The Bardawil Lagoon (Sirbonian Lagoon) of North Sinai - A Summing Up

by

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Abstract

The metahaline Lagoon of Bardawil (Sirbonian Lagoon) in Northern Sinai has been intensively investigated during the last 12 years. Over forty scientific publications are reviewed. The Lagoon is the most important high-salinity lagoon of the Eastern Mediterranean and as such it is inhabited by characteristic biota, new species, and Lessepsian immigrants. The lagoon is highly productive and fisheries have been developed in accordance to modern management principles, in order to ensure high catches of Sparus aurata, Mugil cephalus and other fishes.

Résumé

La lagune metahaline de Bardawil (Lagune Sirbonique) du Nord du Sinaï a été étudiée de pres pendant la dernière douzaine d'années. Plus de quarante publications scientifiques sont passées en revue. C'est la lagune saline la plus importante de la Méditerranée Orientale. En consequence, un monde vivant tout á fait characteristique a été decrit, contenant aussi des espèces nouvelles et des immigrants lessepsiens. Les eaux de la lagune sont trés productives et la pêche a été dirigée selon des principes scientifiques modernes pour accroitre les prises des poissons commerciaux comme Sparus aurata, Mugil cephalus, etc.

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Twelve years of research and management in this big metahaline lagoon of Northern Sinai can now be summarized. Prior to 1969, when the first data started to appear in the scientific publications, there were only the classical references of the hellenistic authors, mentioning the "Sinus Sirbonicus" or the brief travel account of Jarvis (1941). Some data on commercial landings were reported by Faouzi (1938) and Wimpenny (1932). The Bardawil Lagoon was one the white spots on the scientific map.

In the last 12 years considerable knowledge has accumulated and over 40 scientific papers dealt with this Lagoon. The morphology and the hydrography of the lagoon are summed up by: Levy (1971a,b, 1974), Por (1971),

Roth (1972, 1973) and Ben-Tuvia (1979). The geology of the region is treated by Neev et al. (1976) and Neev and Ben-Avraham (1977).

The Bardawil Lagoon covers an estimated area of 650 square kilometers with a maximum length of 90 km and a maximum width of 22 km. The water depth ranges from 0.5 m to a rather rare 3 m. Separated from the Mediterranean by a sedimentary bar with maximum width of 2 km, it is connected to the sea by artificial openings in the west (Boaz I and Boaz II) and an eastern natural opening, the Zarniq. Winter gales can spill over the bar and penetrate the Lagoon.

Salinities increase from the openings towards the southern shore and in years of normally functioning openings they range from Mediterranean values to around 70 ‰. Salinity in the main waterbody of the lagoon fluctuates seasonally between 41-68 ‰. Salinity highs are reported for the late summer, July-September. In the years 1969-1971, the artificial openings were occluded by sand and the salinity in the lagoon increased to around 100 ‰ maximum value. The study of Krumgalz et al. (1980) on the magnesium/salinity and calcium/salinity ratios of the Bardawil Lagoon brines confirms that the saline water of the Lagoon was formed by processes of evaporation of the Mediterranean seawater.

Minimal winter temperatures are around 12°C and summer maxima of 34°C were measured. Dissolved oxygen is relatively low in the summer, but on the average the supply is good. The nutrient content of the open waters is low, but the nearness of the detritus-rich and nutrient-rich bottom is of decisive importance in determining the high productivity of the Bardawil Lagoon.

The bottom is usually covered by the sea grass Ruppia spiralis (Lipkin, 1969, 1977) on which Cladophora and a diverse diatom flora grow. Some of the diatoms, such as Cocconeis bardawilensis, Amphora cofeaeformis and Mastigloia sirbonensis (Ehrlich, 1975), are adapted to the high salinities of the lagoon. The phytoplankton is poor and poor in species, though diatoms of the genus Synedra and dinoflagellates of the Ceratium type were found (Kimor and Berdugo, 1969, Kimor, 1975). A new species, Dunaliella bardawilensis (Ben Amotz, pers. comm.) has been found in the lagoon.

The zooplankton, too, is not very diversified. Kimor and Berdugo (1969) reported several species of Tintinnida, the copepods Acartia clausi, A. latisetosa and Euterpina acutifrons and the very common cladoceran Bosmina coregoni maritima. Mysidacea are very common, forming and important food item of juvenile Sparus aurata.

The zoobenthos of the level bottoms is relatively diversified. Por (1972) described a rich fauna of harpacticoid copepods, among them the new species Paramphiascella sirbonica. Ostracods and nematods reach high biomasses. The chironomid larvae Cricotopus mediterraneus are an important component of the fish diet. Augeneriella lagunaris, a sabellid polychaete common on Ruppia stems, has been described by Gitai (1970).

The mollusc fauna of the Bardawil Lagoon is composed of a core of euryhaline species: Cerithium scabridum, Pirenella cailliaudi, Mactra olorina, Brachidontes variabilis and Cerastoderma glaucum. More recently Barash and Danin (1977) have made some interesting additions to this fauna, among them the tellinid shell Angulus valtonis.

Metapeneus stebbingi is the common shrimp of the lagoon (Tandler, 1972). Dredging at night also revealed the presence of young Peneus semisulcatus (Tom, 1979). A swimming crab Charybdis sp. is also fairly common.

Fishes have been studied over the years 1969-1979 by Ben-Tuvia (1975, 1976, 1977, 1979) and Zismann and Ben-Tuvia (1975). The commercial fishes are a migratory element and among them the most important are: Sparus aurata, Mugil cephalus and Dicentrarchus labrax. Liza ramada, L. aurata, L. saliens, L. carinata, Chelon labrosus, D. punctatus, Solea solea, Argyrosomus regius, Epinephelus aeneus and Crenidens crenidens are also caught in some quantities. Small fish, reproducing in the lagoon are Atherina boyeri, Aphanius dispar, A. fasciatus, two gobies, two syngnathids and the interesting schools of Pranesus pinguis are occasionally found close to the openings. In total, over 60 species of fishes have been collected from the Lagoon (Ben-Tuvia, 1975).

The productivity of the Bardawil Lagoon as expressed in the high yields of commercial fishes compares favourably with other Mediterranean lagoons (de Angelis, 1960). The Venetian Lagoons for example, with their hundreds of years-old tradition of fishing and management, yielded on an average 31 kg/ha (D'Ancona, 1955), while the Bardawil Lagoon yielded during the period 1972-1979 31 kg/ha (Pisanty, 1980).

The scientific importance of the Sirbonian Lagoon can be seen under three different aspects. This is the most important high-salinity lagoon in the Eastern Mediterranean and as such it yields considerable information concerning problems of the biological classification of metahaline and hyperhaline environments (Por, 1972, Ehrlich, 1975). The Lagoon represents also a very good model of the present for the old saline waterbodies which occupied the Isthmus of Suez before the building of the Suez Canal (Por, 1971, 1978). Finally, the role of the Bardawil Lagoon in serving as a stepping stone for Lessepsian migrants in the process of colonization of the Eastern Mediterranean by Red Sea fishes, has been emphasized by Ben-Tuvia (1978); Crenidens crenidens and Autisthes puta are common in the Lagoon, but have not been found in any other part of the Mediterranean Sea. Similar data were collected by Barash and Danin (1972) for Cerithium scabridum, Mactra olorina and Angulus valtonis among molluscs.

Fisheries research has been conducted since 1970 (summarized by Ben-Tuvia, 1979). Catches of the two main commercial fishes, Sparus aurata and Mugil cephalus, decreased sharply during the high salinity years 1969-1971, while the catches of Dicentrarchus punctatus and Liza ramada increased somewhat. In the subsequent years measures were taken to maintain the openings clear; also the mesh size of all the fishing nets was increased

from 34 mm to 70 mm. This measure was supplemented by the setting of a minimum marketable size of 180 mm for Sparus aurata. Recommendations were also made to restrict fishing during the winter months from November to February, when the fish migrate through the openings. Although the fishing power of an average fishing unit doubled during this period, the catches for 1973-1978 continuously increased and in 1977 the all time record of 2,650 metric tons were caught (Ben-Tuvia and Golani, 1979).

Sparus aurata of the Bardawil Lagoon has been intensively investigated for biological parameters (Ben-Tuvia and Herman, 1972, Ben-Tuvia, 1979, Ben-Tuvia and Golani, 1979), feeding habits (Barash and Danin, 1970) and reproduction (Zohar et al., 1978, Eckstein et al., 1978). This fish is also being successfully grown and investigated in pilot plant mariculture ponds in Elat (Sakhnin and Ben-Tuvia, 1974, Pitt et al., 1977, Marais and Kissil, 1979).

The Bardawil Lagoon with its considerable scientific interest and high commercial landings should be considered one of the most important objects of research and management in the Mediterranean Sea, matching the importance of such well known environments as the Lagoons of Venice, the Lagoon of Sivash or the lagoons of southern France.

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