JOJ Wildlife and Biodiversity

Juniper Publishers key to the Researchers

Review Article

Volume 3 Issue 2- December 2020

JOJ Wildl Biodivers

The Impact of Climate Change on Biodiversity in Lake Kinneret, Israel: A Brief Review

Moshe Gophen*

Scientific Research Institute, Kiryat Shmone, Israel

Submission: November 09, 2020; **Published:** December 10, 2020

***Corresponding author:** Moshe Gophen, Scientific Research Institute, Kiryat Shmone, Israel

Abstract

This study evaluated the weekly fluctuations of bovine milk quality from cows fed Legume Stover (LS) and feed grade urea fertilizer (UET). The study involved feeding Maize Stover (MS) improved using UET, Chopped Groundnut Stover (CGS), Chopped Soybean Stover (CSS), Mineralized Groundnut Stover Solution (MGS) and Mineralized Soybean Stover Solution (MSS) to lactating dairy cows. The feeding trial involved twelve (12) dairy cows in their second parity. Effect of supplementation with MS improved with UET, cGS, cSS, mGS and mSS on milk quality was evaluated following on-station feeding trials. The study involved 22 factorial experiments within a Completely Randomised Design (CRD). Milk samples were analysed for protein, lactose, fat and solid not fat (SNF) and milk density.

Mean milk protein levels ranged from 3.52mg/ml to 3,73mg/ml (s.e=0.03) for milk from cows fed on MS improved using cGS and mGS respectively. Protein and Lactose were observed to be the least variable (3.64g/ml ±0.12, and 5.24g ±0.24 respectively). Average milk fat content was highest (4.78%, se=0.52) in milk from cows fed on UET treated MS and lowest (3.43%, se=0.52) in milk from cows fed on gGS protein-based MS. Within legume type milk fat was higher (4.75%±1.99) in milk from cows fed on MS blended with mGS than that in milk from cows fed on MS improved with cGS (3.43%±1.99). Similar result was observed in milk fat from cows fed on MS improved with the use of soybean. Lactose in milk from cows fed on UET treated MS was highest (5.51g, se=0.061) and lowest (5.10g, se=0.061) in milk from cows fed on MS blended with cGS. Milk from cows fed on MS improved with mGS was higher (9.61p/cwt, se=0.14) in SNF and lowest (8.88p/cwt, se=0.14) in milk from cows fed on MS with cGS. The milk density values ranged from 32.65sg, se=0.53 for milk from cows fed on UET treated MS to 30.42sg, se=0.053 for milk from cows fed on MS blended with cGS. Milk components were higher when cows were fed on MS improved using mineralized legume stover solutions. Results of the current study have indicated that milk composition is clearly influenced by diet, and period of lactation. In the current study it was observed that milk fat was the most variable component not only among feed types but also over the feeding period.

Keywords: Fluctuation; Milk quality; Mineralized; Chopped; Maize; Groundnut; Soybean; Stover

Ecological Changes

Evaluation of pollution processes in lakes are commonly indicates changes of nutrients dynamics, phytoplankton biomass (density and composition) and physical properties such as water temperature, water level fluctuations and hydrological conditions. During the last 30-40 years the involvement of fish community structure and feeding habits respectively were also included as factors of lakes pollution significances. The study of thermal pollution recently became an intensive research topic due to climate change, mostly global warming. A world-wide development of awareness to concern about water quality as indicated by major parameters such as biodiversity and biomass density of plankton organisms.

The Shannon–Wiener Biodiversity Index was implemented for the study of Zooplankton Bio-Diversity Index (BDI) in Lake Kinneret. Four, 5 and 9 species of Copepoda, Cladocera and Rotifera, respectively, were included. Direct relations between Epilimnetic temperatures and Zooplankton Bio-Diversity Indexes (BDI) were indicated: Matching was found between low BDI and the high summer temperature and between higher BDI and the low winter temperature. Lake Kinneret is a warm Monomictic body of freshwater located in the sub-tropical geographic zone which represent short, wet and cold winter whilst the summer is long, dry and warm. Consequently, high degree of seasonal temperature changes, induce significant seasonal BDI fluctuations. Since mid-1980`s Regional Climate change of, among others, temperature elevation was documented in the Lake Kinneret (Figures 1 & 2) drainage basin and consequently in the Kinneret Epilimnion (Figure 3). It is suggested that temperature increase probably enhanced the seasonal changes of BDI values. Moreover, progressive dryness conditions (Figure 4) induced Peridinium disappearance and promoted domination of Cyanobacteria in Lake Kinneret (Figure 5). The proliferation of Harmful Cyanobacteria (HFCB) is presently a global concern and the impact of temperature elevation is emphasized. Lake Kinneret is a prominent example of those global climate change. The decline of precipitation, reduction of river discharges and temperature elevation were enhanced during the recent 25 Years. Consequently, the influence of resulted Nitrogen input decline and water temperature increase enhanced the disappearance of the Peridinium phytoplankter domination which was replaced by toxic Cyanobacteria (HFCB) algal composition.

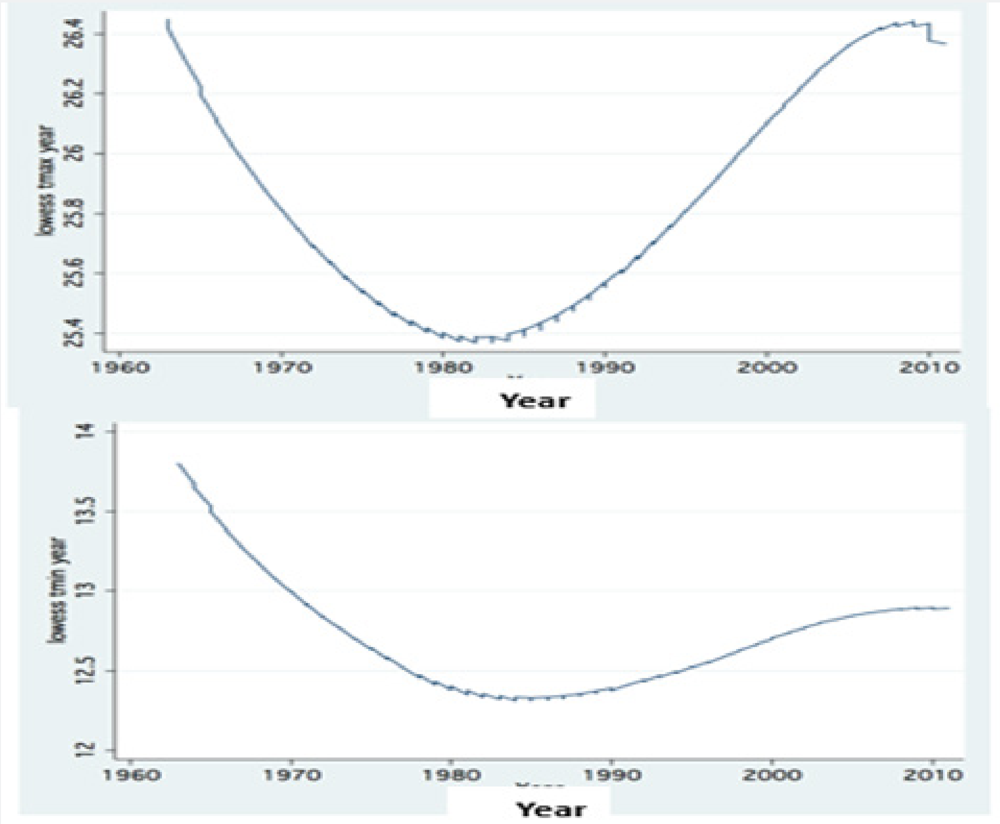

Figure 1: Trend of temporal (1963-2011) changes (LOWESS;0.8) of annual averages of daily maxima (upper) and minima (lower) of air Temperatures in Dafna meteorological station In the Kinneret Watershed**.**

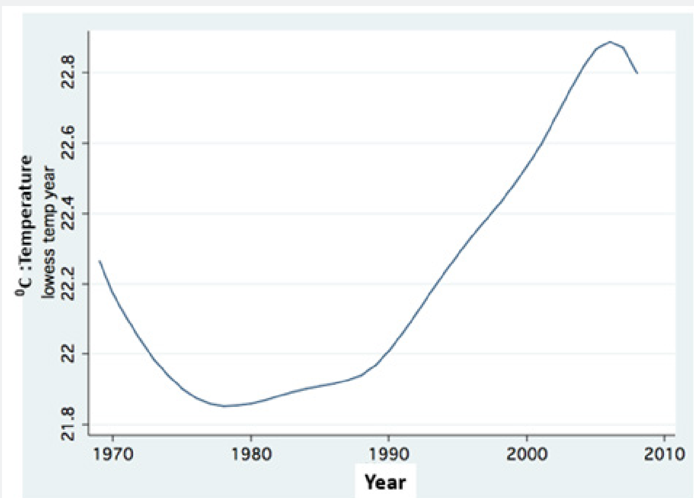

Figure 2: Trend of changes (LOWESS;0.8) of annual means of whole water column averaged temperature in Lake Kinneret during 1969-2008.

How to cite this article: Moshe G. The Impact of Climate Change on Biodiversity in Lake Kinneret, Israel: A Brief Review. JOJ Wildl Biodivers. 2020: 3(2): 555609

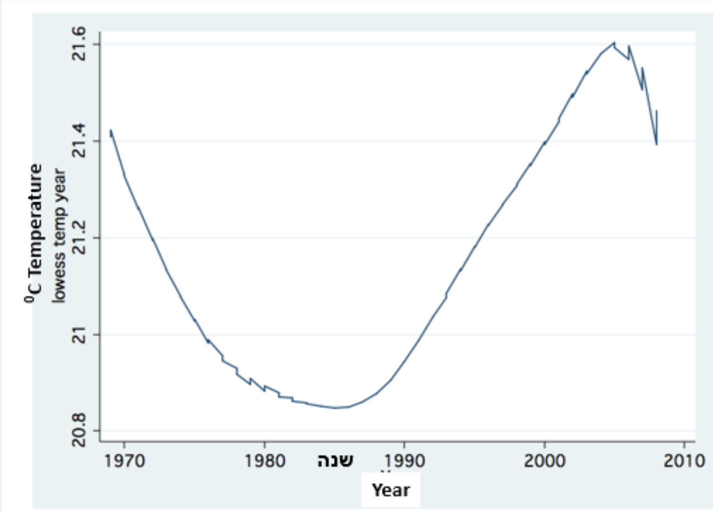

Figure 3: Trend of changes (LOWESS;0.8) of annual means of the Epilimnioin layer averaged temperature in Lake Kinneret during 1969-2008.

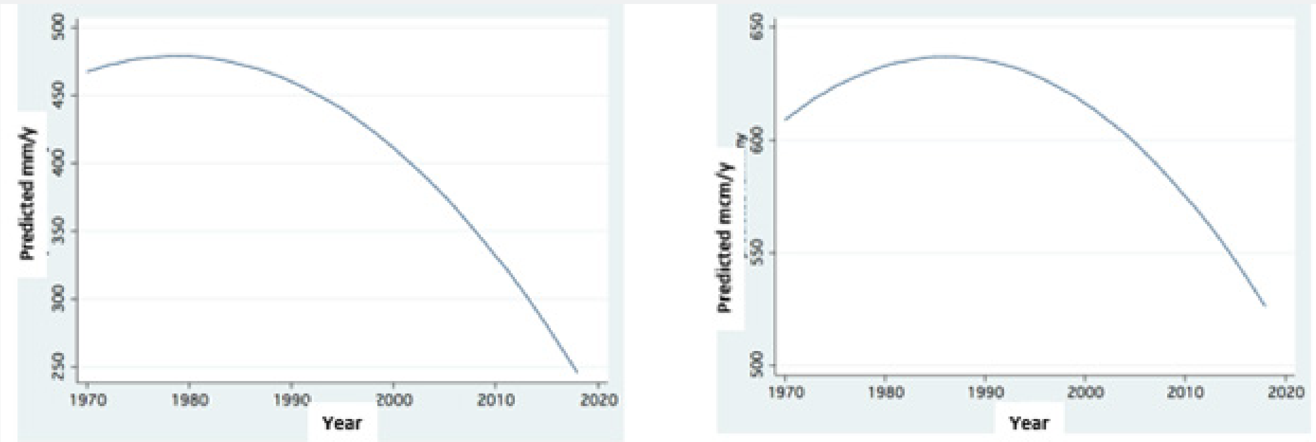

Figure 4: FP Regressions between Annual Rain (mm) (left) and Annual Jordan Discharge (mcm/y) (right) and Years (1970-2010)

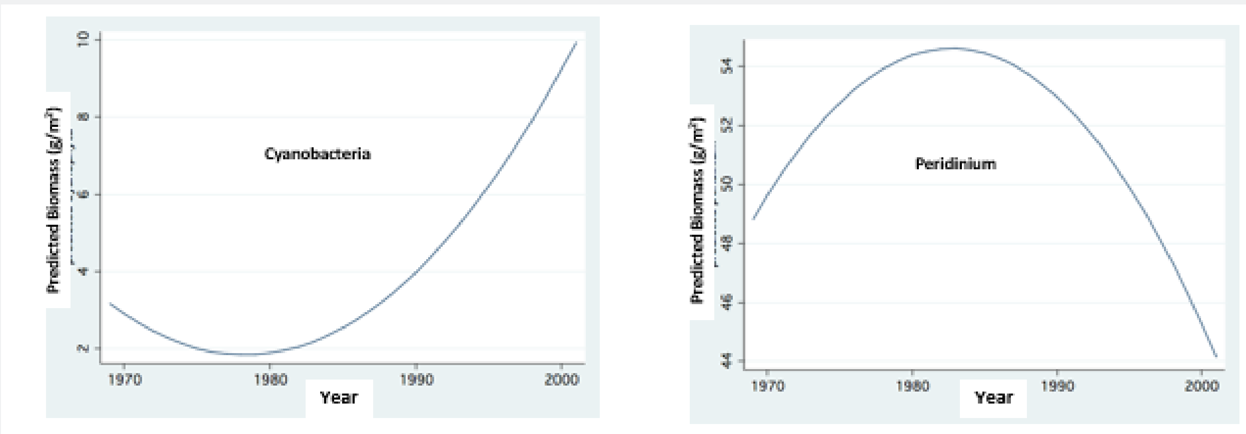

Figure 5: FP Regressions between annual averages of Phytoplankton Biomass (g/m2): Peridinium (right) and Cyanobacteria (left), and years (1970-2001).

How to cite this article: Moshe G. The Impact of Climate Change on Biodiversity in Lake Kinneret, Israel: A Brief Review. JOJ Wildl Biodivers. 2020: 3(2): 555609

Climate Change Implication

Heat capacity or thermal capacity, defined as the amount of heat energy that must be provided to an object (water mass) in order to raise its temperature by one unit. Heat capacity is proportional to the water mass volume. Heat capacity of a certain mass is divided by the weight or volume of the mass, yielding the specific heat capacity (or "specific heat"). The volumetric heat capacity indicates the heat capacity per volume (Tables 1 & 2).

Table 1: Bathymetrical depth layer volumes (106m_3) and respective mean temperatures during two periods in Lake Kinneret: 1969-1980 (mean Water level-210.09 mbsl; mean lake volume 3834 106m_3) and 1991-2002 (mean Water Level 211.42 mbsl; mean lake volume 2863 106m_3) and periodical DT (0C). Data given in Table 1 indicates a typical reduction of Bathymetric layer volumes Serruya 1978, and the increase of layer temperatures (DT) by 0.2-0.4 0C between 1969-2001.

Depth Layer (m)	Volume (106m_3) 1969-1980	Volume (106m_3) 1991-2002	Mean Temp. (0C) (1969-1980)	Mean Temp. (0C) (1991-2002)	ΔT (0X)
0-10	1573	1279	21.9	22.3	0.4
20-Nov	1215	992	20.2	20.4	0.2
21-30	729	506	16.3	16.7	0.4
31-40	309	85	15.3	15.5	0.2

Table 2: Periodical means of annual precipitations (mm), daily maximal and minimal air temperatures (Dafna the data given in Table 2 indicates the closely related changes of rain decline and air temperature increase. Station).

Period	Annual Precipitation (mm)	Daily Minimal air temperature (0C)	Daily Maximal air temperature (0C)
1969-1980	657	12.6	25.6
1981-1990	617	11.8	25
1991-2001	604	12.8	26

Climate Change and BDI Interreklationships

There are many documentations about temperature causation for modification of the BDI's aimed at undermining ecosystems' stability. It was indicated that Climate change potentially drive Biodiversity patterns. The great level of dependence between Biodiversity and Temperature at the extreme nutrient level, confirmed the direct impact of Temperature and nutrients on Biodiversity. Consequently, future climate scenarios such as global warming could alter Biodiversity. The positive relations between temperature and species richness (Biodiversity) were widely documented (Table 3).

Table 3: Linear Regression parameters (r_2, p) between epilimnetic Temperature (annual mean) (Tem.), Time (year), Annual mean Index of Diversity (Index), annual mean of Total zooplankton densities (No/L) (Total) during 1970–2001, S = Significant(p<0.1).

Regression	r_2	p
Tem Vs Year	0.307	0.001 (S)
Index Vs Year	0.525	<0.0001 (S)
Index Vs Tem	0.18	0.015 (S)
Total Vs Year	0.141	0.034 (S)
Total Vs Index	0.272	0.002 (S)

Linear Regression parameters (r_2, p) between epilimnetic Temperature (annual mean) (Tem.), Time (year), Annual mean Index of Diversity (Index), annual mean of Total zooplankton densities (No/L) (Total) during 1970–2001, S = Significant(p<0.1). Results in (Table 3) indicates linear temporal significant relations between BDI and Years, and Temperature and Years; and also, Significant relations between BDI and Temperature, and Total zooplankton. The BDI is a measure of biological diversity which is an indicator of species richness in a habitat diverted. It was fairly accepted that the dominant parameter effect on the BDI changes is temperature. Global Biodiversity expressed as the richness of families, genera, species and sub-species is significantly affected by temperature. The decline of BDI in response to warm "greenhouse" phases which may have implications for biological extinctions and Biodiversity changes under future global warming events is also known. An important conclusion documented in a UN report on loss of Biodiversity and extinctions is that the severe threat to species richness and elimination is significantly affected by climate change and the decline of the index is clearly related to temperature elevation. BDI is affected by temperature but the significance of this impact depends on the time span continuation and/or the thermal range of the modification. If high and low thermal conditions alternate, BDI fluctuates intermittently as well. It was indicated that seasonal fluctuations of epilimnetic temperature are consequently accompanied by a significant change of BDI level. Therefore, it is suggested that BDI monitoring in the Kinneret Epilimnion supports an indication of Global Warming effect in this part of the planet.

Air temperature elevation cause warmer lake surface waters which in turn increase stratification stability due to increase water density gradient profoundly. Reduction in bottom-up fluxed nutrient migration is possibly enhanced. Decline of rainfall could be the reason for longer residence time following by nutrients accumulation a well-known cause of pollution and water quality deterioration. Moreover, bloom forming Cyanobacteria are likely

How to cite this article: Moshe G. The Impact of Climate Change on Biodiversity in Lake Kinneret, Israel: A Brief Review. JOJ Wildl Biodivers. 2020: 3(2): 555609

to be favored in a warming climate Vincent IPPCC, Mackay. It was reported that in the last century temperature increased by approximately 0.7 0C and continuation is likely to be elevated by 1-6 0C by the end of the 21st century.

The climate change (rainfall decline) induced lowering of external nutrient inputs (mostly Nitrogen) whilst internal factors of volume shrinkage and possibly internal conditions which enhanced Phosphorus release from the sediments. Consequently, the thermal pollution (Temperature increase) driven eco-forces enforced a combined effect between the external (climate condition) and internal conditions (enhanced P release from the sediments and dust deposition) resulted a water quality deterioration. Moreover, global warming caused an increase of extinction risk i.e., BDI decline [1,2]. Climate change acts as an additional pressure compromising Biodiversity and freshwater ecosystem function and potentially disturbing the ecological services they provide [3]. Increase of diversity in response to minor decline of temperature in a warm deep sea was documented by [4].

References

1. Gophen M (2018) Temperature Impact on the Shnnon-Wiener Biodiversity Index (BDI) of Zooplankton in Lake Kinneret. Open Journal of Modern Hydrology 8(2): 39-49.
2. Gophen M (2019) The Ecological Outcome of Climate Change in Lake Kinneret-Thermal Pollution; Open Journal of Modern Hydrology 9(3): 89-102.
3. Thomas CD (2004) Extinction risk from climate change. Nature 427: 145-147.
4. Danovaro R, A Pasceddu, (2004) Biodiversity Response to Climate Change in a deep sea. Ecxology Letters 7: 821-828.

How to cite this article: Moshe G. The Impact of Climate Change on Biodiversity in Lake Kinneret, Israel: A Brief Review. JOJ Wildl Biodivers. 2020: 3(2): 555609