition, unstable nutrient composition, lower dissolved oxygen levels, release of toxic substance during the process, and increased turbidity. Estuaries are the intermediate water body with extreme alteration in the composition of water and nearby soil properties due to influx of marine water during tides. Both by human interference as well as by natural commotion, this paper concludes the impact of such physical agitation on macro-faunal communities as well as physicochemical properties of water and sediment composition. Marine beds are very much in demand to get explored by dredging. The aim of present work was to provide a comprehensive study about the extent to which benthic community and prevailing ecosystem has been disturbed by the interference and an insight about recovery of the benthic population disturbed. The assessment has been done by comparing two sites which were subjected to dredging with one undisturbed reference sites. Most of the analyses suggested that sediment composition and lowered nutrient levels are the main constraints affecting the distribution of benthic community.

I INTRODUCTION

Human activities impart effect upon the environment so as upon estuarine ecosystem and prevailing ecological processes. Such effects cause deterioration in the quality of ecosystem and on estuarine and marine species also it is indirectly harmful for human (Balmford *et.al.,* 2002; Wackernagel *et.al.,* 2002)

The faunal community similar to the species which were present at the place prior to disturbance re-establish to the place which shows the inclination. The statistical analyses conclude the biological recovery; or by means of a comparison between altered areas and natural undisturbed reference areas (Cooper *et. al.,* 2007). Several indices, such as number of individuals, number of species and biomass, have been used to assess the status of community assemblages following aggregate dredging (Kenny and Rees, 1996; Carvalho et al., 2001; Boyd and Rees, 2003; Newell et al., 2004; Sanchez-Moyano et al., 2004; Cooper et al. 2005). According to Gray (2000), the number of species alone does not represent the real structure of an assemblage in a community because the number of individuals per species varies. Most popular indices use a combination of species richness and evenness, for example the Margalef index and the Simpson index (Magurran, 2004).

Dredging is the physical agitation which causes the disturbance in benthic habitat which promote the organism to move on to a new place. Macrofauna which are filter feeders are selective to a particular size of sediment, the species composition of such macrofauna changes frequently (Szymelfening *et. al., 2006)*. In the study, samples has been taken from two site comparing the disturbed with comparatively undisturbed. The biodiversity of an disturbed may recover once the habitat settle down to normal condition (Elliott *et.al.,* 2007) Recovery pattern of meiofauna is after dredging activity is very important as it also helps to give an idea of rehabilitation of dredged area (Boyd *et.al.,* 2004). To restore the degraded habitat is a prime concern of ecosystem management (Apitz *et.al.,* 2006; Borja *et.al.*, 2008) An Ecosystem and its functioning can better evaluate as per the functional role of species (Loreau. e*t.al.*, 2001)

A recent study by Cooper et al. (2005) covering the period from 2001 to 2004 found that the meiofauna of the area was dominated by a number of polychaete worms (e.g. *Pomatoceros lamarcki, Lanice conchilega and Lumbrineris gracilis*), Crustacea (*Pisida longicornis)*, echinoderms (*Amphipholis squamata* and *Echinocyamus pusillus)*; and also a high abundance of colonial species such as hydroids (*Sertularia cupressina*, *Plumularia setacea*,) and bryozoa (*Alcyonidium mytili* and *Bugula plumosa)*.

Dredging imparts alteration of water quality and along with this also cause alteration in intertidal soil quality. Certain Physico-Chemical parameters have been analyzed throughout the season to relate quality of the aquatic habitat with the diversity of the organisms.

II METHODOLOGY

Study area: Certain dredging spots in Tapi river at surat district, has been selected for the study. Tapi river rises in the eastern Satpura Range of southern Madhya Pradesh state, and flows westward, draining south Gujarat, before emptying into the Gulf of Cambay of the Arabian Sea, in the Surat District of Gujarat. Three sites has been taken with-in the Surat, Gujarat. The sites are Furza-Chowk-S1, Magdalla Jetty-S2, Magdalla bridge- S3. Site 1 is 20 km away from Site 2 which in turn is nearly 8 km away from Site 2. Water sampling has been done monthly. The water parameters selected were pH, temperature, DO, BOD, COD, macronutrients, chlorine.

Soil sample has been taken by core sampler of 4Cm radius. Certain physical and chemical parameter observed includes soil pH, temperature, alkalinity, chloride, nutrients, soil texture, moisture, porosity.

III RESULT AND DISCUSSION

Other factors including biota itself cannot be overlooked for the disturbance in soil consistency. Species also show resettlement on the same substrate after dredging activity completion. Following are certain consequences which have been observed during one year of sampling.

(a) Effect of Benthic biota activity on sediment stability- Sediment dynamics, including profile, texture and moisture must be evaluate to understand and estimate morphological changes in soil, pollution quotient in estuarine, marine and intertidal ecology, interdependency of biota and sediment (Collins and Balson, 2007).

Shifting sediment due to any activity will change the topographical arrangement gradually the texture of soil (Kenny and Rees, 1996). Disturbance due to dredging ultimately releases sediments as well as contaminants into the water column which alters the water quality (Boyd et al., 2005; Cooper et al., 2005). Alteration in sediment quality by eroding the uppermost surface may also improve the sediment quality. This may improve the habitat for resettlement of benthic communities (Hall, 1994). The other way round dredging can also erode and uncover the unsuitable surface and which may hinder the resettlement of benthic community (Kenny and Rees, 1996). Thus, given that sediment fluctuation is very important when it comes for biodiversity development (Saunders, 2007)

(b) Effect of dredging on benthic community and sediment quality- There are few effects which dredging impart upon the physical as well as biological characteristic features of studied area. First direct most are removal and alteration of the sediment substrate, removal of biota from the substrate, destruction of biota by the dredger, alteration in benthic communities due to changes in quality of substrate. Certain indirect effects are like noise pollution raised due to dredger, released fine sediment particle in water profile, released or imported nutrients' concentration of an area. The influence of dredging is sometime not specific but also alters nearby areas too (Newell *et. al*., 1998; Boyd *et.al.,* 2005) and it's a must to consider these factors when we talk about the potential environmental effect of dredging in an ecosystem.
The site S2 shown maximum variability in sediment composition when compared with S1*i.e.* Furza-chowk (fresh water area, near temple) and S3 *i.e.* Magdalla bridge (estuarine zone). There are some factors which also effect the sediment composition and cannot be explained well in dredging context like time era of sampling, dredger's head shape, frequency and topography of the riverbed. The S3 also shown variation in sediment composition with comparison to reference site S1 which explains that soil composition also varies naturally by the time and the species invading in that particular area adapt according to the simultaneous prevailing conditions. Boyd *et.al.* 2005 also contributed by his studies on sea bed that natural variation may have not changed due to any human activity and still participating and contributing along with post dredging settlement. While the gravel component in sediment texture has been recorded high at S3, the low dredging intensity site, an increase in gravel texture was significant along with reduction in coarser particles at S2, high intensity site. Sediment composition of S3 found to vary from S1, reference site in terms of gravel fraction. Although the basic features of the substrate were different, gravel part of the soil texture found increasing nearly in same trend at all of the sites throughout the study period (Cooper *et.al.*2005). The variation of gravel fraction found to be least in post-monsoon season, which support the concept of physical recovery of sediment naturally. After comparing sediment texture of all the three sites coarse sand and gravel fraction shown substantial variation due to dredging, gravel fraction being the more responsive particles shown intense sensitivity towards any agitation. It may be concluded by the results that the difference between the benthic gatherings of both sites is due to this factor. The biological impact includes decrease in richness of biodiversity as well as number of individuals. While the dredging impact on physical properties of sediments includes

variation in soil profile, soil texture and nutrients distribution (Cooper *et.al.*, 2007)

Intertidal zone near the high intensity and low density dredging site also show distinct agitation when compared to the reference site. The benthic biota compositions of these intertidal zones represent the communities of corresponding sites of estuarine area in river Tapi. This fact give an insight about the dwelling of biota between intertidal mud flats and river bed, because they found both of the environment nearly same in at least nutrients composition. Moreover, species gathering shows an abundance at intertidal mud flats (Newell *et.al.*, 2004). Species seems to shift over to intertidal mud flats to avoid the intense variation raise due to dredging activity (Szymelfenig *et.al.*, 2006). However some intertidal patches at reference site also shows similarity in biota composition. While few species shows no variation in composition resulting due to changes in sediment composition at dredging sites (Cooper *et.al.*, 2011). Which can be observed as that some species are doesn't show affinity to a particular texture.

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