

# EXOTIC SPECIES AND LESSEPSIAN MIGRATION OF PLANKTON IN LEBANESE WATERS, LEVANTINE BASIN, EASTERN MEDITERRANEAN

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## Abstract

The plankton community in the Levantine Basin is relatively poor in biomass and high in diversity. 35% of the local species are found in the Red Sea, and 65% are present in the western Mediterranean. The majority of the exotic species encountered off Lebanon are Lessepsian migrants of Indo-Pacific and Erythrean origin. However, several species that inhabit either in the Mediterranean and the Red Sea before the opening of the Suez Canal have their geological history back to the Miocene era and Tethys Sea. The Aswan High Dam and deepening of Suez Canal have enhanced hydrological changes in the entire Levantine Sea and induce a continuous migration process. This phenomenon leading to the "Tropicalization" of the Levantine Basin is an index of certain global climate change.

**Keywords :** Exotic species, Levantine Basin, endemism

## Introduction

The Eastern Mediterranean, and in particular the Levantine Basin, are highly oligotrophic water bodies. Furthermore, their temperature and salinity are the highest in the entire Mediterranean. These hydrological characteristics are similar to those of the Red Sea. The opening of the Suez Canal enhance the migration process between the two marine environments, particularly from the Red Sea into the Mediterranean. An estimated 400-500 marine species were introduced into the Levantine Basin (1) and many planktonic species established permanent populations along the Levantine coast (2,3). Some other exotic species may reach the area, not only through the Canal pathway, but through human activity, namely with ballast water. The fauna and flora of the Eastern Mediterranean, belong to the Atlanto-Mediterranean type, with certain tropical and subtropical affinities. Studies of the Levantine plankton before the opening of the Suez Canal in 1869 were scarce and poorly known. Considering this gap of knowledge, it is difficult, even impossible, to ascertain whether species occurring both in the Levant and in the Red Sea may be considered exotic. However, we concur (1,4) that several Mediterranean endemic species inhabited the Tethys Ocean.

In this paper we try to define the exotic species found in the Lebanese waters, from Indo-Pacific origin and from other remote seas.

## Methods and Material

Qualitative and quantitative series of samples for both phytoplankton and zooplankton were taken monthly or seasonally, from 1970 up to 2002, at several inshore and offshore stations along the coast of Lebanon between 33°52' N-35°29' N and 34°30' N-35°50' E. Major hydrological profiles were collected simultaneously with vertical and surface plankton net hauls. Taxa were identified to species. Long-time series of plankton and hydrological data were published in previous works (5,6).

## Results

Several exotic species of Indo-Pacific and Erythrean origin have been introduced into Levantine Basin through the Suez Canal. Several other species were introduced by ballast water of vessels coming from remote seas. Possibly, up to 50% of these species adapted themselves to the new environment where they established permanent populations. We estimate that 35% of the species recorded in the Lebanese waters are also present in the Red Sea (7, 2) (Table 1).

**Table 1. Number of plankton species commonly found in Lebanese waters and Red Sea.**

GROUPS	Nb.Species Lebanon	Nb.Species common with Red Sea
Diatomae	175	40
Dinoflagellata	230	70
Tintinnidae	141	40
Radiolaria	25	?
Hydromedusae	74	?
Scyphomedusae	8	3
Siphonophorae	28	18
Pteropoda	8	4
Heteropoda	4	?
Cladocera	6	2
Amphipoda	25	7
Copepoda	175	50
Decapod larvae	109	?
Chaetognatha	10	5
Thaliacea	6	4
Appendicularia	15	8
Ichthyoplankton (eggs & fish larvae)	95	15

Some Indo-Pacific species in the Levantine Basin have been mentioned or recorded in the western Basin ; these exotic species have been probably introduced through the Gibraltar strait rather than the Suez Canal pathway.

The complete list of the exotic species found in Lebanese waters was given in a previous work (3). Some of these introduced species may develop and overcome other species to become an invasive species. This is the case of the scyphomedusa *Rhopilema nomadica*, which appeared in the late 1980s and replaced the previously common *Rhizostoma pulmo*. This stinging species injures swimmers and damages fishingnets. The main exotic species are given in Table 2.

**Table 2. Major exotic species found in Lebanese waters during the last decades.**

Diatoms	<i>Chaetoceros coarctatus</i>
Dinoflagellates	<i>Ceratium egyptiacum</i> , <i>C. breve</i> , <i>Dinophysis</i> spp., <i>Oxytoxum</i> spp
Tintinnids	<i>Tintinnopsis</i> , <i>Epilopylis</i> , <i>Favella</i> spp. <i>Coxiella</i> spp.
Hydromedusae	<i>Bougainvillia platygaster</i> , <i>Nubiella mitra</i> , <i>Paracystaeis octana</i> , <i>Cystaeis vulgaris</i> , <i>Aequorea conica</i>
Scyphomedusae	<i>Cassiopea andromeda</i> , <i>Rhopilema nomadica</i>
Copepods	<i>Paracalanus crassirostris</i> , <i>Galanopia elliptica</i> , <i>C. media</i> , <i>Pontellidae</i> sp., <i>Labidocera pavo</i> , <i>L. madurae</i> , <i>Centropages furcatus</i> , <i>Acartia fossae</i> , <i>Corycaeus speciosus</i> , <i>Oncaea rufa</i>
Decapod larvae	<i>Peneus</i> spp., <i>Leucifer hansenii</i> , <i>Leptochela</i> sp. <i>Hippolytidae</i> spp., <i>Paguridae</i> sp., <i>Alpheidae</i> sp., <i>Periclimenes</i> , <i>Paguridae</i> sp., <i>Neptunus pelagicus</i> , <i>Leucosiidae</i> sp.
Ichthyoplankton (eggs & fish larvae)	<i>Siganus rivulatus</i> , <i>S. luridus</i> , <i>Selar djeddaba</i> , <i>Cynoglossus cinusarabici</i> , <i>Sargocentrum rubrum</i> , <i>Stephanolepis hispidus</i>

## Conclusion

Lessepsian migration is a continuous phenomenon. Most of the exotic species establish permanent populations, some became invasive. Most of them remain confined to the Levantine Basin ; few reach the Aegean Sea, Ionian and Adriatic. Fewer still reach the western Basin. The increasing number of exotic species is due to the hydrological changes taking place in the Levantine Basin, namely, the rise of temperature and salinity, and also due to the global climatic change.

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