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Climate change and status of migratory shorebirds

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Abstract

The coastal wetlands are degraded / destroyed in the recent years. The rapid changes of mud flats resulted in decline of coastal life forms and ultimately the shorebirds due to the poor availability of prey species. Climate changes such as tsunami, and global warming are the causes of qualitative change in the habitat.

Keywords: coastal wetlands, mud flats, shore birds and tsunami

In the recent decades, many coastal wetlands have been destroyed or degraded, resulting in major impacts on shorebird populations (Goss-Custard and Moser, 1988). Collectively some species have probably declined 50 per cent to 60 per cent in the last 30 or 40 years. The precipitous decline is primarily due to wetland habitat loss and as consequences, the wetlands worldwide have seen great losses, (Science Daily News, 2008). In this context identifying the causes for the widespread decrease in the number of shorebirds is a vital issue in developing conservation strategies. In fact most of the coastal habitats have almost disappeared in the east coast of southern India because of coastal erosion and severe ecological change, a study shows within ten years. The mudflats are shrinking at a much faster rate which results lose of benthic organisms, that forms the major prey items of migratory shorebirds.

Availability of habitat and prey base by using the method of (Ntiamoa-Baidu *et aI*., 1998). The study was conducted in recent months from November 2009 to January 2010 (pre-migratory and migratory periods) at six tidal flats viz., Pazhaiyar (79° 49' 11"; E 11° 21' 22" N), Thirumullaivasal (79° 50' 11"; E 11° 21' 23" N) and Niravi (79° 51' 02" E; 10° 53' 25" N) and three were sandflats at Chinnangudi (79° 51' 19" E ;11° 05' 33" N), Tharangambadi (79° 51' 19" E; 11° 01' 35" N), and Karaikal (79° 50' 03" E; 10° 57' 07" N) of east coast of Tamilnadu and Pondichery state. It was found that the mudflats are losing the prey availability as well as shrinking of tidal flats when compared to the previous results (Pandiyan, 1999). The availability of tidal mudflats, abundance and distribution of prey are very important for migratory shorebirds. Numerous studies have shown positive correlation between shorebird abundance and their invertebrate prey availability at both fine (Boettcher, et al., 1995) and large spatial scales (Placyk and Harrington 2004). In addition to prey availability, the habitat use of shorebirds may also be constrained by their foraging (e.g., accessibility of prey detection) (Barbosa and Moreno, 1999). However, the availability of exposed surface areas is vital features for foraging the shorebirds (Pandiyan, 2002).

The rapid changes of mudflats have resulted in a direct impact of coastal life forms and declining the bottom substrates viz., benthic organisms such as brine shrimps, amphipods, chironomid larvae. The effect of these factors is directly influencing the shorebird population, which has been already well established by many studies in and around the world, i.e. positive relationships between shorebird abundance and invertebrate prey density (Ashley et al., 2000). Although many studies reported that the east coast of India, especially the Tamilnadu and Pondichery regions, play a significant role for shorebirds because many extensive wetlands are found there, including the Pichavaram mangroves and the swamps at Point Calimere (a Ramsar Site) (Nagarajan and Thiyagesan, 1998). Apart from that certain unprotected tidal flats are also found in east coast which, are important for the shorebirds and these unprotected wetlands are acting as a stop over site for migratory birds, because of abundance and distribution of prey (Pandiyan, 1999, 2000, 2002; Pandiyan et al., 2006; Pandiyan and Asokan 2008 a&b).

In fact initial survey was made in the above said tidal flats of east coast of Tamilnadu region during 1999 and reported 26 shorebird species and subsequent continuance of survey during 2000, 2001 and 2002 reported shorebirds species richness of 21, 19 and 17 respectively. On the other hand, bird census conducted during October 2009 to January 2013 (migratory season), bird censuses were done in in the same regions (two census per month, during low and high tides) revealed that there were only 10 species during 2009 and 8 species during 2013 viz., Kentish plover (*Charadrius alexandrinus*), Little ringed plover (*Charadrius dubius*), Little stint (*Calidris minuta*) Great sand plover (*Charadrius leschenaultia*), Common sandpiper *Actitis hypoleucos*and, Yellow wattled lapwing (*Vanellus malabaricus*),Red wattled Lapwing (*Vanellus indicus*) and dunlin (*Calidris alpine*). This indicated that there had been rapid changes in these tidal flats and shorebird population during this period

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of ten years. Interestingly there were no strong winter visitors observed in these coastal tidal flats when compared to the previous years.

The decrease in the shorebirds species might be due to the poor availability of prey bases. A remarkable change in the prey abundances was recorded from the benthic sampling (mud samples) made at random from each tidal flat. Three core samples were taken from a 10-cm diameter (78.5 cm^2) area at a depth of 20 cm, from each point which is the greatest accessible depth for most shorebirds (Masero *et al.*,1999) The samples had just 8-15/m^2 chironomid larvae, whereas in the earlier report it was 19-187/m^2 chironomid larvae (Pandiyan, 2000). This indicated that availability of prey declined drastically in these tidal flats which could be the reason for the remarkable decline in shorebirds.

It is concluded that the impact of Tsunami might have played a major role. In fact the available surface area of these tidal flat is shrinking. The availability of surface area by using Sigma Scanpro, Version 4.0 was analysed. All the tidal flats were covered and only the exposed area of 0-20cm around the edge was available for the foraging shorebirds. However, the accessible exposed area varied with reference to water levels, which were measured at the specific depth in each tidal flat while conducting surveys. The status of the depth of each tidal flat was confirmed by conducting various transects, and the exposed area accessible for foraging, while time of survey was estimated by image analysis (Sigma Scanpro, Version 4.0).

The climate change and global warming ultimately damage the coastal ecosystem, which has been already established (Polunin, 2008). Global temperature influences water and ice volumes and, thus they have the impact of the sea level (Rahmstorf, 2007). Sea level influences the inundation and establishment of coastal habitats and ecosystems (Peters, 2008; Hoegh-Guldberg, 2007). The rate of sea level rise during the 20th century was proportional to the warming above pre-industrial temperatures (Rahmstorf, 2007), and extrapolation suggests further rises of between 0.5 and 1.4 m and above 1990 levels by 2100. Sea level changes impact habitat space, drive speciation, influence biodiversity (Peters, 2008) and alter local nutrient flux. Whilst rising sea levels could mean the end of some island nations, they could bring some respite to coral reefs as abandonment by humans of some atolls may lead to reduced fishing pressure. Elsewhere rising waters may force organisms towards steep, artificial sea defenses, with implications for intertidal sediment-dwelling organisms, zoned rocky-shore ecosystems and nursery habitats (Hoegh-Guldberg *et al.*, 2008).

The overall impact of the climate change and global warming are creating oceanic warming. Ocean warming may partly counteract the acidification process, but the scale of impact will be insufficient to provide long-term reprieve from increased CO_2 (Hoegh-Guldberg *et al.*, 2007) One of the main impacts of ocean acidification on marine life arises because of interactions between acidity and carbonate availability. A taxonomically diverse array of marine organisms, including tiny coccolithophores (a type of phyto plankton), pelagic and benthic mollusks, fist-sized starfish and urchins, as well as massive corals, require calcium carbonate for their skeletons, and others have key carbonate rich structures (e.g. fish otoliths). All of these are likely to suffer as increasing acidity reduces carbonate availability, and impacts at the species level may cascade through widespread community change (Hall-Spencer *et al.*, 2007). It shows that the climate change and global warming are affecting the productivity of coastal ecosystem.

In fact the present study and other studies clearly states that there is a real threat to the shorebird's food security due to climate change and global warming. Mudflats are coastal wetlands that form when mud is deposited by tidal rhythm or run of water from rivers streams. They are found in sheltered areas such as bays, lagoons, and estuaries. Due to the climatic changes the elevating sea levels and changing coastal ecosystems had damaged the tidal flats. So, damage to mudflats has become a global concern. When a species is approaching the extinct stage, it is possible to save that species by using *ex-situ* conservation measures such as captive breeding programme, artificial breeding techniques and cryopreservation whereas the loss and alterations of habitats due to natural disasters such as cyclone and tsunami are unavoidable and are difficult to control. Hence, it is essential to find ways to overcome the natural problems by using proper habitat management for the conservation of biodiversity. It is vital to assess the habitat loss and alterations as soon as possible, immediately after the natural disaster, and restoration of habitat to its earlier condition by adopting management strategies such as removal of silt deposition, opening of closed estuary mouths, prevention of soil erosion, maintenance of fresh water discharge, etc. Therefore 'early detection and rapid response' towards habitat loss and alterations could prevent loss of biodiversity.

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