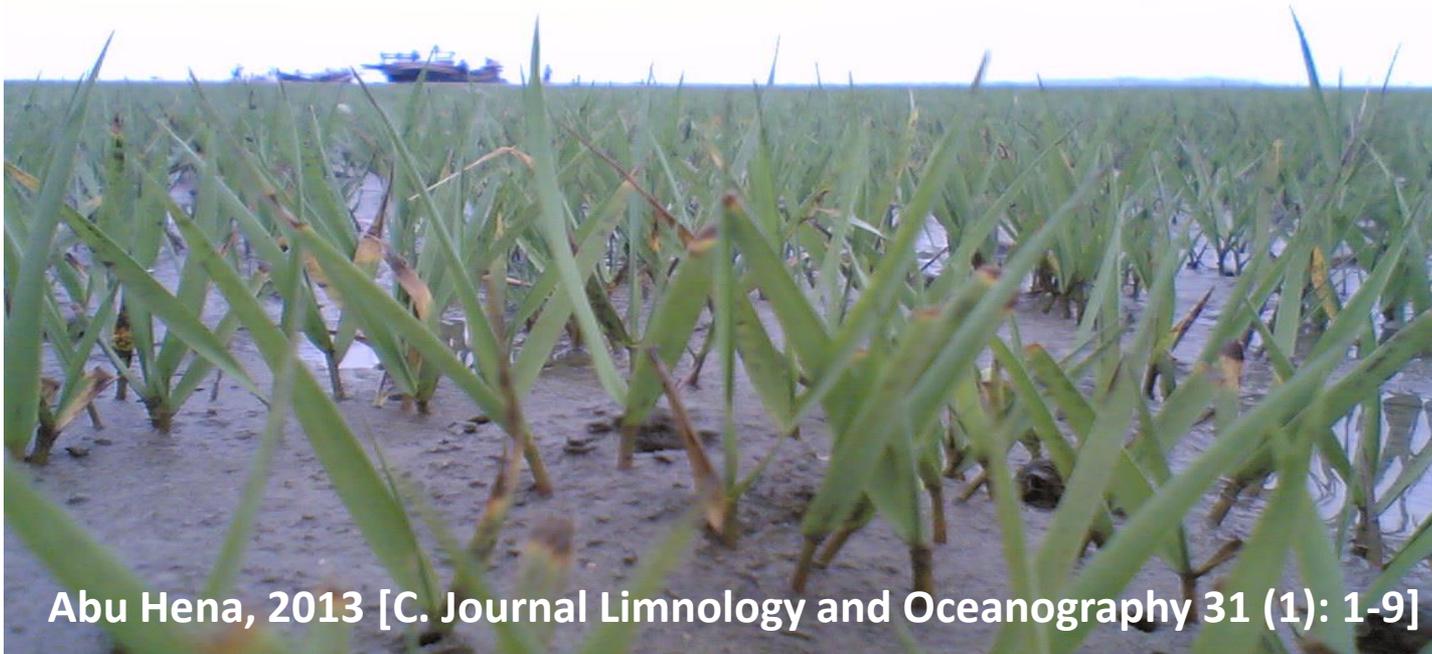


Vulnerability of Coastal Resources to Climate Change and Sea Level Rise in the North Eastern Estuarine Coast of Bay of Bengal, Indian Ocean



Abu Hena, 2013 [C. Journal Limnology and Oceanography 31 (1): 1-9]

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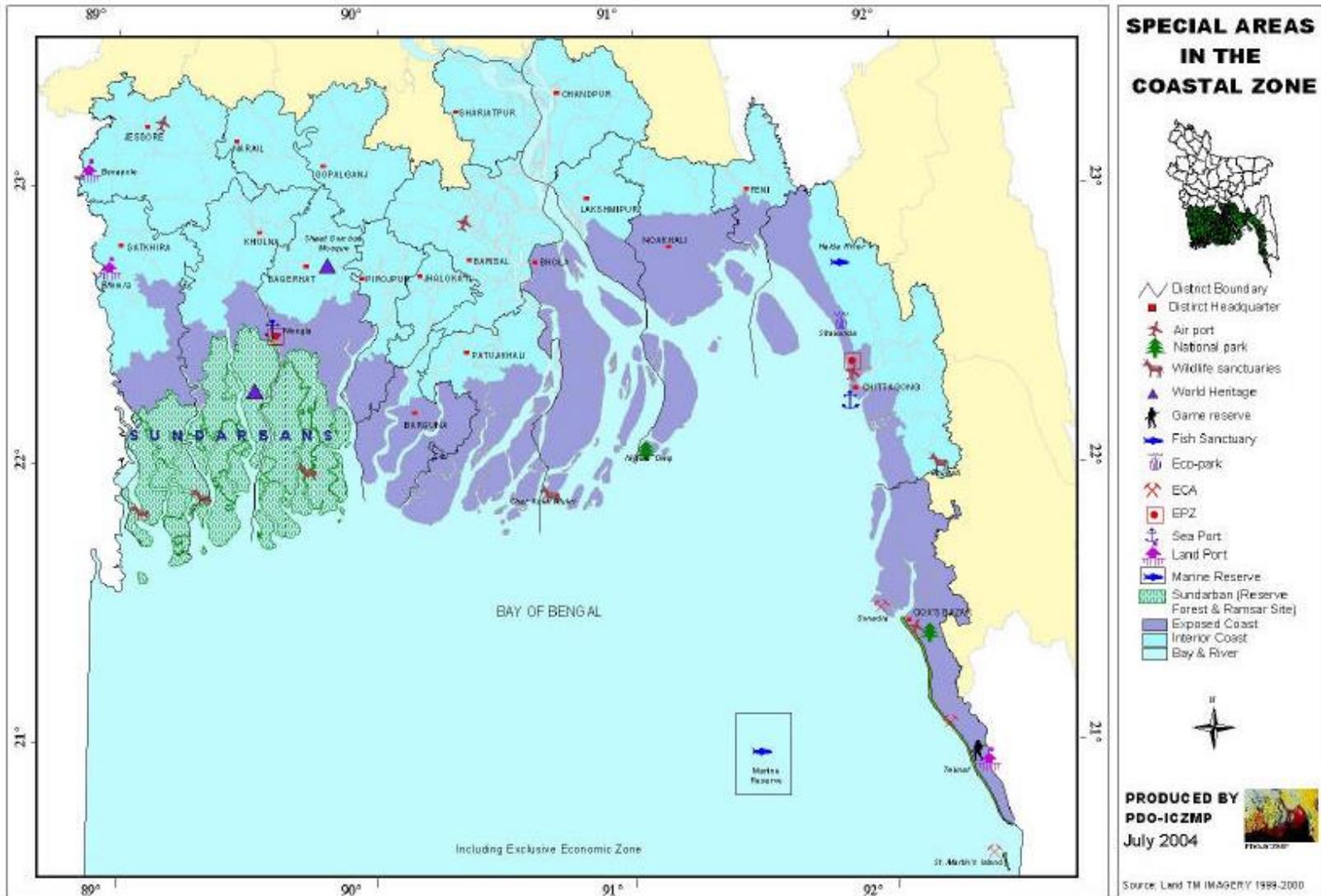


Fig: Coastal Area of North Eastern Area of Bay of Bengal (Bangladesh)

Coastal Inter-tidal Macrophytes

24 spp.

Mangrove →



5 spp.

Salt Marsh →



4-5 spp.

Seagrass →



Inter-tidal Macrophytes and Their Importance

- Macrophytes grow in the **transitional area between the land and water**, occurring along the inter-tidal shore of estuaries and coastal areas.
- **Live macrophyte in the inter-tidal zone is not only a source of food but dead plants are source of nourishment for many species in the coastal and marine ecosystem.**
- Biologically it is important for estuarine and **coastal food chains, primary productivity** and a supporting resource for estuarine food webs.
- Hydrologically it supports the water quality and maintenance of groundwater.
- **Physically it protects coastlines from the erosive effects of storms and extreme tides.**
Traps and binds sediment aiding in the land making process.
- Macrophytes produce peat from decaying litter fall while the growth of pneumatophore, root, rhizome and stem trapped sediment in the water including litter. The process of building peat helps coastal macrophytes keep up with sea level rise.

Functions of Macrophytes (Cox's Bazar Coast)



Climate Change and Marine/Coastal Ecosystem

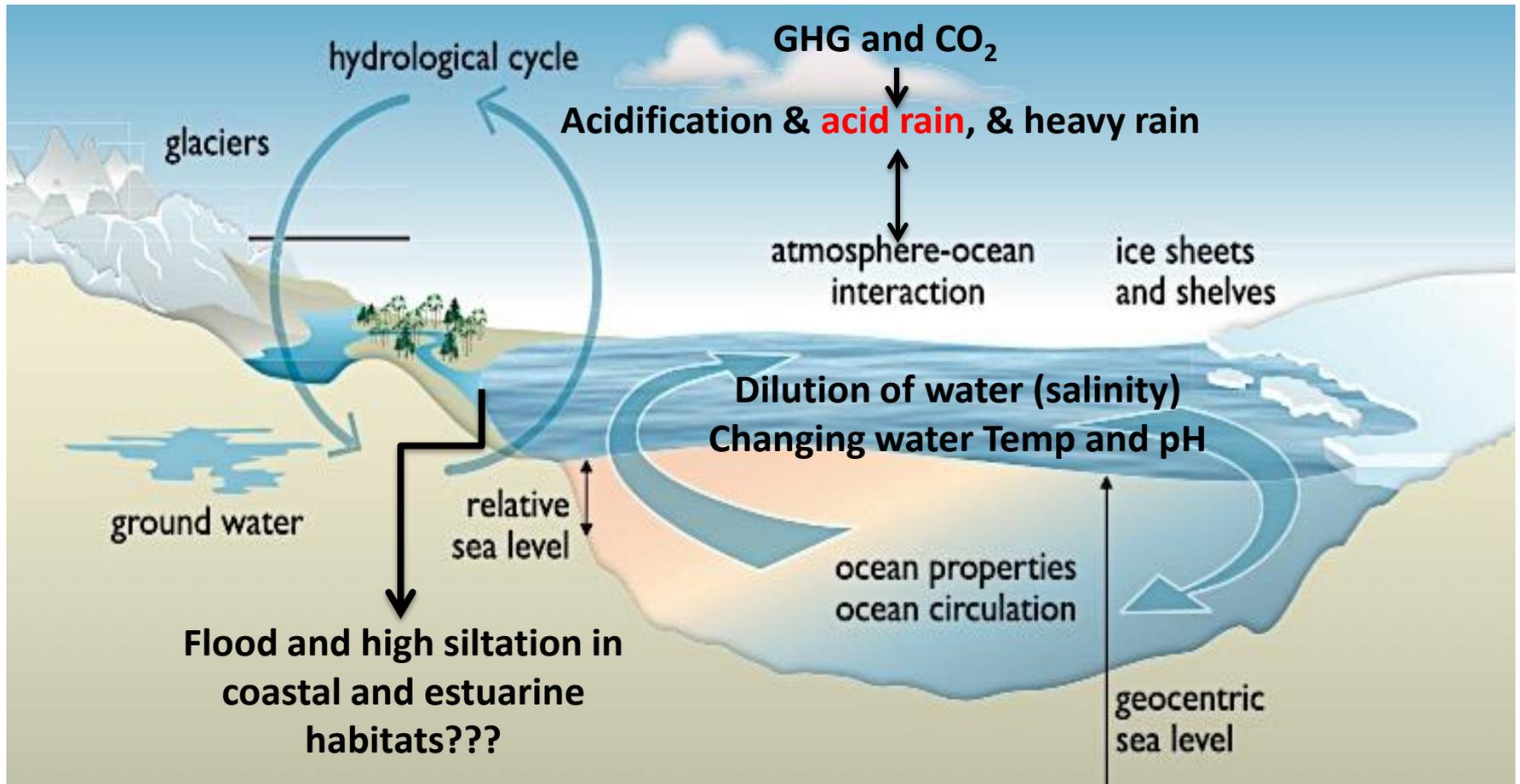


Fig: Climate-sensitive process and component that can influence global and regional sea level and ecosystems (Modified from IPCC 2013, AR5).

Impact: A Case for Breeding Crab

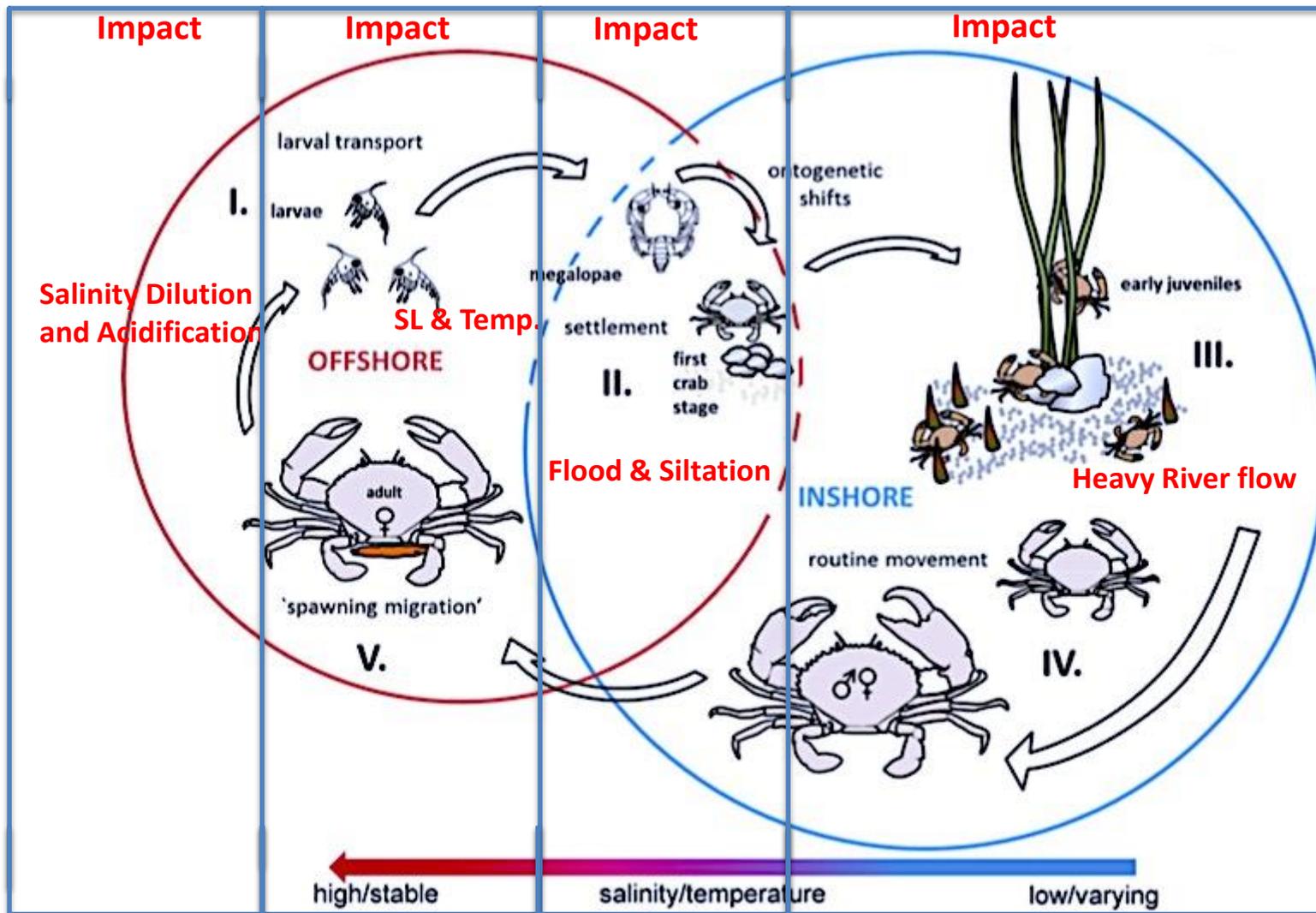


Fig: Schematic drawing of the life cycle of *Scylla serrata*. The arrow indicates the gradient for salinity (from low/varying to high/stable) and temperature (from varying to stable)

Modified from Hilke et al. 2016

Impact: A Case for Breeding Fish

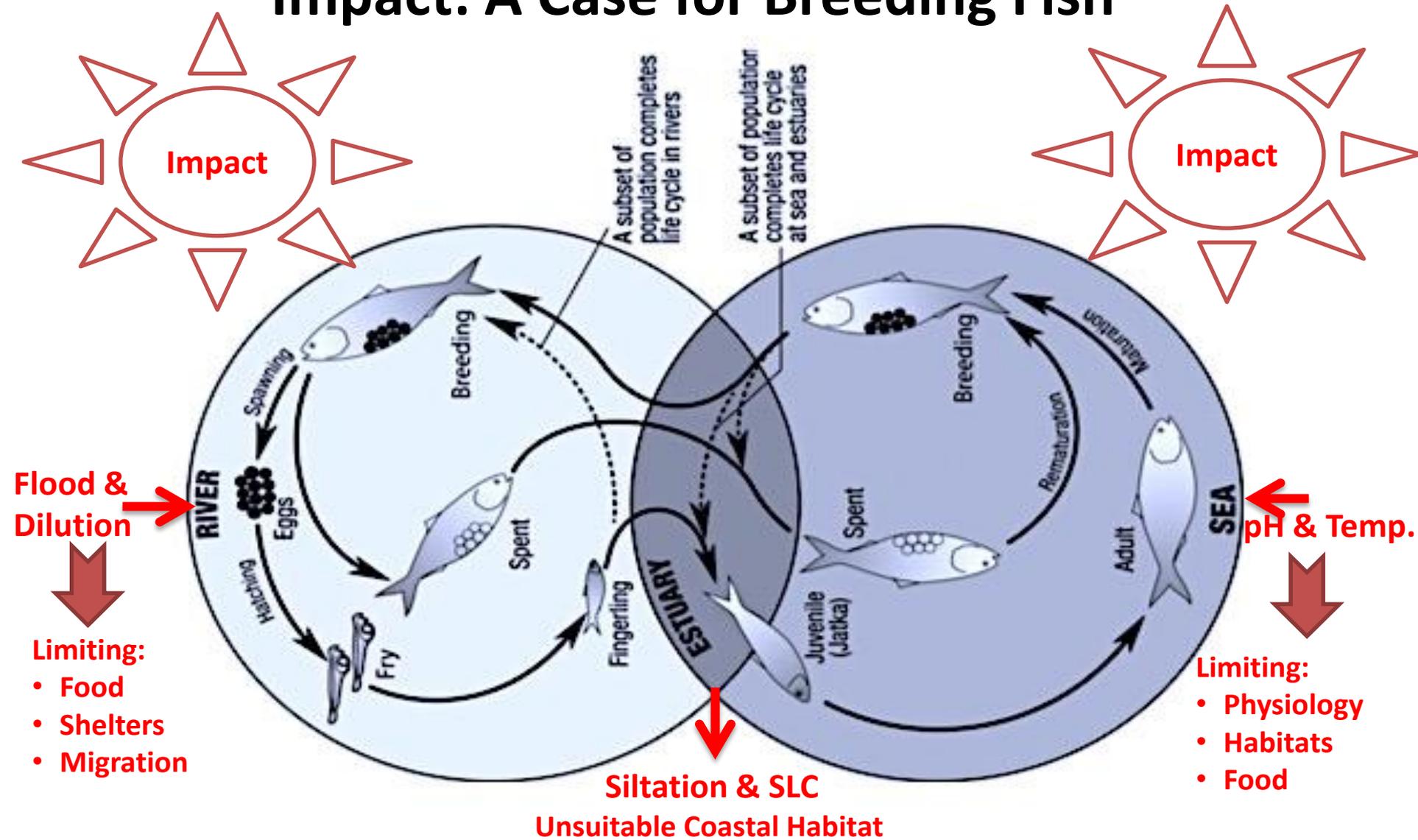


Fig: Life cycle of Hilsa shad and effect of climate change on the cycle (Modified from Hossain et al., 2016)

Impact on Inter-tidal Macrophytes of Bangladesh

Mangrove

- @ One of the likely adverse impacts of climate change is **the loss of the inter-tidal resources like Mangroves in Sundarban and other coastal forest and plants** (UNESCO, 2002 from IPCC).
- @ If the Sundarbans are lost, the habitat for several valuable species would also be lost. A 45 cm sea level rise would inundate 75% of the Sundarbans, and 67 cm sea level rise could inundate all of the system (UNESCO, 2002 from IPCC).
- @ **Extrapolating** from this information, Smith *et al.* (1998) **calculated that a 25 cm sea level rise would results in a 40% mangrove loss.**

Salt Marsh & Seagrass

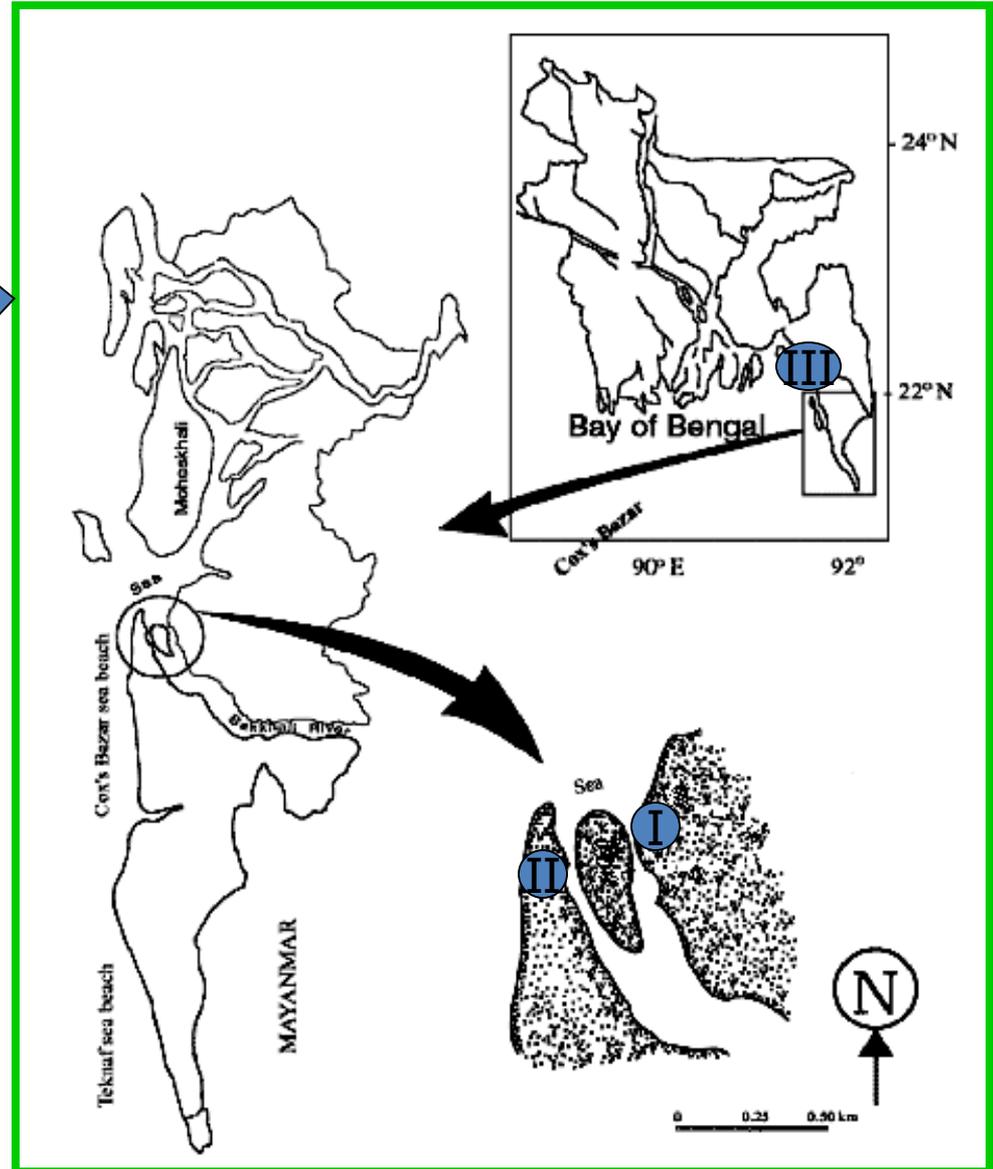
- @ Increasing sea level would results in **uprooting of salt marsh and seagrass due to shore line erosion of inundated but unstable sediments.**
- @ The **greatest impact** will occur on the **inter-tidal zone due to increases of water level** especially at **the deeper or lower edge.**
- @ These species may **colonize newly** inundated lands, if the **environment is suitable** to grow the species or will **die.**
- @ The **vertical rise in the water column due to SLR and limitations of shoreward margins** may results in water logging, which ultimately killing inter-tidal biota.

A Case Study as IPCC Said

The location of the case study area is situated in the Bakkhali estuary, Cox's Bazar at the southeastern part of Bangladesh.

The approximate geographical location of this estuary is between $20^{\circ} 85' 40'' - 21^{\circ} 46' 92''$ N and $91^{\circ} 96' 60'' - 92^{\circ} 34' 37''$ E (I & II).

The area is situated at the Salimpur coast, Chittagong and located at $22^{\circ} 15' N$ and $91^{\circ} 49' E$, and 15 km away from Chittagong port city (III).



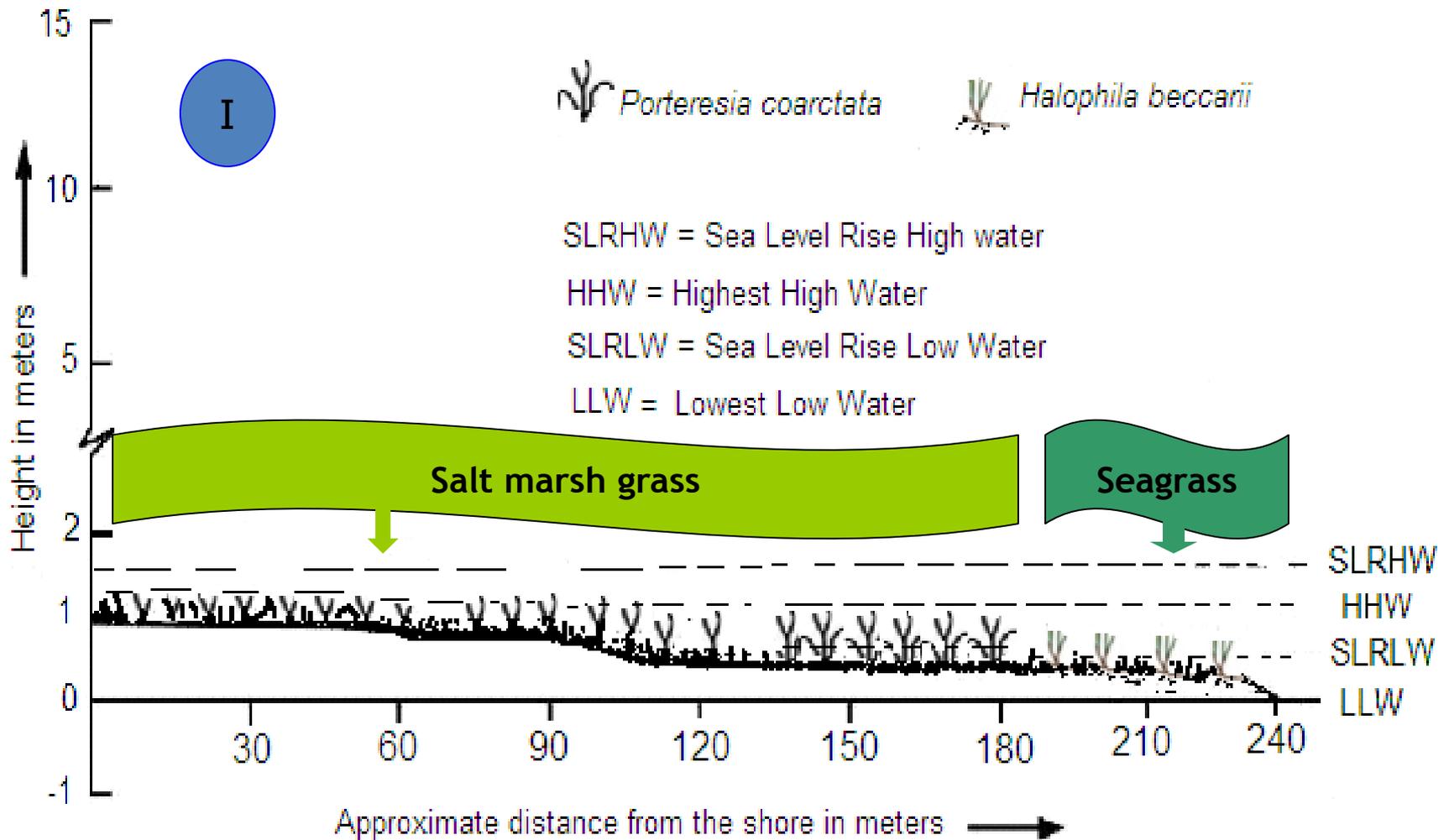


Fig: Likely impact of sea level rise on seagrass and salt marsh zone in the Bakkhali estuary, Cox's Bazar, Bay of Bengal (Abu Hena, 2010).

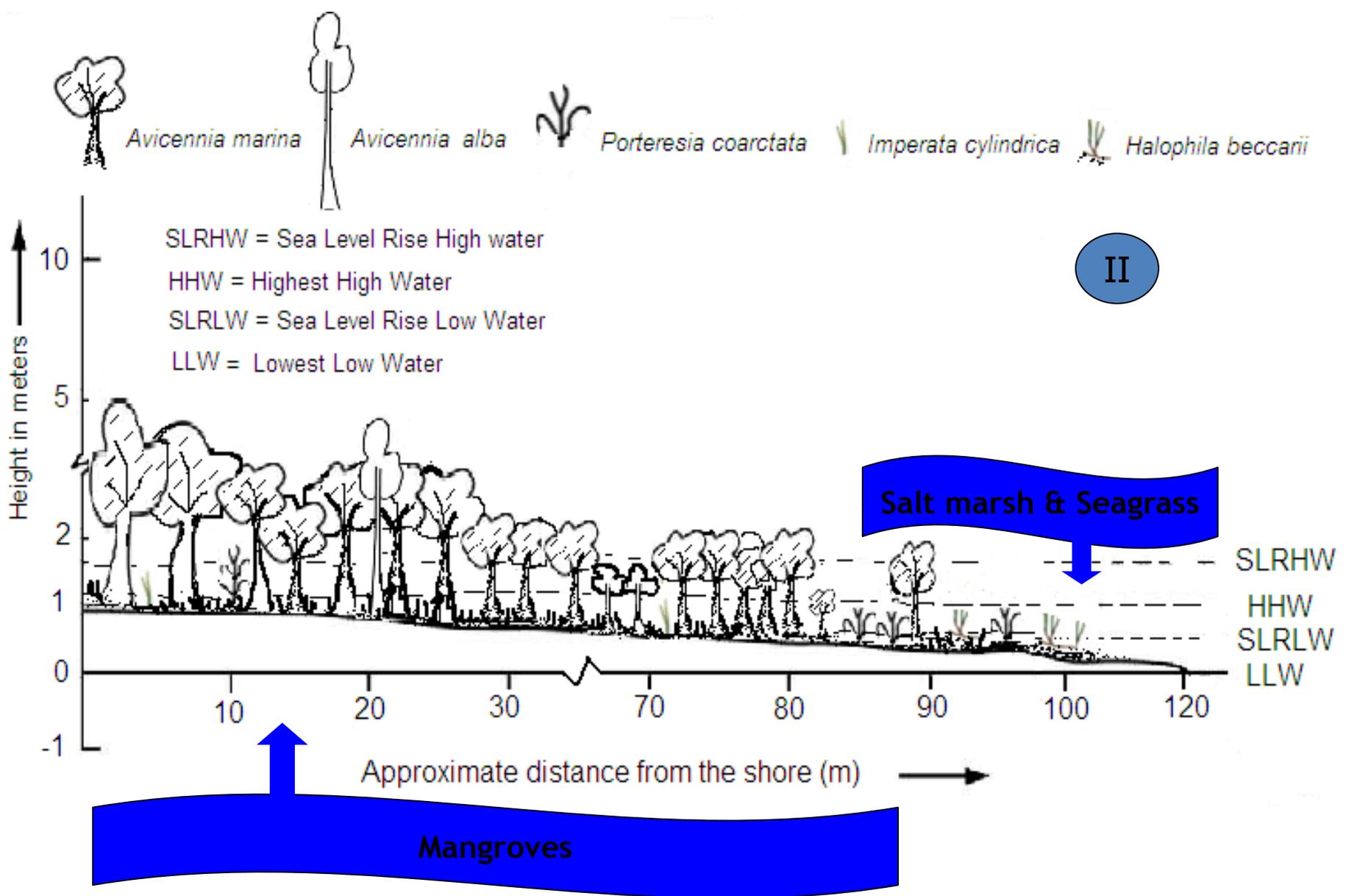


Fig: Limited landward shift and vertical rise in water column in the mangrove vegetation zone in Bakkhali estuary, Cox's Bazar (Bay of Bengal) (Abu Hena, 2010).

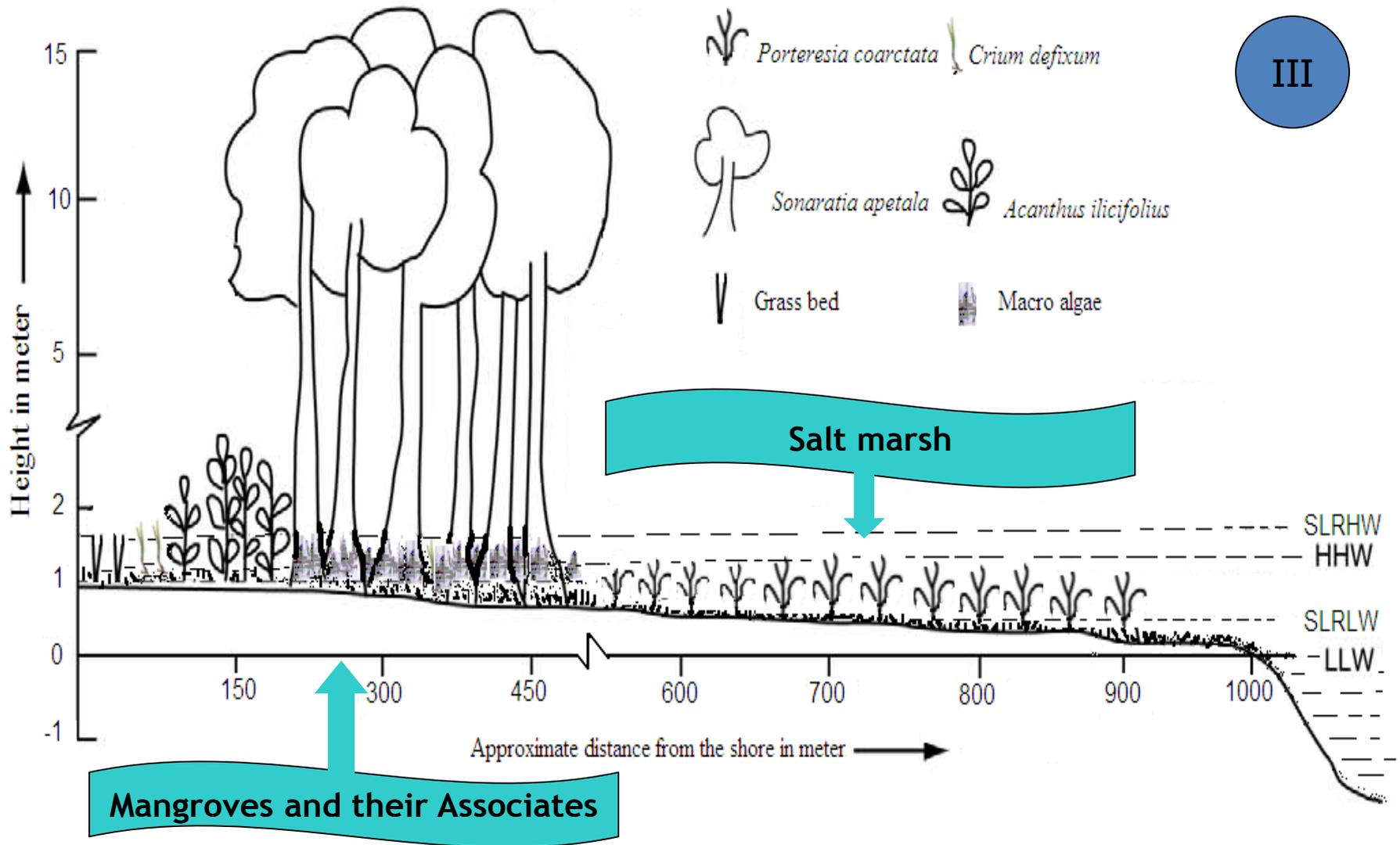


Fig: Limited landward shift and vertical rise in water column in the intertidal zone in the coastal area of Salimpur, Sitakunda, Chittagong (Bay of Bengal) (Abu Hena, 2010, 2013).

Do We Have Any Hope?

According to IPCC: 16-17% of land will be submerged under water including Sunderban and 112 million people will be climatic refugees !

Drawbacks/Limitation of IPCC comments are:

Sedimentation and rate

Land erosion and accretion

Role of plate tectonic

Coastal land formation and water flow from Himalaya

Role of mangrove and salt marsh etc.

Therefore, it is still doubtful and unclear what percentage of North Eastern Part of Bay of Bengal (Bangladesh) will be submerged under water due to sea level rise!

The Message

We Do Have Hope and Good News!!



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Accumulation of peat and sediment at salt marsh and seagrass bed which may keep up the land to fight against sea level rise

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Planted Mangroves in mud 20
years ago (~1 m Deep Mud)



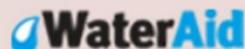
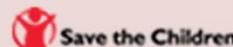
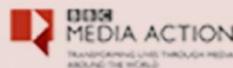
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According to Hendry and Digerfeldt (1989), mangroves communities were able to sustain themselves in western Jamaica because their rate of sedimentation exceeded the rate of the Mid-Holocene sea level rise i.e., 3.8 mm/yr. Mangroves may expand their range despite sea level rise if the rate of sediment accretion is sufficient to keep up the sea level rise.

Conclusion and Climate-resilient Bangladesh

- @ The Inter-tidal ecosystems are complex in nature. A multidimensional long term study for monitoring the impact of climate change and sea level rise is needed.**
- @ Role of inter-tidal macrophytes in coastal land making process against sea level rise should be monitored constantly using Surface Elevation Table (SET)!**
- @ The changes of hydrological, ecological and biological characteristics of inter-tidal areas of Bay of Bengal are needed to be monitor constantly.**
- @ Global policies and biodiversity regulations will be needed to implement strictly for mitigating emissions of Green House Gases and conservation of marine habitats.**

Thank You



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