Global Warming: Its Effects on Fish Resources

HE atmospheric conc entration of major greenhouse gases (CO2 Cha. NoO and CFSs) have been increasing significantly since the last centuries due to the accelerated anthropogenic activities such as fossil fuel burning, deforestation, enhanced agricultural practices chloroflurocarbon production carried out by modern man to keep the wheels of civilization rolling. In lact, 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 chloroflurocarbons are increas-

ing by 4 to 11% per year. It is estimated that a doubling of CO2 concentrations would eventually raise average global temperatures by 2 to 50c higher than they have been over the last one hundred thousand years.

If greenhouse gas concentrations confinue 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, inspite 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 fish-Thus who manage natural resources such as fisheries should begin to take these changes into account.

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 climatic changes on sca 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 sca area due to global warming. On the otherhand, many researchers think little change would likely to occur in sea level in the southern hemi-

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 occan 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 locations 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 policymakers 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

by Dr Shahadat Ali

species and many allow for the reunion of the now disjunct

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 otherhand, 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 faual 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.

salinity would also increase in inland waters. This would jeoparadise the habitats of changes in thermal regime most of the freshwater fish provided by atmospheric scithereby reducing fish produc entists, limnologists have estion from inland waters to a timated potential changes in great extent. seasonal thermal structure and On the contrary, there are dynamics of major fish fauna of reasons to believe that global Lake Michigan and Lake Erie. warming would bring about a With climate warming, habitat for warm, cool, and cold water fish would expand in Lake Michigan whereas cold water

little change in the present areas of land mases 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 engalf substantial areas of coast land of Bangladesh. Moreover, the huge quanti-

ties 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 mases of the country. But still the fisheries of Bangladesh would likely be affected ad versely for the increased temperature.

If the changes in climate affect the rainfall in monsoon, this would have important effect on major carps, hilsa and other important fisheries of the country. Rainfall also influences patterns of reproduction and recruitment of shrimp. On the otherhand 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 in pacts 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 eries. But we can minimise the adversity through some mitigatory steps and thereby save the species diversity and abun dance of majorities of freshwa ter 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.

lands are to be made

In each upazila at least or other available wa ters are to be reexcavated to make these waters perennial and

Effective regulations for water fisheries.

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

Are Sulawesi's Maleo Birds Irresponsible Parents?

by Chng Soh Koon

buries it 20 to centimeters deep 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

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

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

INDONESIA

Scientists are still unsure as to

the purpose of this "helmet".

One guess is that it could be

used to gauge the temperature

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

birth, the Maleo chicks can fly

immediately after reaching the

earth's surface. Lately, how-

ever, 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

chicken egg, the Maleo egg

can fetch as much as Ruptah

1,500 (about 80 US cents). A

chicken egg costs less than Rp

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 wed-

dings and the birth of a child.

But people are willing to

150 (about 8 US cents).

Six times the size of a

a chance to hatch.

Abandoned even before

buried and the soil structure.

The female Maleo is

4

of the soil.

DUMOGA BONE NATIONAL PARK

Selling Maleo eggs is, how ever, 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 executant 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

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

But egg poaching is onlyone of the causes for the dehabitat — the tropical rainforest - for farming, and de-

grounds.

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

which still had a lot of Maleo birds, and talked to the village headmen and local officials. One of the more enthustas-

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.

We are happy to help bedisappear from Tambun beassociated 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

vide 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 farm-

ing," said Mr Koesno. Mr Koesno would like to establish more buffer zones around the park and turn

can be bought in the black

more shocking to Mr Argeloo

was to find the project's

hatchery, inside the Dumoga

Bone National Park, broken

into and badly damaged four

Mr Argeloo blamed the rat-

"I discussed the egg poach

tan collectors who, he said, go

into the forest with very little

food and therefore had to et-

ing problem with the local vil-

lage and police officials," said

Mr Argeloo. They then staked

out the area and arrested the

illegal egg collectors. But a

month later, the problem sur-

Park officials recognized

the problem. One solution

about which Mr Koesno, head

of Dumoga Bone National Park,

feels quite strongly is to pro-

laced again.

ther hunt or collect eggs.

However, what was even

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 exper-

"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

to the people. Mr Padmo reckons that this way, egg poaching can be reduced.

cline in the population of Maleo - once abundant throughout Sulawesi. Other causes are clearance of its struction of its nesting 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 "We have to convince the

Mr Argeloo visited villages,

tic village headmen is Simon Iroth of Tambun, an important Maleo nesting ground often

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.

cause we are responsible for having cleared the Maleo habitat," said Mr Iroth. "It would also be sad to see the Maleo cause our village has long been

will come back.

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

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But nevertheless, the increase in atmospheric temperature, will have profound effects on climate's sensitive systems such as forests, agriculture and fisheries. Thus who manage natural resources such as fisheries should begin to take these changes into account.

form a body for assessing and monitoring global climate changes with major fish stock

of the area. **Estuarine Fisheries** The estuary and nearshore systems are the most productive aquatic systems on carth. Around the world estuaries serve as migration paths for anadromous and catadromous fish, nurseries for vertebrate and invertebrate larvae, feeding grounds for transact organisms, and year-round habitat for a variety of species. I many parts of the world the estuaries and coastal systems support intensive commercial and recreational fisheries.

The global warming. though there exists some dispute in its timing and magnitudes, would adversely affect the estuarine fisheries in the next century. Higher temperature is likely to melt significant areas of glacters round the globe leading to expansion of oceans, loss of many coastal wetlands, and increase in salinity which could cause a drastic decline in estuarine fisheries.

At least five environmental factors of significance to estuarine and coastal ecosystems might be modified as climates warm. These are, sea level rise, water-column warming, precipatation, salinity increase, wind and water circulation.

A prehistoric example of similar heat related modification is known to us. During the period some estuarine and intertidal benthic fauna (both boral and warm temperate) have distunct ranges along the northwest Atlantic coast from labrador to Cape Cod. Warmer disjuncts such as the commercially important hard clam, Mercenaria mercenaria, and eastern oyster, Crassostrea virginica, are predominantly southernly species that have Cape Cod as their northern limit of main abundance.

A the beginning of the period of global warming the estuarine fauna would have been mainly boral due to increased temperature. With this proposed historical scenario in mind, one can hypothesize that the expected northward extension of warmer conditions will again displace boral

It is even more difficult to go beyond broad generalizations to make specific predictions because we have little relevant our hand. in Nevertheless, global warming would greatly influence species distribution and restrict species diversity since some of the fish and other organisms are intolerant to increased temperature which is a master factor affecting all vital forces viz., feeding, growth, and

reproduction. We know that high temperature results in an increased demand for dissolved oxygen among the estuarine organisms due to increased rate of ectothermic metabolism. The supply of dissolved oxygen during this period would be reduced further because the water at higher temperature loses capacity of holding oxygen. Thus, population which are sensitive to hypoxia would probably be affected due to global warming.

It would largely result "habitat squeeze" in relation to

escape death. and other would suffer loss.

cycle, stream flow patterns, ground water recharge and release, lake level, rainfall, fisheries.

by anoxic conditions. The changes in maximum summer temperature and minimum winter temperature will affect hydrographic and geographic distribution of fish in lakes and streams. At the species association/ecosystem level, climate

will become squeezed between

thermocline and the bottom or

habitat for freshwater fish

would shrink in Lake Eric

Laké morphometry will likely

influence the effects of climate

fish. The habitats of cold water

fish like lake trout, Salvelinus

namayoush, lake white fish,

Coregonus clupeaformis, in

large and deep lakes like that

of Lake Michigan will likely be

shifted to deeper water with

expect that cold water habitat

But in shallower lakes, we

thermoclin in summer.

change on thermal habitat of

warming is expected to levels and stream flows.

would likely be followed by changes in water quality understood clearly.

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.

Why Rio Must Face up to the Ozone Danger

Dr Sanjiva Wijesinha writes from Hong Kong

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 refriger ators, certain industries and aerosol sprays. Once released, they persist in the atmosphere for up to 100 years. Only over the last 50 years

ducing large quantities of CFC. but concentrations of it in the atmosphere have been increasing by about five per cent each What is so significant about the gas ozone, which is pre-

have human beings been pro-

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 sur-

sent in greatest amounts in the

layer of the earth's atmosphere

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

As the Earth Summit in Rio de Janeiro (June 3-14) approaches, international negotiations to produce a worthwhile treaty continue to dilute commitments by the industrialised countries to reduce greenhouse gas emissions. All except the US have pledge to stabilise release of the gas at 1990 levels by the year 2000, but as Rio nears they are wavering. Gemini News Service examines the dangers of ozone depletion.

The holes in the sky Ozone: ▶ Filters solar ultra-violet radiation. Depletion cuts crop output, increases ARCTIC skin cancer, eye damage. Contributes to greenhouse effect 2nd hole spotted ▶ Destroyed by CFCs OZONE by weather satellite, 1987 in some aerosols, fridges, foam packaging ANTARCTIC First hole ■ Montreal '87: 24 countries identified from agree to 50% cut in UK base, 1985 chlorofluorocarbons (CFCs) by 1991

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

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

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.

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 In the United States, 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.

The indirect effects of exposure to ultra-violet radiation are more subtle. Experimental exposure of mammals to ultraviolet 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-

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 Move-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 se-

nior surgeon trained in Sri Lanka, Oxford and Melbourne and is now working in Hong

IIE 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 destroy-Then, in 1985, British sci-

entist 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 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

- and the gas is, volume for volume, more dense than pure oxygen. Oxygen and ozone is the atmosphere are closely interrelated. Oxygen is constantly being broken down into its constituent atoms, which then

·link up with other free oxygen

atoms to form ozone. This in

represented by the symbol o3

turn breaks to re-form oxygen. This formation-destructionregeneration 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

temperature increase along estuaries of the would. The sessile species of the estuaries would possibly face total destruction due to the extreme anoxia or hypoxia that might result from warming in climate whereas the mobile species, which can avoid such condition, would migrate towards an areas with suitable climate conditions and thus would

It is broadly believed that due to global warming estuarine and coastal systems could experience poleward retreat of cold tolerant species and range expansion of warm tolcrant species. Thus we may assume that in many parts of the world, some fisheries and aquacultural enterprises based at estuaries would benefit from the results of climate changes

Freshwater Fisheries

Drastic changes (precipitation patterns, hydrologic etc.) in freshwater systems due to global warming would adversely affect the freshwater

Using information on

increase productivity at all aquatic tropic levels at a particular location by about 10-20% per 1°C increase in temperature. Shifts to warmer water species assemblages are expected to accompany the in-

crease in production in aquatic ecosystems of temperate zones. Climate changes will alter annual and seasonal precipitation patterns. This in turn, would possibly affect lake Changes in water quantity

resulting from changes in concentration of ions, dissolved gases, and organic materials. However, the exact status of productivity of freshwaters due to global warming can hardly be ascertained as the ecological linkage between climate, aquatic habitat, and fisheries resources in the changed situation is yet to be

Fisheries of Bangladesh

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 Penacus spp., Macrobrachium rosenbergii and many other commercial fish like Pangasius pangasius, Johnius spp., etc. With the expansion of sea.

Some perennial wet

fish sanctuary'. five seasonal wet lands fish sanctuary.

management of open To survive in the face of

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