

Feature Environment Global Warming: Its Effects on Fish Resources

by Dr Shahadat Ali

THE atmospheric concentration of major greenhouse gases (CO₂, CH₄, N₂O and CFCs) have been increasing significantly since the last centuries due to the accelerated anthropogenic activities such as fossil fuel burning, deforestation, enhanced agricultural practices, and chlorofluorocarbon production carried out by modern man to keep the wheels of civilization rolling. In fact, the atmospheric CO₂, CH₄, N₂O were quite stable for hundreds of years before the industrial revolution that subsequently swept the globe. The concentrations of CO₂ have increased from 280 PPBV (parts per billion by volume) before the industrial revolution to over 350 PPBV and are rising at an annual rate of 0.3%. Methane concentrations are increasing at a rate of 0.8% to 1.0% per year. The concentrations of chlorofluorocarbons are increasing by 4 to 11% per year.

It is estimated that a doubling of CO₂ concentrations would eventually raise average global temperatures by 2 to 5°C higher than they have been over the last one hundred thousand years.

If greenhouse gas concentrations continue to grow as they have done in recent decades, the effective doubling would occur by about the year 2030. It means the increase in global average temperature would be effectively felt in and around the year 2030. The greenhouse effect, in spite of the alarm sounded by the environmental scientists, is a natural phenomenon for the planet we live in. But nevertheless, the increase in atmospheric temperature, will have profound effects on climate's sensitive systems such as forests, agriculture and fisheries.

Climate Change and Marine Fisheries

Fish respond directly to ocean environment rather than that of atmosphere. It is thus difficult to predict the possible effect of climate changes on sea fish resources unless we develop clear understanding how marine environment would respond to the changes in the atmosphere.

There are many conflicting ideas about such effects. Some people believe that global warming would result in an acceleration of coastal upwelling, whereas others indicate that it would reduce coastal upwelling. According to some, there would be a rapid expansion in sea area due to global warming. On the other hand, many researchers think little change would likely to occur in sea level in the southern hemisphere.

Yet we know that in ocean there are specific zonation for habitat of all fish including those commercially important. Any changes in sea either on the compression or expansion, the areas of specific fisheries would be disturbed substantially, resulting the reduction of abundance of fish. However, it would largely depend on how the reproductive processes of fish and ocean ecosystems do respond to such changes in atmosphere. It is not yet clear how ocean circulation will be affected which has tremendous

impact on fish dynamics. Yet, we should give due importance to the effect of global warming on marine fish. As a first step we should prepare a global inventory on exact location of commercially important marine fisheries which might be vulnerable to the potential effects of climate changes. This would enable us to pinpoint the areas where we would keep constant vigilance against changes in marine ecosystems. A close co-operation between public policy-makers and men of science at the regional level under the umbrella of UBO to focus effectively environmental problems posed by global warming is of great help.

This would facilitate to develop a warming system against such odds. The scientists of vulnerable areas should

species and many allow for the reunion of the now disjoint warm tolerant population. However, such predictions must be made cautiously if the casual aspects of past and future warming are different, as they would seem to be in this instance.

On the other hand, melting of land-based ice would mostly occur in northern regions and circulation pattern along the coastal water in the estuaries of north hemisphere and similar situation might occur with less intensity in estuaries of southern hemisphere.

Thus, patterns of faunal dispersal may well be different in the future for the estuaries of northern hemisphere and it may be true for other coastal waters of the world. Yet it is difficult to make general prediction of this end.

changes in thermal regime provided by atmospheric scientists, limnologists have estimated potential changes in seasonal thermal structure and dynamics of major fish fauna of Lake Michigan and Lake Erie. With climate warming, habitat for warm, cool, and cold water fish would expand in Lake Michigan whereas cold water habitat for freshwater fish would shrink in Lake Erie. Lake morphology will likely influence the effects of climatic change on thermal habitat of fish. The habitats of cold water fish like lake trout, *Salvelinus namaycush*, lake white fish, *Coregonus clupeaformis*, in large and deep lakes like that of Lake Michigan will likely be shifted to deeper water with thermocline in summer.

But in shallower lakes, we expect that cold water habitat

salinity would also increase in inland waters. This would jeopardise the habitats of most of the freshwater fish thereby reducing fish production from inland waters to a great extent. On the contrary, there are reasons to believe that global warming would bring about a little change in the present areas of land masses of the country, as there would be little warming in southern hemisphere at high latitudes. Thus due to global warming possibly there would not be enough expansion of the Bay to engulf substantial areas of coastal land of Bangladesh.

Moreover, the huge quantities of silts now being deposited annually by river systems at the sea bed and estuary would also help to minimise the risk of inundation of land masses of the country. But still the fisheries of Bangladesh would likely be affected adversely for the increased temperature.

If the changes in climate affect the rainfall in monsoon, this would have important effect on major crops, sila and other important fisheries of the country. Rainfall also influences patterns of reproduction and recruitment of shrimp. On the other hand, the inland fisheries of Bangladesh would possibly face a greater risk of destruction by precipitation modification due to global warming. The higher precipitation rate would dry up most of the perennial waters during summer.

This would reduce the habitats and reproduction of most of subsistence fisheries which contribute to a large extent (nearly 70%) to the national fish production. As the 90% of our population mostly depend on freshwater subsistence fisheries for their daily intake of animal protein, negative impacts on inland fisheries of Bangladesh due to global warming can be catastrophic to human welfare.

It is hardly possible to avoid the profound effects of changes in climate on fish resources. But we can minimise the adversity through some mitigatory steps and thereby save the species diversity and abundance of majorities of freshwater fish fauna of the country from total destruction.

Mitigatory Steps

- To avoid high evaporation rate more tree shades are to be created through massive afforestation.
- Some perennial wet lands are to be made fish sanctuary.
- In each upazila at least five seasonal wet lands or other available waters are to be re-excavated to make these waters perennial and fish sanctuary.
- Effective regulations for management of open water fisheries.

Fisheries of Bangladesh

There are two sets of conflicting opinions about changes in areas of land mass to be expected in Bangladesh due to global warming. Some people think that most of coastal areas including the Sunderban and other low lying land mass of the country would possibly be engulfed by the expansion of the Bay of Bengal. Some high land at the coast such as Khulna, Patuakhali and Barisal would likely to become isolated islands.

If the above changes occur, it would result in a drastic decline in fish population. Because the coastal areas including the Sunderban serve as nursery grounds for Penaeus spp., Macrobrachium rosenbergii and many other commercial fish like Pangasius pangasius, Johnius spp., etc. With the expansion of sea,

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To survive in the face of enormous demand of 21st century, biologists, social scientists and aquaculturists have important role to play. We must work hand in hand to-day with a view to facing the changed climate due to global warming. Global change will not wait. The time to act is now.

(The writer is professor of the Department of Zoology, University of Dhaka)

Are Sulawesi's Maleo Birds Irresponsible Parents?

by Chng Soh Koon

IT lays its egg, then buries it 20 to 80 centimeters deep in volcanic ash or sun-exposed beaches. This way, the warm soil incubates the egg leaving the parents free from having to sit on it for days.

An intelligent bird, some might say. Others will, however, call it irresponsible because after buying the egg, both parents fly away, not returning even to find out whether they had a boy or a girl.

Such is the life of the Maleo bird (*Macrocephalus maleo*), which is found only in Sulawesi. A member of the megapode family, the Maleo is about the size of a chicken but somewhat heavier. An adult can weigh between 1.4 and 1.75 kilograms.

The Maleo has a salmon-pink breast and a black back. But its most distinguishing feature is its "black helmet".

Selling Maleo eggs is, however, illegal. The Maleo is protected under Indonesian wildlife regulations. Those who are caught and found guilty can be jailed. Yet people are not deterred.

Six times the size of a chicken egg, the Maleo egg can fetch as much as Rupiah 1,500 (about 80 US cents). A chicken egg costs less than Rp 150 (about 8 US cents).

Marc Argeloo, project executive for a Maleo conservation project financed by WWF - World Wide Fund For Nature and the International Council for Bird Preservation (ICBP), found the eggs being sold openly in a market in Pinolosian, a small village on the south coast of North Sulawesi. Elsewhere, the eggs



Scientists are still unsure as to the purpose of this "helmet". One guess is that it could be used to gauge the temperature of the soil.

The female Maleo is thought to lay 8 to 12 eggs a year. The eggs take about 60 to 80 days to hatch. A chick's struggle to the surface may take several days, depending on the depth the eggs were buried and the soil structure.

Abandoned even before birth, the Maleo chicks can fly immediately after reaching the earth's surface. Lately, however, not many Maleo chicks have been flying. It is not that nature has altered their ability to fly but rather man and other predators such as monitor lizards have not given the eggs a chance to hatch.

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But people are willing to pay the price, claiming that the Maleo egg is far superior in taste to the chicken egg and there is more of it. Also the egg has been used traditionally during festivals such as weddings and the birth of a child.

can be bought in the black market. However, what was even more shocking to Mr Argeloo was to find the project's hatchery, inside the Dumoga Bone National Park, broken into and badly damaged four times.

Mr Argeloo blamed the ratten collectors who, he said, go into the forest with very little food and therefore had to either hunt or collect eggs.

"I discussed the egg poaching problem with the local village and police officials," said Mr Argeloo. "They then staked out the area and arrested the illegal egg collectors. But a month later, the problem surfaced again."

Park officials recognized the problem. One solution about which Mr Koesno, head of Dumoga Bone National Park, feels quite strongly is to provide people with alternative ways of earning a living.

"For many people here, collecting rattan brings them immediate returns whereas it takes months before they can reap the rewards from farming," said Mr Koesno.

Mr Koesno would like to establish more buffer zones around the park and turn

these into working farms where people could be employed. The people would be paid daily so that they would reap immediate returns. Mr Koesno's idea has yet to be approved.

Meanwhile, Padmo Wiyoso, the park's programme head, is conducting a rather risky Maleo captive-breeding experiment.

"It is a risky experiment because the Maleo is after all an endangered species," said Mr Padmo. "However, if this experiment proves successful, we will be able to increase the Maleo population and at the same time satisfy people's demand for the eggs."

If the Maleo can be bred satisfactorily, Mr Padmo plans to release half the chicks into the wild and sell half the eggs to the people. Mr Padmo reckons that this way, egg poaching can be reduced.

But egg poaching is only one of the causes for the decline in the population of Maleo - once abundant throughout Sulawesi. Other causes are clearance of its habitat - for farming, and destruction of its nesting grounds.

Bakiriang in Central Sulawesi used to be the island's largest Maleo nesting ground. On some mornings, over 100 birds would gather. Now, however, it is threatened by the establishment of a new settlement, a few kilometres away.

"We have to convince the people of the need to protect the Maleo bird," said Mr Argeloo. "And the only way to do this is to talk to them."

Mr Argeloo visited villages, which still had a lot of Maleo birds, and talked to the village headmen and local officials. One of the more enthusiastic village headmen is Simon Iroth of Tambun, an important Maleo nesting ground often visited by tourists.

Mr Iroth started his own Maleo project to restore the Tambun nesting ground to its original condition. He got together several Tambun villagers to clean the nesting ground, which was overrun by dense vegetation.

He also planted some trees in the surrounding area to provide the birds with a sleeping and resting place, and to shade the nesting holes.

"We are happy to help because we are responsible for having cleared the Maleo habitat," said Mr Iroth. "It would also be sad to see the Maleo disappear from Tambun because our village has long been associated with it."

His work and that of Mr Argeloo have shown that if the Maleo nesting grounds are protected and restored to their original state, the birds will come back.

But more than this, such village cooperation gives hope to the survival of the Maleo. WWF Feature.

Chng Soh Koon is Asia/Pacific Communications Officer Conservation News Services Unit, Communication Services Division, WWF International

Why Rio Must Face up to the Ozone Danger

Dr Sanjiva Wijesinha writes from Hong Kong

THE issue of ozone depletion will be at the centre of the June World Summit in Rio de Janeiro. Since the early seventies people have been worried that certain man-made chemicals were leaking into the atmosphere and actually destroying it.

Then, in 1985, British scientist Joe Farman reported considerable losses of this gas from the atmosphere over Antarctica. In 1989 depletion of the ozone layer over the North Pole was detected as well. Now we know that there is a generalised thinning of the entire ozone layer over our planet.

Why exactly is the ozone layer so important? Basically, ozone is a rare form of the gas oxygen - but unlike the commonly found oxygen molecules, which are made up of two oxygen atoms linked together and denoted by the chemical symbol O₂, the molecules of ozone are each formed of three oxygen atoms.

The molecules of ozone are represented by the symbol O₃ - and the gas is, volume for volume, more dense than pure oxygen.

Oxygen and ozone is the atmosphere are closely inter-related. Oxygen is constantly being broken down into its constituent atoms, which then link up with other free oxygen atoms to form ozone. This in turn breaks to re-form oxygen.

This formation-destruction-regeneration cycle is constantly taking place, and the amount of ozone present at any time depends on the balance between the forces that create it and those that destroy it.

The conversion of oxygen to ozone progresses more quickly when sunlight is present while the reverse process, responsible for the breakdown of ozone to free oxygen, is hastened by the presence of chlorofluorocarbons, known as CFCs.

These gaseous chemical compounds are released into the atmosphere from refrigerators, certain industries and aerosol sprays. Once released, they persist in the atmosphere for up to 100 years.

Only over the last 50 years have human beings been producing large quantities of CFC, but concentrations of it in the atmosphere have been increasing by about five per cent each year.

What is so significant about the gas ozone, which is present in greatest amounts in the layer of the earth's atmosphere called the stratosphere - about 15 to 50 kilometres above ground level - is this: Ozone absorbs most of the harmful ultra-violet rays of the sun, thus preventing them from reaching the earth's surface.

The dangerous effect on human beings of depleting the layer of ozone in the atmosphere is due to the action of these ultra-violet rays on our eyes and skin. Acute exposure to ultra-violet rays can cause sunburn and temporary blindness (often termed "snow blindness"). Exposure over prolonged periods results in skin cancers and early cataract formation.

It is well known that skin cancers are more common in

people whose skin has suffered prolonged exposure to the sun, especially Caucasian, whose white skin lacks the protective pigment melanin.

Asians and Africans have an unfair advantage in this respect because this dark pigment, which is situated in the outer layer of human skin and gives the skin its characteristic colour, can absorb those ultra-violet rays that have managed to penetrate the earth's atmosphere, thus preventing these rays reaching the body's cells.

Ultra-violet rays are known to cause direct damage to the genetic material or DNA of human cells.

In the United States, 400,000 new cases of skin cancer are being diagnosed each year. Of these, 6,000 are fatal. Among white Australians, this type of cancer is three times more common than all other cancers combined - and by the age of 75, two-thirds of all Australians are affected.

It is estimated that a 10 per cent reduction in ozone levels would produce an extra 160,000 cases of this type of cancer each year in the US alone.

With increased radiation reaching us all following the depletion of the ozone layer, even those with melanin pigment in their skins will become susceptible to the increased risk of cancer.

The indirect effects of exposure to ultra-violet radiation are more subtle. Experimental exposure of mammals to ultra-violet light has been shown to act on the immune system, suppressing the body's defence mechanisms, thus making the body more susceptible to infections and cancers.

Now that the health risks are known, the need for action is urgent. In 1987, an interna-

The holes in the sky

ARCTIC

2nd hole spotted by weather satellite, 1987

OZONE:

- Filters solar ultra-violet radiation. Depletion cuts crop output, increases skin cancer, eye damage. Contributes to 'greenhouse effect'
- Destroyed by CFCs in some aerosols, fridges, foam packaging

■ Montreal '87: 24 countries agree to 50% cut in chlorofluorocarbons (CFCs) by 1991

■ ANTARCTIC

First hole identified from UK base, 1985

2106

Why Rio Must Face up to the Ozone Danger

As for the less common but more dangerous type of skin cancer, malignant melanoma (which affects Australians more than any other nation - about one in 150 white male Queenslanders dying of it each year) the incidence has been increasing throughout the world.

The age at which melanoma strikes has been falling over the last few years. It is estimated that a 10 per cent loss of ozone from our atmosphere could increase the worldwide incidence of malignant melanoma by 20 per cent.

The formation of cataracts - thickening of the eye's transparent lens which occurs as one gets older - is associated with exposure to the sun's ultra-violet rays.

The US Environmental Protection Agency predicts that a 10 per cent reduction in ozone over 50 years would cause 600,000 extra cases of cataract in the existing population - and over 4.5 million extra in people born in the US over the next 40 years.

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tional accord signed in Montreal, Canada, called for nations to cut their output of CFCs by 50 per cent. In June 1990, 93 countries signed a United Nations agreement to stop producing CFCs by the end of the 1990s.

Central to this agreement was the establishment of a \$240 million buffer fund to help Third World countries develop alternatives to CFCs.

But the long residency of these noxious chemicals in the atmosphere means that even if production completely stops tomorrow, their destructive effects on the ozone layer will continue for many years.

On an individual level, we all need to become aware of the risks of exposure of our skin and eyes to sunlight and to learn to recognise the signs of early skin cancer. Intensive health education and publicity campaigns are needed - such as that recently begun in Britain by the Greenpeace Movement.

In January this year it sent every family doctor a colourful poster and information pack to draw their attention (and that of the millions of patients who consult them) to the danger of destroying "Mother Earth's own sunscreen."

The ozone layer is a vital barrier, rather like a sub-block cream, shielding us from the sun's damaging rays. Once the ozone goes, even melanin will not be able to protect us.

— Gemini News

Dr Sanjiva Wijesinha is a senior surgeon trained in Sri Lanka, Oxford and Melbourne and is now working in Hong Kong.