Climatic Change and its Impact on Fish
(Review Article)

Mona S. Zaki and Mostafa F. Abd elzaher Prof. Dr.

Department of Hydrobiology, Vet. Division National Research Centre, Giza, Egypt
dr_mona_zaki@yahoo.co.uk

Abstract: Climate change has had a clear impact on the annual timing of the life-history events of animals and plants. It is often assumed that the timing of annual migrations of marine fish to spawning grounds occurs with very little change over time. However, it is unclear how much fish migration is influenced by climate change. Detecting such changes may be important to consider if climate-linked temperature increases act to shift the timing and location of annual peak abundance, shifts which may have consequences for both fishery catches and their management.
[Mona S. Zaki and Mostafa F. Abd elzaher. **Climatic Change and its Impact on Fish.** *Life Sci J* 2014;11(3):108-111]. (ISSN:1097-8135). http://www.lifesciencesite.com. 14

Keywords: Climate change; marine fish**;** fish migration**;** temperature.

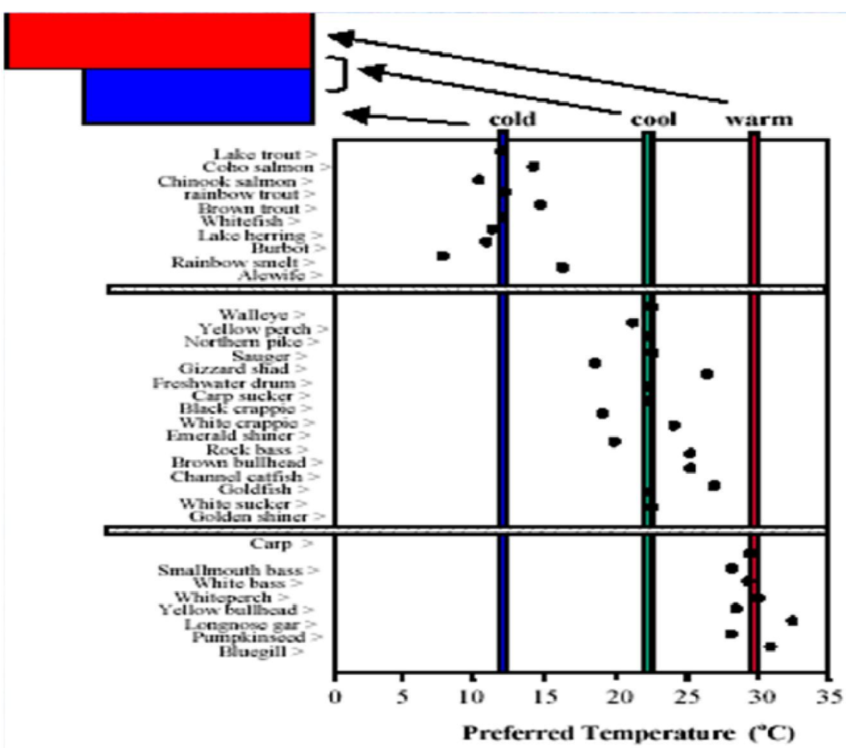
Introduction

The name cancer in fish due to pollution is given to a group of diseases which are characterized by uncontrolled cellular growth. Genetic toxicology exists because of the concern that environmental agents can cause genetic damage.

This genetic damage may be manifested both in germ cells and in somatic cells. An increase in mutational events in germ cells will lead to an increase in the incidence of inherited disease and disability in future generations. In somatic cells, mutations play an important role in fish cancer.

Temperature and Water Quantity

The body temperature of a fish is essentially equal to the temperature of the water where it lives. Typically, each species exhibits a characteristic preferred temperature – the temperature that individual fish choose to live in when given a choice. Rates of food consumption, metabolism, and growth rise slowly as the preferred temperature is approached from below, and drop rapidly after it is exceeded until reaching zero at the lethal temperature.



Given the vital importance of water and temperature to fish, they will respond strongly to natural variations in climate that involve changes in water volume, water flow, and water temperatures. Responses to such environmental changes fall into two broad categories:

1) changes in fish distributions, including shifts in the large-scale centers and boundaries of individual species and species groups, and shifts in the distributions of individual population members at local scales.

2) changes in the overall production of the entire fish community in a particular region and changes in the relative productivity of individual populations within a community.

Changes in Fish Distribution

Individual fish actively select and rapidly change living areas based on suitable temperatures, oxygen concentrations, and food availability. Cold-water fish will actively avoid temperatures that exceed their preferred temperature by 2 to 5°C (3.6 to 9 °F) (Magnuson et al. 1979), and seek out refuge areas of cooler water such as deep water or groundwater and headwater streams (Meisner 1990).

Fish species will likely extend or retract their ranges in ways that are related to thermal tolerance, behavior, and climate shifts.

These disruptions are likely to be compounded by invasions of other aquatic organisms, many of which are capable of totally restructuring existing food chains (e.g., Ricciardi 2001)

Warm waters may lead to greater release of heavy metals (Dollar et al. 1991) as mercury in aquatic environments, and consequently higher mercury levels in fish (Bodalyet al. 1993; Heyes et al. 2000; Scheuhammer and Graham 1999; Yediler and Jacobs1995). This will have negative impacts on the fish populations themselves, and on any human populations dependent on them for food.

Changes in Fish Productivity

Comparing freshwater lakes from the Arctic to the tropics, the overall production of fish is strongly correlated with the mean annual air temperature (Schlesinger and Regier 1982). Within smaller geographic regions, variation in fish production in lakes or seas is most closely associated with differences in nutrient availability and lake or seas morphometry (Ryder 1982; Downing et al. 1990; Leach et al. 1987).

A lake, the productivity of a fish population is related to the amount of water present and its thermal suitability. The amount of suitable living space available is a time-weighted average of the volume of water with temperatures close to the preferred optimum but less than the lethal limit.

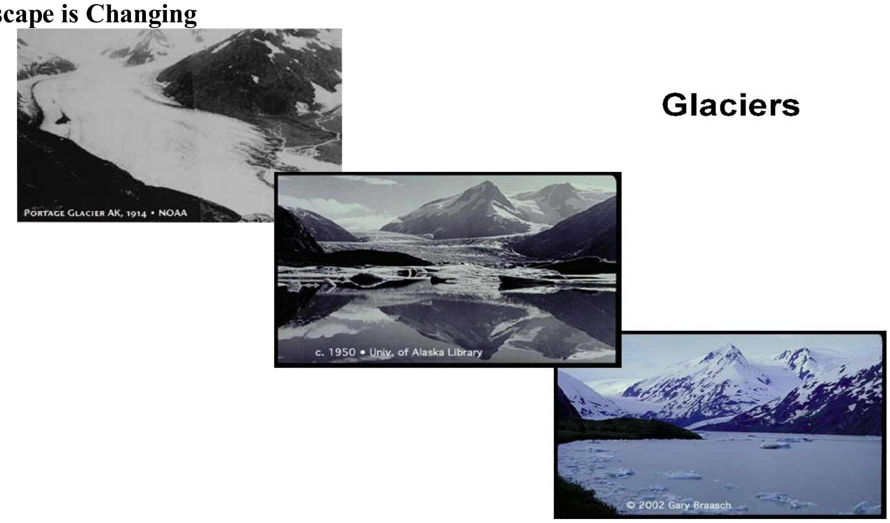
Both freshwater e.g., walleye, lake trout, whitefish (Christie and Regier 1988) and marine species (Friedland et al. 1993) have demonstrated that the abundance and productivity of fishes increases with increased time spent at the optimal temperature.

Given such impacts, effective human adaptation to the impacts of climate change on fish and fisheries should involve explicit efforts to protect those native fish communities that are most vulnerable to climate driven invaders (e.g., Jackson and Mandrak 2002).

It is predicated that climate warming will cause large decrease in the amount of thermally - suitable habitat for fish population in conclusion: Climatic change affect both fish distribution and fish productivity Fish distribution affect directly the fish ecology and fisheries & fish productivity appear clearly in:

1.Slow growth.
2.Slow maturation.
3.Retarded fecundity.

Alaska's Landscape is Changing



Alaska's Landscape is Changing

Infrastructure

We can plan ahead…. or we can react

Wildlife can only react

But humans can anticipate

References:
1. Bodaly, R. A., Rudd, J. W. M., Fudge, R. J. P and Kelly, C. A.: 1993, *Can. J. Fish. Aquat. Sci.* **50**,980.
2. Christie, G.C. and Regier, H.A. (1988). Measures of optimal thermal habitat and their relationship to yields for four commercial fish species. Canadian Journal of Fisheries and Aquatic Sciences.45: 301-314.
3. Donald A. Jackson and Nicholas E. Mandrak (2002): Changing fish biodiversity: predicting the loss of cyprinid biodiversity due to global climate change. American Fisheries Society Symposium 32: 89-98.
4. Downing, W.L., S.L. Sullivan, M.E. Gottesman, P.P. Dennis 1990. Sequence and transcriptional pattern of the essential Escherichia coli secE-nusG operon. J.Bacteriol. 172:1621-1627
5. F. Hayes *et al* (2000)*:* Functional assay for BRCA1: mutagenesis of the COOH-terminal region reveals critical residues for transcription activation, Cancer Res: *60:* 2411–2418,
6. Friedland, K.D., D.G. Reddin, and J.F. Kocik. 1993. Marine survival of North American and European Atlantic salmon: effects of growth and environment. ICES J. Mar. Sci. 50: 481–492.
7. Magnuson, J. J., L. B. Crowder, and P. A. Medvick. 1979. Temperature as an ecological resource. American Zoologist 19:331-343.
8. Meisner (1990): Effect of climatic warming on the southern margins of the native range of brook trout, *Salvelinus fontinalis*. Canadian Journal of Fisheries and Aquatic Sciences Vol. 50(4): 883 – 884.
9. Scheuhammer A.M. and J.M. Graham (1999): the bioaccumulation of Mercury in aquatic organisms from two similar lakes with differing Ph. Ecotoxical 8 :49-56.
10. Yediler, A. and J. Jacobs. 1995. Synergistic effects of temperature-oxygen and water-flow on the accumulation and tissue distribution of mercury in carp (Cyprinus carpio L.). Chemosphere 31: 4437-4453.

2/3/2014