The stability of the Biota of the Bitter Lakes

by

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H. STEINITZ [1969] was the first author of modern times to emphasize the fact that the Suez Canal is a habitat, and not only a mere pathway, as sought by many authors who considered the Lessepsian migration through this Canal. The Bitter Lakes, the large and saline waterbody which contains 85 % of the Canal waters [THORSON, 1971], has to be considered by all means as an aquatic basin in its own right. KELLER [1882], the first zoologist to investigate the Lakes, wrote " *...Das Kanalbecken ist... so eng dass es sich zum Seebecken ausnimmt, wie ein Federstrich auf einer Papierfläche* ". One might easily say that a species becomes established in the Canal system, only when it has established itself in the Bitter Lakes.

We cannot accurately follow the stages in the repopulation of the Bitter Lakes — an old landlocked hypersaline basin — after the opening of the Suez Canal. However, I am tempted to distinguish three successional stages in the establishment of the Lakes' biota. The first phase, started immediately after the flooding of the Lakes, was characterized by a very small number of extremely euryhaline marine species such as *Cardium edule*, *Mytilus variabilis* and *Sphaeroma serratum*. TILLIER [1902], referring to this stage, mentioned that even in the very first years of the canal works, in the 2-3 meters deep canal trail, there was a rich fish fauna.

A second stage is witnessed by KELLER [*op. cit.*], and it might have reflected the situation 10-12 years after the Canal opening in 1869. By this time, the present molluskan fauna already had its major species inventory : *Strombus tricornis*, *Murex tribulus*, *Mactra olorina*, *Gaphrarium pectinatum*, etc. *Cassiopea andromeda*, the obvious medusa, and most of the fish species were already established. The hardiest of the echinoderms and decapods *(Nudechinus scottiopremnus*, *Metapenaeus stebbingi*, *Pilumopeus vauquelini* and *Neptunus pelagicus)* were already on site. Algae and flowering plants were still mostly lacking.

By 1924, the time of the Cambridge Expedition [M. FOX, 1926-1929], the main of the present vegetation was already established. The inventory of the dominant Echinodermata was complete with the addition of *Synaptula recirpoquans*, *Asterina burtoni*, *Astropecten polyacanthus*, *Ophiothrix savignyi* and *Ophiactis savignyi*. The list of the dominant decapods became enriched with the three species of widespread leucosiid crabs.

Recent work done on the Bitter Lakes collections of 1967-1971, 45 years after the Cambridge Expedition, show that the biotic inventory of the Lakes shows surprisingly little changes [STEINITZ & BEN-TUVIA (fishes), *in press ;* LIPKIN (plants), *in press;* BARASH & DANIN (mollusks), *in press;* LEWINSOHN & HOLTHUIS (decapods), *in letteris;* AILSA CLARK (echinoderms), *in letteris;* MONNIOT & MONNIOT (tunicates), *in letteris*]. According to POR [1971], there are no indications of species among the dominants, which disappeared from the Lakes during these 45 years, on the other hand, there are very few additional species recorded since. This statement holds true, first of all, for the major groups in the macrofauna for which good information is available.

This stability in the Bitter Lakes' biota is dramatically illustrated by the accuracy of two of KELLER's statements, 90 years after he made them. He wrote : "*...pelagische Organismen sind mit Sicherheit im Kanal nicht in Migration begriffen* ". Decades afterwards, MACDONALD [1933], GHAZZAWI [1936] and

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KIMOR *(in letteris)* still did not find a typical marine plankton in the Bitter Lakes; it is still predominantly estuarine. KELLER also wrote " *...Am venigsten Neigung zur Wanderung (into the Canal!) zeigen Echinodermen und Coelenteraten* ". 90 years later they are still the least represented groups of the macrofauna.

There are also a few examples on the positive side. M. FOX, in his addendum to MORTENSEN [1926], wrote about *Nudechinus* that " *tests of this form were found in incredible numbers... on the eastern shore of the Great Bitter Lake* ". On our visits in recent years the picture was still the same. CALMAN [1927] speaks of many dead specimens of the crab *Leucosia signata* on the shore. The same can be seen today.

There are two largely complementary reasons for this stability :

1. The surface salinity of the Bitter Lakes attained a minimum value of 45 $^{o}/_{oo}$ sometime around 1958 [OREN, 1971]. This salinity is comparable to that of many Red Sea lagoons [POR, 1972]. But even before this minimum was attained, a full fledged biotic community flourished in the Lakes.

2. The biota of the Bitter Lakes went through a rapid successional sequence, as does every newly settled environment. By 1924 at the latest, a climax community had been established, showing the fluctuations in composition which are usual in every waterbody. This community of euryhaline marine animals is similar to that of other such Red Sea lagoons, and became, in a way, an obstacle for further newcomers. The fact that the Lakes have two entrances does not basically change the terms of reference. Therefore it is understandable, that many of the dominant species *(Cassiopea, Strombus tricornis, Nudechinus)*, while plentiful in the Lakes, did not venture into the Mediterranean. The number of Lessepsian migrants into the Mediterranean is actually limited to those Bitter Lakes inhabitants which have the possibility to get adapted to Mediterranean conditions.