CLIMATE CHANGE DIMINISHES INDONESIAN AQUACULTURE; DIVERSIFYING ITS LIVELIHOOD

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INTRODUCTION:

Indonesia is the fourth most populous nation. It is a maritime country that has the largest sea area with a coastline of 81000km.This vast country has more than 17000 islands scattered in the archipelago region. Indonesia has 800,000 ha of potential area for brackish water ponds of which 3, 60,000 ha have been used for aquaculture. Having a huge region, Indonesia has the economic potential of both biological and non biological in the maritime sector. The role of fisheries into Indonesian economy is very important. The output of marine economic sector supports approximately 7.86% to the economy. Marine sector contributes about 6.06% to the community income and 4.12% to the workforce. In terms of HTB this sector is essential to support approximately 6.64% to the national income.

PRESENT SCENERIO:

Indonesia waters have the big potential for Indonesia has 800,000 ha of potential fishery area for brackish water ponds of which 3, 60,000 ha have been used for aquaculture. These sites of ponds used by more than 100,000 farmers are classified into four categories:

A :< 2 ha (46.58%). B: 2-5 ha (31.37%)

C: 5-10 ha (14.70%). D :> 10 ha (8.35%).

Following the success experienced by some farmers to maximize profit aged brackish water ponds (designed for milkfish culture) converted to extensive or semi intensive shrimp ponds.

Large pelagic, small pelagic demarsal fish shrimps, reef fish, lobster and squids are the valuable fish resources of Indonesia Indeed, the potential of pelagic fish in Indonesia is the most promising one. According to the Ministry of marine and Fisheries (Ministry of marine and Fishery, 2013) the total production of processed fish in this sector reached 4.10*10000000t in the third quarter of 2013.The total production was highest in 2012 which was 4.83*10000000t.Looking at the domestic production of processed fish, it can be seen that there is a positive

growth about 6.6% per annum. Fish processing employment also supports the development of fish processing unit (unit pemrosesan Ikan- UPI).Until 2012; the numbers of UPI development were 64028 units. Most of the UPI are situated in Java(approx 45% units) then Sumatra(25%) and Borneo(13%).The remaining are in the Sulawesi(8%),Bali Nusa Tenggara(8%),Papua Malaku(1%)

CLIMATIC CONDITION OF INDONESIA:

Indonesia consists of nearly two million square km of land, most of which is covered by mangrove and other dense forests. Spanning both sides of the equator, Indonesia has a tropical climate with two distinct seasons: monsoon wet and dry. The rainy season is usually from November to April with some regional variations. Average annual temperature ranges from 23°-32°c.

However, some issues like deforestation, land-use changes, increasing population, rapid industrialization are making Indonesia a significant emitter of green house gases (WRI 2005). Climatic change is not only to exacerbate the aforementioned issues but also create new ones like the decay of the potential fishing ground with the diversification of the livelihood.

OBSERVED CLIMATIC CHANGE:

Hulme and Sheard(1999) (in figure 1) find that Indonesia has become warmer since 1900 and that the annual mean temperature has increased by 0.3°c.

Overall annual precipitation has decreased by 2%-3%. The patterns of precipitation also change over time. There has been a decline in annual rainfall in southern regions. On the other hand, it has increased in northern regions. It has been experienced that the capital of Indonesia, Jakarta receives the highest amount of rainfall. The seasonality of precipitation has changed over time. In the southern region the wet season rainfall amount has increased while the dry season rainfall has decreased. However, the opposite pattern has been observed in the northern region (Boer and Faqih 2004).

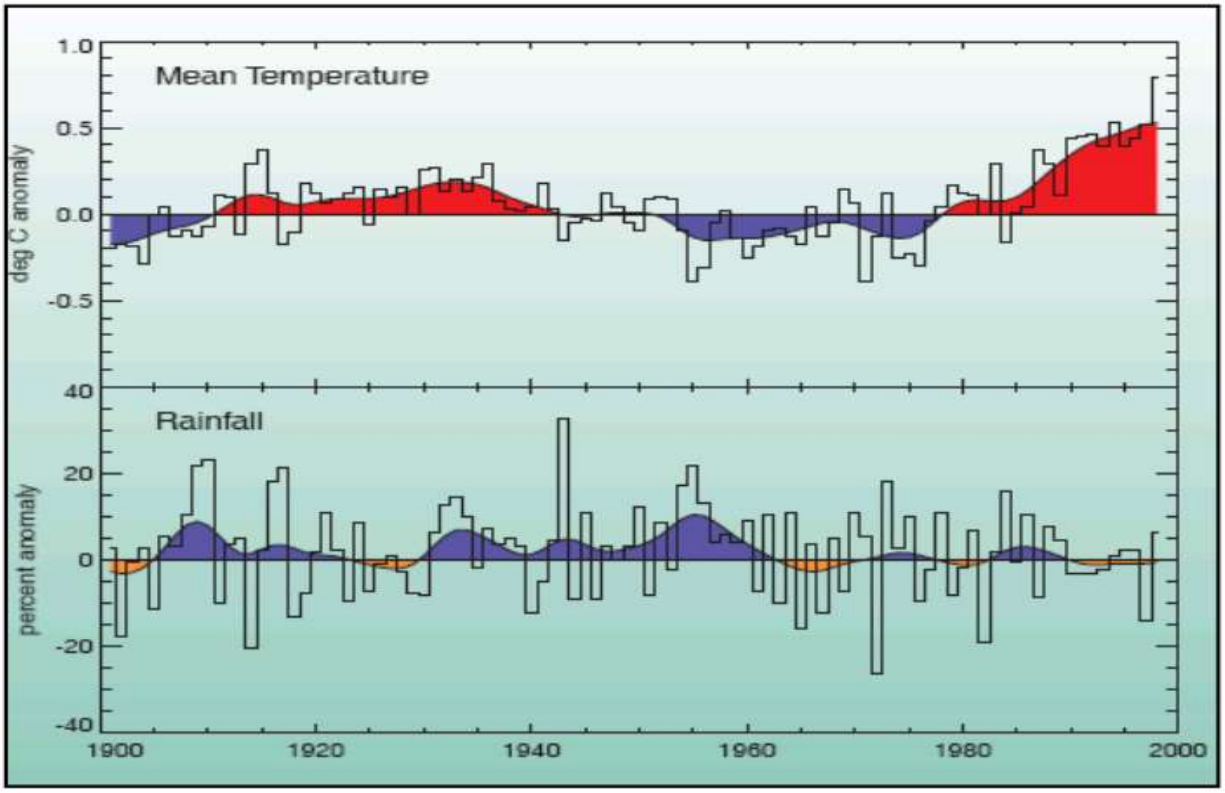

Figure 1. Changes in annual mean temperature, 1901-1998 (top), and annual rainfall, 1901-1998 (bottom), across Indonesia. Adapted from Hulme and Sheard (1999), Figure 1.

PROJECTED CLIMATIC CHANGE:

Temperature and Precipitation are both projected to increase in the future, over all of south-east Asia. It has been projected that there will be warming from 0.2°c to 0.3°c per decade in Indonesia. There will be an increase in annual precipitation across the majority of the Indonesian islands except in southern Indonesia where it is projected to decline by up to 15%. There will be a delay of minimum 30 days in the coming or retreating in the annual monsoon.

It also has been projected that the parts of Sumatra and Borneo may become 10% to 30% wetter by the 2080's during December-February due to the changing in the seasonality of precipitation whereas, Jakarta is projected to become 5% to 15% drier during June- August.

IMPACTS:

Whether through a natural disaster or a gradually over time, climate change has a direct impact on livelihoods and incomes in affected geographies. Impacts are already evident in Indonesia and will likely become dreadful due to further human induced climate change.

Due to the change of the quantity and patterns of the precipitation some of the Indonesian regions become worsen. For example, the Jakarta flood in the year 2007, affected 80 districts in Jakarta. It has worsened the UPI units as well as the livelihoods. The Government estimates the losses amount to $ 4.1 trillion (WHO 2007).

Global sea-level rise is currently increasing at about 2 mm per year and is projected to accelerate to a rate of about 5 mm per year over the next century (Cruz et al 2007). As a result, Indonesia will experience a significant loss of having 80,000km of coastline and thousands of islands and associated aquaculture. Approximately 60% of all Indonesian Population live in coastal areas and low-lying coastal cities like Jakarta and Surabaya. Therefore, sea-level rise will result in massive impacts on infrastructure as well as fishing industries. Groundwater near the coasts is also at risk due to saltwater intrusion. This intrusion could harm the fresh water fishes. The loss of coral reefs, coral bleaching is associated with warmer sea surface temperature and thus the ability of corals to calcify is reduced. It is projected that 88% of corals will disappear due to the changes of climate in south Asia.

The Asia-Pacific region is the world's largest producer of fish (1/4 of the world's tuna is caught from East and South-East Asia. Projected climate indicate that there could be large scale changes in fish habitat (Skipjack tuna) due to the regional warming. The ENSO events will also harm the fisheries. Like, El Nino if become more frequent, there could be significant declines in fish larvae abundance in coastal water. With the changing of bio-physical characteristics of rivers; the migration, spawning, dispersal, growth of fresh water fishes also be affected. Thus, in the future, there will be fish food scarcity. So many Indonesians rely on for food and livelihoods will be most affected. Thus, shifting over livelihood due to climatic changes disturbs the ancillary services and sectors. It may also force permanent or temporary migration.

VULNERABILITY AND ADAPTATION:

Indonesia must take mitigation action now in order to prevent massive impacts.In order to cope with the impacts of climatic change, millions of people who rely on fisheries, adaptation should be employed.

Increase in education and technical skills, increasing income levels, improvement of public food distribution, managements and health care systems are suggested by IPCC. The Institute of Brackish water aquaculture in Jepara, Central Java is involved in education and primary extension of technology. Sustainable management of coastal zones through Integrated Coastal Zone Management could also be effective. WWF is also working on 1) Contribution to the development of a national adaptation strategy ,2) Establishment a network of fish resources monitoring and warning system are preferred . The government have to develop contingency plans to overcome the losses of the fishermen. Moreover, people has to aware to adapt strategies like 1) to strenghthen coastal systems against storm surge and sea-level rise by planting tree barriers, 2) Development of low fish meal feed

technology using plant protein sources, 3) Strengthening and increasing the height of pond dykes and farm bunds, 4) Use of electricity for water pumping and providing aeration during weather disturbance situations, 5) Encouraging women's participation in future adaptation measures.

CONCLUSION:

The challenge for Indonesia is to create appropriate and effective adaptation strategies to combat climate change and its impacts by building resilence and resistance. Action needs to take place at all levels to acheive the goals.

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