

Additional information on impact of pollution on Flamingo

Introduction

Flamingos are widely distributed in alkaline saline lakes especially those found in the Rift Valley. They constitute the greatest numbers and biomass of life in these Rift Valley lakes. These lakes are known for their low species diversity due to hostile ecological conditions to many aquatic species and high productivity, especially that of *Spirulina platensis* the main food for Lesser Flamingo. Located in arid and semi-arid areas, these lakes undergo regular (and cyclic) changes in water levels mostly in response to precipitation, which is unreliable and unpredictable. They therefore show high variable regimes in water levels, food availability and species composition.

Lesser Flamingos are algivorous filter feeders subsisting mainly on *Spirulina platensis* with occasional resource to diatoms. *Spirulina* is the most common type of algae in the saline lakes and constitute the major food of the lesser Flamingo. Other algae species found in these lakes are too small to provide effective food supplies for Flamingo. Flamingo ecology is finely tuned to their variable food supply, the quality and quantity. They show nomadic movement between the various lakes, which is spontaneous and unpredictable but has been shown by recent research to be closely associated with food availability and fresh water points.

Flamingo movements are aimed at tracking highly productive food patches both within and between the saline lakes. Any ecological process affecting these two major factors triggers off their movement instincts. This aspect of behavior makes Flamingo none residence in any one saline lake, but exploit various lakes as their home range. In spite of this kind of utilization, some lakes are of special importance to Flamingo such as Nakuru as a feeding and display site, Lake Natron as the only safe and successful breeding site, and Lake Bogoria as a stable lake and refuge when other relatively shallow lakes dry out. Other important dispersal lakes like Elmenteita, Simbi, Amboseli, Turkana, Sonachi and Magadi and other small lakes in the East African region are important for occasional conditions in the main lakes deteriorate simultaneously.

Flamingo deaths – Historical Back Ground.

In the recent past Flamingo mass deaths have been reported in 1993-95, 1999-2000. Clinical and laboratory analyses have associated the deaths to food poisoning. However all the studies done to date have never been conclusive on the main cause of death.

In 1993 about 35,000 were reported to have died between August and November. In 1995 about 15,000 died in August. The number of deaths in 2000 was not documented, but it can be estimated to have been around 100,000. In all these incidences of deaths have been starting from Lake Bogoria, where accurate data on dead birds has never been kept. At the moment these birds are dying in Lakes Bogoria, Nakuru and Elmenteita.

Causes of deaths

During the 1994/5 and subsequent deaths, dead and weak birds were emaciated with swollen lymph nodes and puss accumulation. They had morphological changes that included

- ❖ Dissention of gall bladder with thick bile,
- ❖ Dark-green discoloration of the liver and surrounding tissues,
- ❖ Pale and enlarged kidney and
- ❖ Enlarged spleen.

Toxicological analysis of liver, kidney, brain and blood samples showed

- ❖ Accumulation of heavy metal (Cadmium, Lead, Zinc, Chromium, Arsenic, Nickel)
- ❖ Pesticide accumulation (DDT)

Histological analysis showed

- ❖ Liver portal hepatitis
- ❖ Scattered single cell necrosis
- ❖ Intra-cytoplasmic globules, renal tubular degeneration
- ❖ Interstitial haemorrhage

The lake Bogoria catchment has experienced changes in vegetation cover, with in some areas experiencing serious degradation. The rivers flowing into the lake have become more turbid in the recent past. Although lake Bogoria lake level is not depended on surface flow, river flow regimes has been affected by this change in vegetation cover, resulting into reduced river flow periods

In the recent past flamingo mortalities has been associated to heavy metal pollution especially in the saline alkaline lakes. Although dead birds have shown signs of toxicosis, this cannot be associated to heavy metal pollution, as some scholars have tried to prove. The levels of heavy metals in the birds' tissues have not been proved to be at lethal levels. The following are some gray areas in this theory: -

- ❖ Other water bird species are found in these lakes experiencing flamingo mortalities, yet non of these other water birds is responding to the hypothesized heavy metal pollution. In some of these lakes like Magadi, Elementeita and Nakuru have fish that feed on algae like lesser flamingo. The dilemma is why is the lesser flamingo the only water bird species dying?
- ❖ Heavy metal pollution affects birds' populations through reduced breeding success before mortalities strike. These birds are still breeding judging from large numbers of young flamingos already in these lakes. Secondly heavy metal mortalities are continuous and not periodic as is the case in point. If this theory is true why is it that these deaths are periodic?
- ❖ Heavy metals mortalities occur as a result of continued exposure to high levels of heavy metals in food or the environment. The older an individual is, the higher are the levels of specific heavy metal concentrations in the body tissues. One would expect old birds to have the highest concentrations and mortalities. The situation is centrally to this since these deaths are affecting all ages and the levels of contamination in the tissues similar for various age groups. Mortalities have affected both old and young (in fact young birds less than a year old have been found dead). If it is heavy metal pollution when did these young dying birds get exposed to contamination?

Rift Valley is known for an unusual concentration of minerals, with areas having too much or nothing

at all of specific minerals. A recent survey has shown lakes Magadi, Sonachi, Elementeita, Nakuru and Bogoria as having no significant variation in heavy metal concentrations. Similarly fish sampled from Lakes Magadi and Elementeita has shown no significant variation in heavy metal accumulation with those from Lake Nakuru.

Further these alkaline lakes have for a long time been dominated by blue green algae (*Spirulina platensis*), but in the recent past they have shown high occurrence of cyanobacteria and poisonous algal toxins. These are quite dominant during periods of algal blooms, periods that have also coincided with the deaths, and are believed to produce algal toxins. Symptoms of dying flamingos are similar to those of algal toxicity. This is another aspect of deaths currently being explored to shed more light into these flamingo mortalities.