



Comparing fisheries across climate change vulnerable deltas

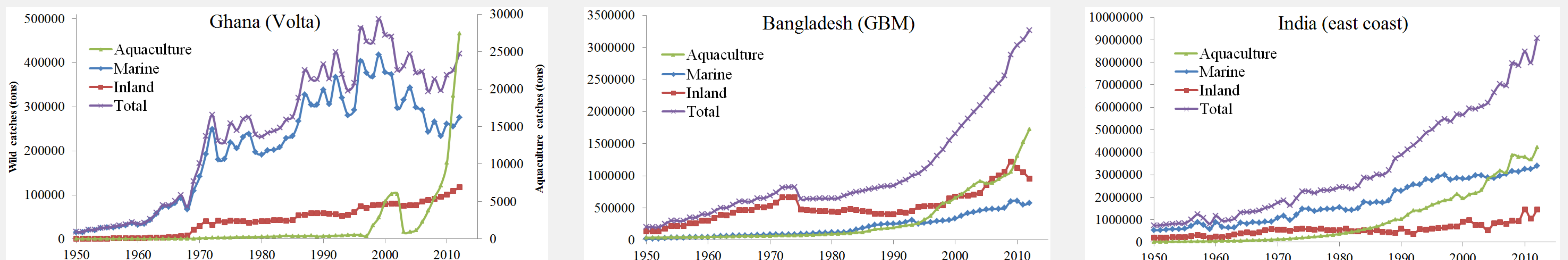
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Fisheries provide 24% of animal protein consumed and employ over 72 million people worldwide. In recent years the world per capita fish consumption has been increasing from an average of 9.9 kg in the 1960s to 19.2 kg in 2012. In Bangladesh and Ghana around 50-60% of animal protein is supplied by fish (12% in India). Fishery and aquaculture sectors are the main source of income for millions of low income families. Fish is also an important portion of total exports in India (23.7%), Ghana (19.6%) and Bangladesh (4.8%). Main export species differs across countries where Ghana and India is dominated by marine species, whereas Bangladesh export species (e.g. Hilsa Shad) are more linked to the delta.

| | Ghana Volta delta | Bangladesh GBM delta | India deltas: Ganges & Mahanadi |
|-----------------------|---|--|--|
| % GDP from fisheries | 4.2 | 4.4 | 4.7 |
| % fish protein intake | 60 | 60 | 12 |
| Consumption (kg/year) | 25 | 14 | 8.2 |
| % export from fish | 19.6 •Tuna spp. •Yellowfin tuna •Salmonids | 4.8 •Hilsa Shad •Freshwater fish | 23.7 •Hairtail •Mackerels •Pomfrets |

1. Catches structure in each country (Ghana, Bangladesh and India)

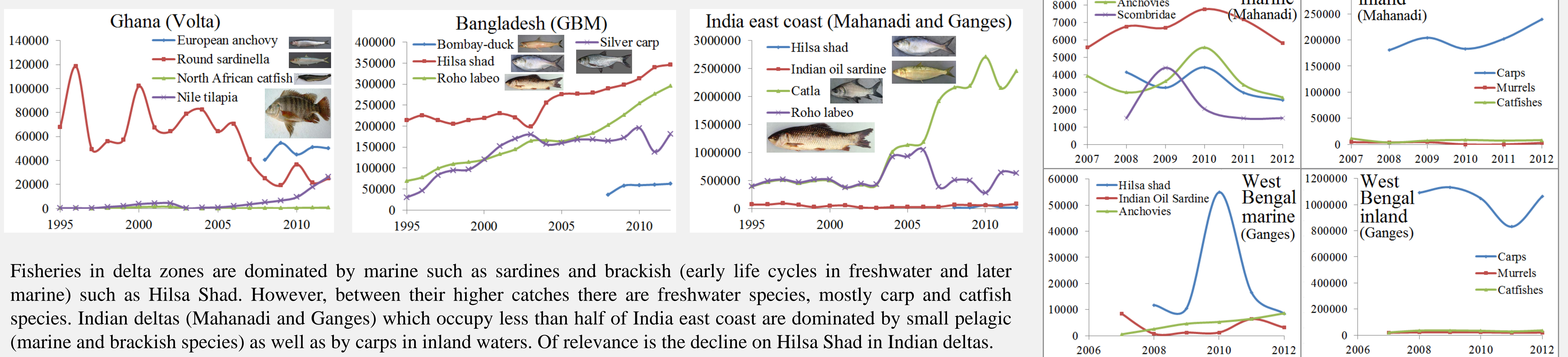


<http://www.fao.org/fishery/statistics>

| | Marine | Inland | Aqua. |
|------------|--------|--------|-------|
| Ghana | 70% | 27% | 3% |
| Bangladesh | 20% | 37% | 43% |
| India | 17% | 23% | 60% |

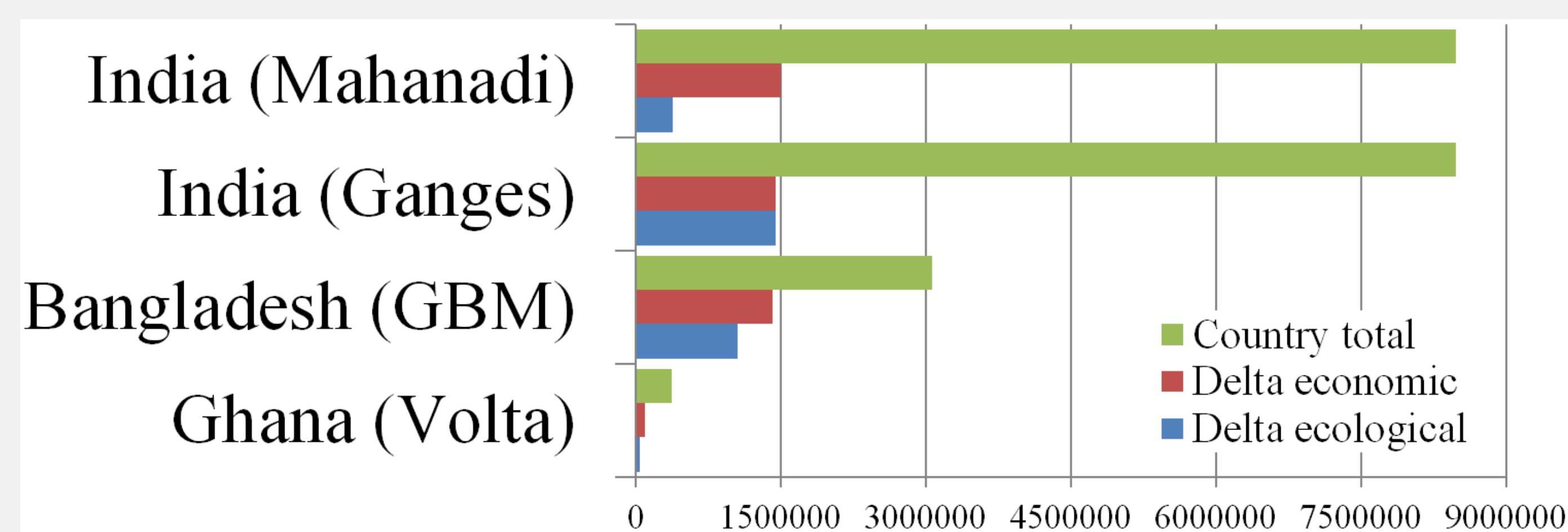
The country where aquaculture and inland fisheries is more developed is India followed by Bangladesh. Ghana is the country that shows the highest proportion of marine catches. However, Ghana also shows a high increase on aquaculture during last decade. In general, the three countries show a continuous increase on fish production driven mainly by aquaculture and to a lower degree by marine catches. Model projections in Bangladesh (Fernandes et al., 2016) show that catches increase is not due to an increase of the sea productivity, but due to an increase of fishing pressure from an increase in coastal population. For example, Hilsa shad has been fished around 2-3 times the Maximum Sustainable Yield (MSY). India and Ghana show also overfishing in species such as Bigeye grunt (*Brachydeuterus auritus*), Chub mackerel (*Scomber japonicus*), Red pandora (*Pagellus bellottii*), Bombay duck (*Harpadon nehereus*) or Indian mackerel (*Rastrelliger kanagartha*).

2. Main species catches in deltas



Fisheries in delta zones are dominated by marine such as sardines and brackish (early life cycles in freshwater and later marine) such as Hilsa Shad. However, between their higher catches there are freshwater species, mostly carp and catfish species. Indian deltas (Mahanadi and Ganges) which occupy less than half of India east coast are dominated by small pelagic (marine and brackish species) as well as by carps in inland waters. Of relevance is the decline on Hilsa Shad in Indian deltas.

3. Estimating delta catches (ecological vs. economic)



The ecological catches refers to catches of species which depend on the delta (freshwater and brackish). The economic catches are all the landing in DECCMA areas of interest (based on 5 meter contour line) independently of where they are produced or if they are species that needs of the deltas freshwater.

4. Fleet structure

| | Artisanal | Industrial |
|------------|--|--|
| Ghana | •49% •Gillnets •Seine nets •Hooks or gorges | •51% •Purse seines •Mid-water trawls |
| Bangladesh | •99% •Gillnets •Pots & Traps | •1% •Bottom trawl •Longline tuna |
| India | •49% •Gillnets •Boat seines •Driftnets | •51% •Shrimp trawl •Mid-water trawls •Bottom trawls |

5. Conclusions: Similarities and differences

This work highlights many of the similarities of fisheries across deltas. For example a growing aquaculture, fleets and species harvest over its MSY levels. But it also highlights some of the differences, mainly in terms of the species composition of the catches as well as the high dependence in Ghana of marine catches in contrast with India on inland catches. Ghana hatcheries developed in less than one decade producing 80 million fish seeds in a small area seems to be unique. However, only 2.5 % of the fish seed is produced in the coastal delta area.