SUNTEXT REVIEWS

SunText Review of Virology
ISSN: 2766-5003

Open Access
Research Article
Volume 2:2

Fishery (Tilapia) Crisis and the Novel RNA virus (Tilv) Disease in Lake Kinneret

Moshe Gophen*

Migal Scientifc Research Institute, POB 831 Kiryat Shmone Israel (11016), Israel

***Corresponding author:** Moshe Gophen, Migal Scientifc Research Institute, POB 831 Kiryat Shmone Israel (11016), Israel; E-mail: Gophen@Migal.org.il

Received date: 13 October 2021; **Accepted date:** 19 October 2021; **Published date:** 24 October 2021

Citation: Gophen M (2021). Fishery (Tilapia) Crisis and the Novel RNA virus (Tilv) Disease in Lake Kinneret. SunText Rev Virol 2(2): 120.

DOI: https://doi.org/10.51737/2766-5003.2021.020

Abstract

The annual landings of the native fish Sarotherodon galilaeus was exceptionally declined from normal annual capacity which varied between 300-500 tons to below 10 tons. Ecological study indicates, among others, an outburst of viral disease infection. A comprehensive evaluation, presented in this paper, indicates natural and anthropogenic reasons for that fishery crisis.

Keywords: Sarotherodon galilaeus; Kinneret; Virus

Background

Kinneret, the only freshwater lake in Israel is a multipurpose body of water utilized for water supply, fishery, tourism, and recreation. Water supply was ranged annually between 300-400 x 106 m^3 until 2010 when desalinized water supply started. Nevertheless, recreation along the Kinneret shore lne is rather popular (last summer – 3.35 x 10^6 recreations leaving 2200 tons garbage). Among 19 native fish species 10 (8 mostly) are commercially utilized by 150 fishers, operating trammel-net (gill-net) and one Purse-Sein fishing boats. Four species are stocked: the exotics Hypophthalmichtys molitrix (SC), three mugilids and the native Sarotherodon galilaeus (SG). During 1985 – 2016 the total annual landing was 1324 ton of which 44 - barbels, 207 - stocked exotics, 653 - Bleaks and 350 - Tilapias. Among Tilapias, SG contributed 248 tons. The highest commercial value is due to Mugilids and SG. Exeptional decline of the landings of SG occur during 2007-2008. Several potential reasons were attributed to that SG`s crisis: Decline of SG`s stocking capacity; natural food resources competition between SG and enhanced Bleak population; Illegal usage of small mesh-size gill-nets; Predation by enhanced population of predator birds (Cormorants): SG`s fingerlings predation by carnivore Catfish; unusual low offset natural cyclic pattern of the population density; and outburst of the Novel RNA Virus (TiLV) which denominated Tilapias [1]. Lake Kinneret is the only freshwater natural lake in Israel. The lake is a warm monomictic body of water that is fully mixed during mid-December and April and stably stratified from June to October. De-stratification process continues from November through mid-December and stratification builtup from mid-December to May. Since the mid-1980`s, the Kinneret ecosystem has undergone ecological modifications including alterations of fish food preferences. Landing decline of all commercial fish species was indicated. Reduction of fishing pressure, enhancement of predator birds (Cormorant) and fishes (Clarias sp.), the use of illegal fishing nets and the reduction of stocking caused harvest decrease. Zooplankton is a significant fish food component within the Kinneret ecsstem. Similarity in biomass consumption by predator zooplankton (cyclopoids) and zooplanktivorous fish feeders were documented. Eleven years frequency of quasi periodical cycling of ups and downs alternates of the Galilee Saint Peters Fish (Sarotherodon galilaeus (SG) population size and consequently dock-side harvest were confirmed. Moreover, lake stocking by Silver Carp (Hypophthalmichthys molitrix) and Mugilids (Mugil cephalus and M. capito) improved water quality and contribute significant support to the Fisher's income. Since mid-1990`s the decline of Nitrogen and a moderate increase of Epilimnetic Phosphorus concentrations resulted a change of their bioavailability ratio and the Kinneret Epilimnion was modified from Phosphorus to

Nitrogen limitation. The outcome of these changes was a prompt reduction of the dominant bloom-forming dinoflagellate Peridinium gatunense and enhancement of Cyanobacteria, Diatoms and Chlorophyts. Annual water supply from Lake Kinneret until early 2000's (350-450 X 106 m^3) were pumped and conveyed through the National Water Carrier (NWC) to be supplied for agricultural irrigation and mostly (>50%) domestic consumption. Since 2010 domestic water supply was converted to Desalinization. The demands for Kinneret waters were therefore to local consumers and to Jordan Hashemite Nation as part of the peace treaty obligation. Upgrading status of the Kinneret Ecological Services was therefore re-defined. From top domestic water supply to present, fishery, recreation and tourism. At the very beginning of fishery maintenance in Lake Kinneret, the impact of fish communities on water quality was not thoroughly considered by managers. Later on a bridging between fishery managers and limnologists was implemented. Anyway, fish impact on water quality was recognized by water and fishery managers. Sarotherodon galilaeus (SG) is a key organism within the Lake Kinneret fishery management design. This species is a high market valuae component and the most efficient known consumer of Peridinium sp. The long-term record of SG fishery (1959-2016) indicated an annual average of 308 tons. An exceptional lowest annual harvest ("SG crisis"), was recorded during 2007-2008 and recovery was documented later [2,3]. Among other potential reasons for this unusual decline a viral disease infection was suggested and investigation was initiated abruptly. Results are briefly reported here.

Results

The fishing yields are normally dependents of economical (income) fisher motivation, fishing pressure, fishing technology efficiency and specimen availability. Considering those parameters, "Catch Per Unit Effort" is controlled either by the effort intensity and/or SG`s population density (availability). Because SG is highly market demanded, the intensification of effort induced illegal minimizing gill-net mesh-size. It was followed by sharp reduction of Bleaks marketing demands which enhanced fishing effort release from bleaks which cause their population to enhance. Independently, preferred food biomass by SG, Peridinium gatunenze. Was replaced by Cyanophyta. Alternatively, the SG feeding pressure on zooplankton was intensified. This diet switch of SG enhanced severity of food competition with the common zooplanktivorous Bleak fishes. Under common conditions the Bleak fishery was the major biomass component of the total whereas the SG and Mugil comprised the major financial value of the annual yield (Figure 1).

Indicates the followings: Figure 1: Bleaks weight (Biomass) ration (53%) of the total Kinneret fishery during 1985-2006 were Bleaks whilst later (2007-2016), Bleaks comprised only 22% of the total landing. The reason for this significant decline was minimizing market demands (Figure 2). Figure 3 represent the periodical SG crisis when annual landing was exceptional low (<10 tons/y in 2007, 2008) declined during 2006-2010. Temporal changes of another Tilapia species, Oreochromis aureus, (OA) are shown in Figure 4. This fish became common in Lake Kinneret as a result of stocking prior to the 1990`s and its fishery was therefore decreased later. Two commercial native and non-stocked Barbel species are not highly favored by the local consumers and therefore their crops are only "fishing effort" dependent (Figure 5). The lake population of two exotic species, Silver Carp (Hypophthalmichtys molitrix and Mugilids (Mugil cephalus, and Liza ramada) are absolutely dependents on stocking with respective dock landing (Figures 2-7).

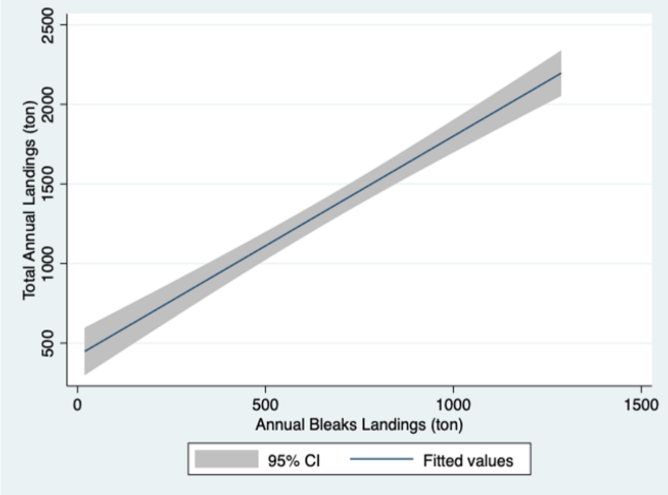

Figure 1: *Linear regression (95% CI) between Bleak and total landings during 1985-2016.*

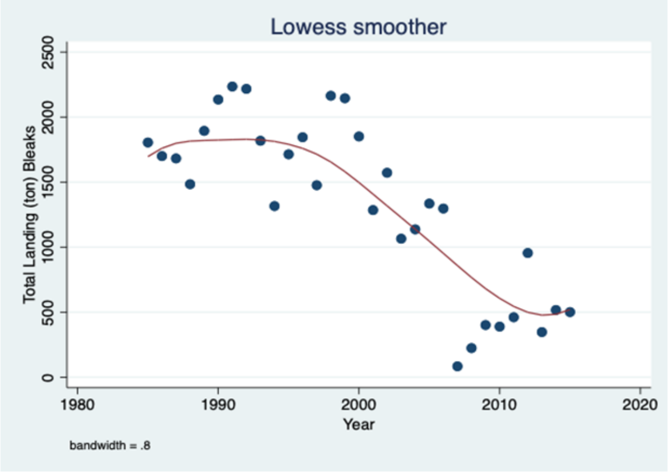

Figure 2: *LOWESS Smoother plot of annual fluctuations of Bleak landing (1985-2016).*

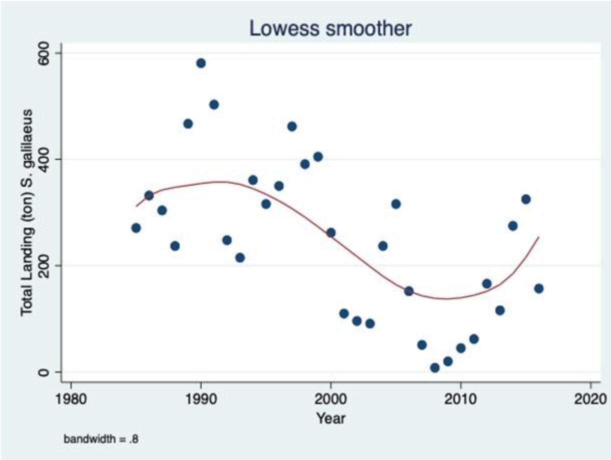

Figure 3: *LOWESS Smoother plot of annual fluctuations of SG landing (1985-2016).*

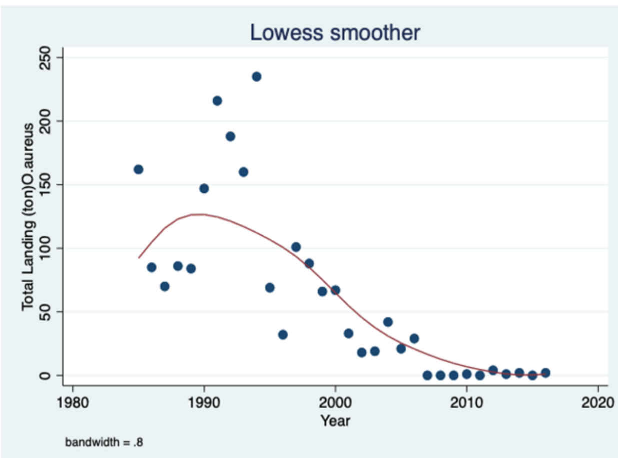

Figure 4: *LOWESS Smoother plot of annual fluctuations of Oreochromis aureus landing (1985-2016).*

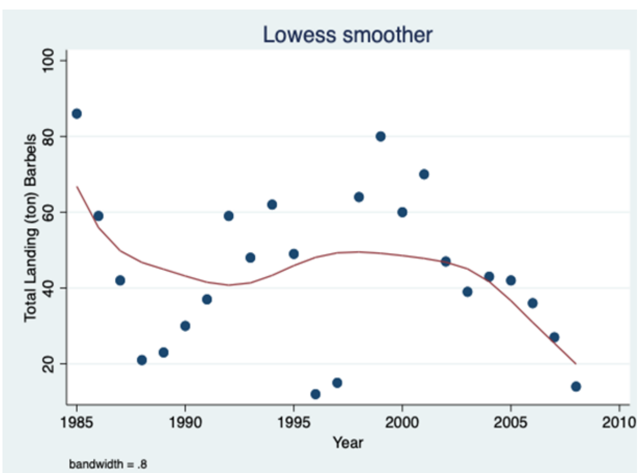

Figure 5: *LOWESS Smoother plot of annual fluctuations of Barbels landing (1985-2016).*

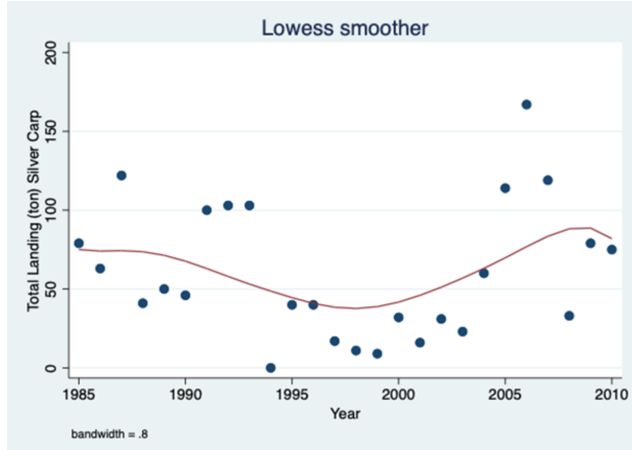

Figure 6: *LOWESS Smoother plot of annual fluctuations of Silver Carp landing (1985-2016).*

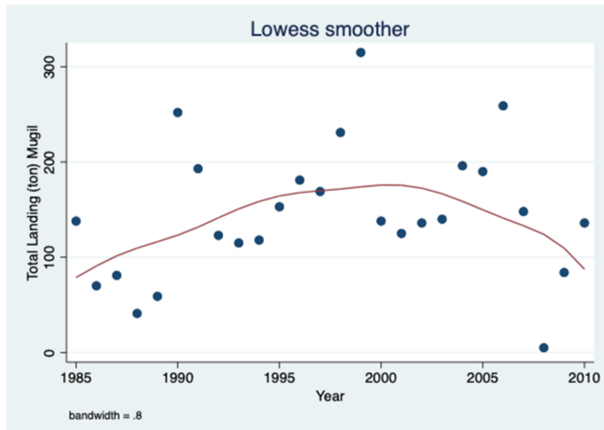

Figure 7: *LOWESS Smoother plot of annual fluctuations of Mugil landing (1985-2016).*

Discussion

The rational of Fishery management in Lake Kinneret is not only fisher income motivated because water quality impact is significant as well. Beside the high commercial value, the SG role as a contributor of water quality protector is un-doubtful. Consequently the unusual sharp decline of the SG`s population became a national concern. Obvious approach was likely a search for the reasons within the ecological trait: among others, climate conditions and physical parameters, potential predators, native food availability and potential competition, illegal fishery implementation or overfishing. Rather quickly those factors were clarified. The decline fishery of Bleaks followed by their population enhancement and food competition implication, the damage done by Cormorants and Catfish predators was also confirmed. Moreover, enforcement of elimination of illegal gill-nets was implemented as well. An unexpected alarm was abruptly signaled by fishes (M. Lev personal communication) (2009) about mysterious, eye defects spreading within Tilapia specimen (Photo

1) as well as mortality. An immediate contact was created with virologists in the Israeli Veterinary Service which initiated a long-term research, the Virus was classified and biochemically identified (Eyngor et al 2014). The etiological agent of the disease factor was defined (a novel RNA virus entitled "TiLV") and its isolation procedures was revealed. Sequence of trials were carried out which evidently provide proof of the ability of the TiLV virus to disperse throughout a waterborne infective rout. Fish were injected with TiLV and 74-85% of them developed clinical disease symptoms and died within 10 days. Nevertheless, the virologists suggested that fish can mount a protective immune response to TiLV.

Conclusion

The SG crisis in Lake Kinneret include ecological and virological outcomes beside anthropogenic involvement. Dilution of the Bleak population. Cormorant deportation are feasible as well as SG fingerlings protection. The native cyclical fluctuations of the SG1s population size changes are not under control. Changes of climate conditions which induce phytoplankton composition modification are not open for human intervention. The abrupt outburst of the TiLV initiate intensive onset research which presently offset/ recent reports from Kinneret Fishers inform a very wide spread of the TiLV disease among 3 species of Tilapia and Barbels. The fate of protected Fish population in Lake Kinneret effective for Fishery and water quality protection is not fully guaranteed. The population size and appropriate age composition in the lake aim at water quality protection and effective fishery are presently exist as a result of appropriate management. The deteriorated outbreak of the TiLV virus was unpredictable. The potential recover of the Tilapia community was documented but how to combat the TiLv is not yet known and severe damage is presently reported (Figure 8).

Figure 8: *SG: Commercial size: SL – 15.5 cm; TL-19.0cm; Left eye is infected by TiLV.*

References

1. Eyngor M, Zamostiano R, Krmbou JE, Berkovitz TA, Borcovier H, Tinman S, et al. Identification of novel RNA Virus Lethal to Tilapia. J Clinical Microbiol. 2014; 52: 4137-4146.
2. Gophen M, Sonin O, Lev M, Snovsky G. Regulated fishery is beneficial for the sustainability of fish population in Lake Kinneret (Israel). Open J Ecol. 2015; 5, 513-527.
3. Gophen M. Fishery Management in Lake Kinneret: A Review. J Fish Aqua Dev. 2014.