Iranian Fisheries Research Organization (IFRO)

The effects of climate change on the alien and invasive marine species migration behavior, in the NW Indian Ocean Seas

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The five threats to biodiversity

Land and Sea use Change
(Including habitat loss and degradation)

Example:
Agricultural land use which is responsible for **80%** of the global deforestation

Pollution

Make the environment unsuitable for survival directly and indirectly

Species overexploitation

Example:
Overfishing which may decimate global fish populations by 2050

Climate Change

Forcing the animal to shift range or confounding the signals that trigger seasonal events and more

Invasive species and disease

Compete with native species for space, food and other resources; sometimes spread disease that native species have no immunity of

Intelligent Man: The first known invasive species on earth

- Nearly 5.4 billion years have passed since the creation of the earth, and even now the earth is home to millions of living species, of which humans are one.

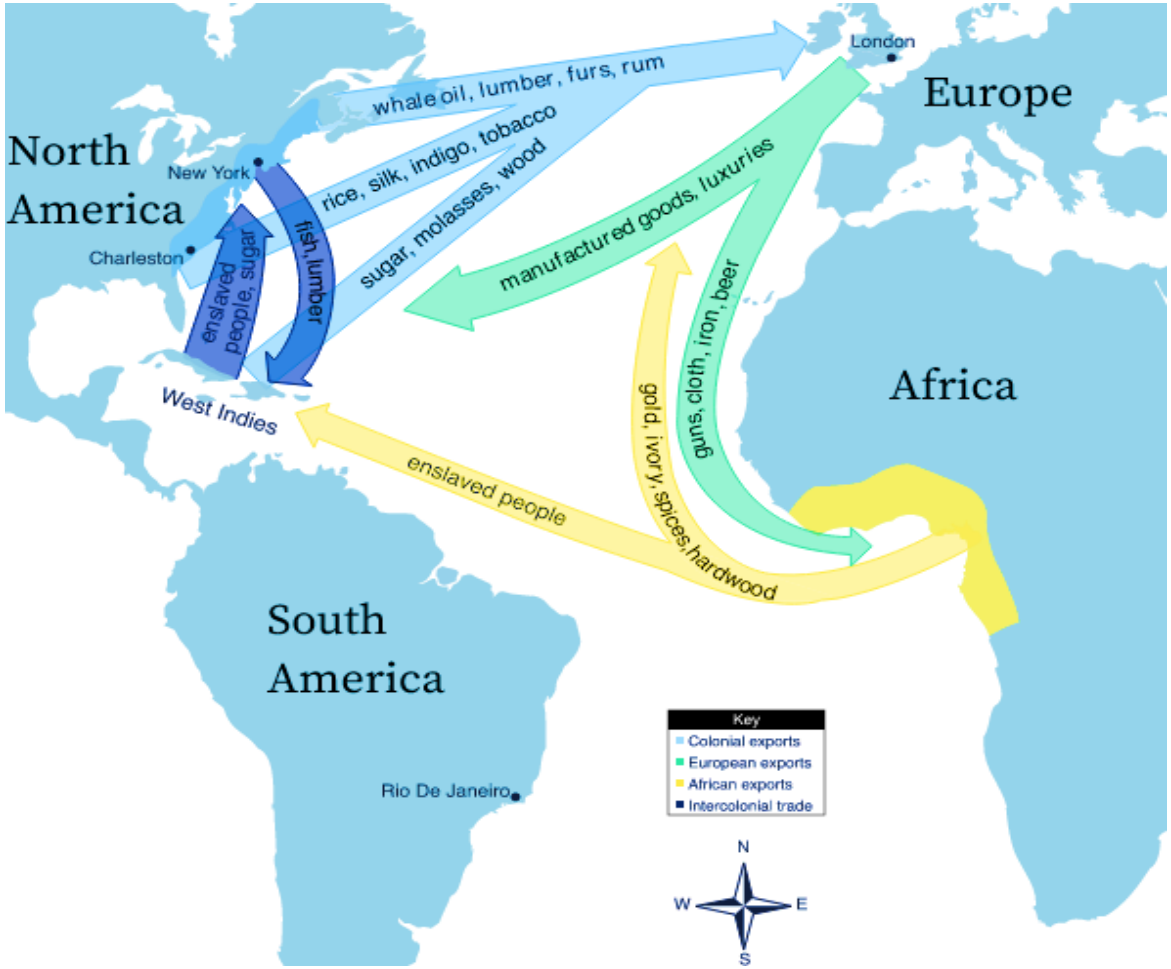
- It can be clearly stated that the intelligent human species, ***Homo sapiens***, is one of the oldest invasive species within a billion years since the appearance of life and the history of the formation of human geography on the planet.

- From thousands of years ago until today, humans have transferred in various ways, including local and intentional transfer of microorganisms, plant and animal species from native geographical areas to new areas between countries and intercontinental.

- ***H. sapiens*** has played a key role for the destruction of habitats and different ecosystems, disruption of the food cycle and introduce the natural enemies directly or indirectly.

Columbian exchange / Interchange

Following the voyage of Columbus to America in 1492, the widespread transfer of more than 200 species of plants, animals and unwanted diseases between 16 countries and between continents along with cultural displacement, human population from the Old World (Europe and Africa) to the New World (America) was done.



Principles of planning for the study of Alien Invasive Species (AIS)

- Identification of AIS should be planned and carried out based on three principles.
  1) Review of archival sources and documents,
  2) Refer to databases (national, regional and international),
  3) Field monitoring and information updating,

- This process was carried out by / based on :
  - Global Invasive Species Database-GISD specialist group as the AIS check list,
  - International Union for Conservation of Nature (IUCN) standards provided,
  - Available information and data regarding the AIS distribution patterns,

- The most important consequences of the presence of alien invasive species as follows:
  - Food and habitat competition with native species
  - Emergence of non-native parasitic species
  - Displacement of species
  - Change in habitat structural process
  - Phase change of the food web
  - Transmission of diseases and parasites
  - Threats to food security
  - Threats to human societies

Acceptable types of data quality and information needed

Observed

Observed information is directly based on well-documented observations of all known components of the habitats in the ecosystem.

Estimated

Estimated information is based on calculations that may involve assumptions and / or interpolations in time (in the past).

Projected

Projected information is same as "estimated", but the variable of interest is extrapolated in time (towards the future).

Inferred

Inferred information is based on variables that are indirectly related to the variable of interest, but in the same general type of units .

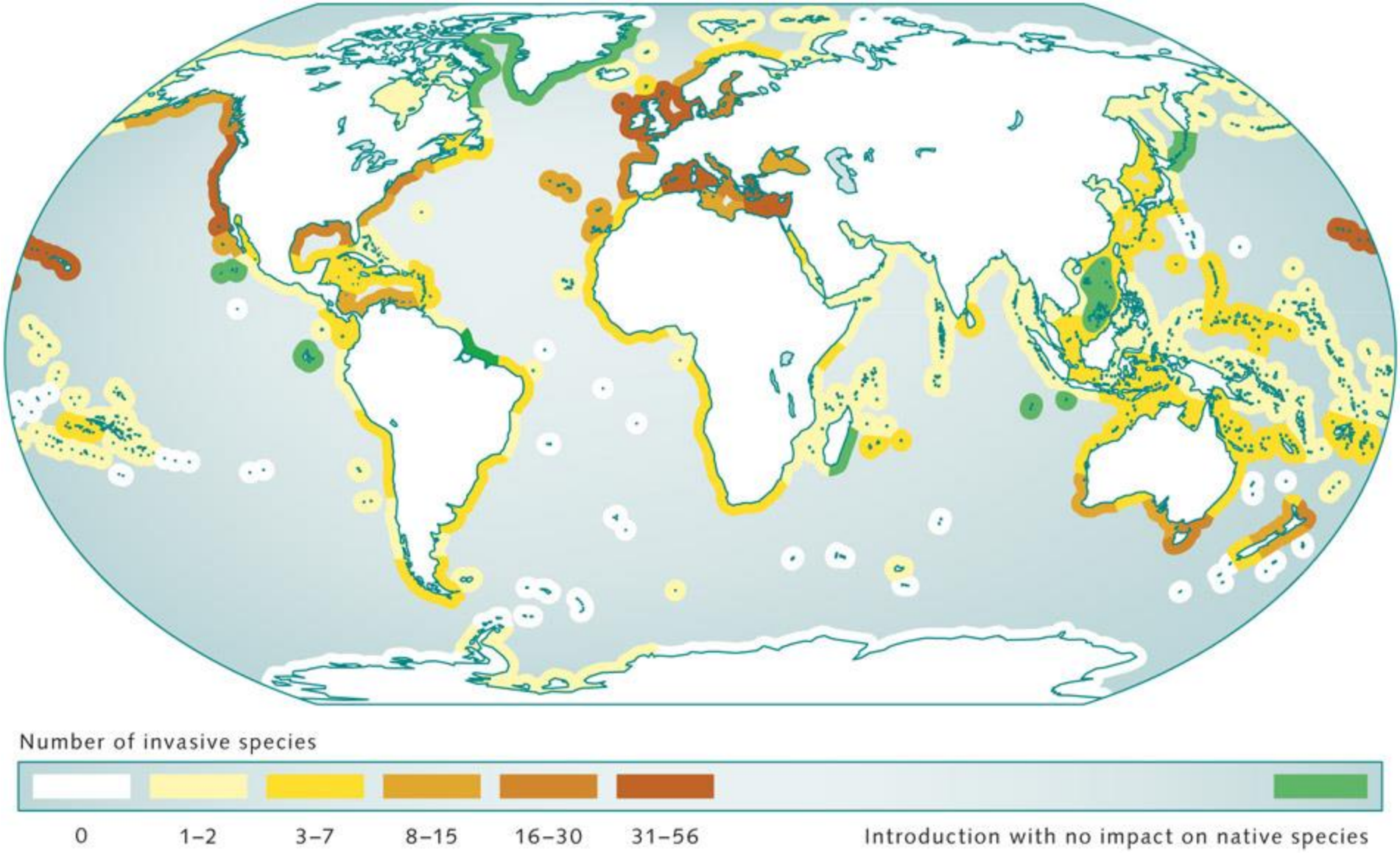
Suspected

Suspected information is based on circumstantial evidence, or on variables in different types of units, can be based on any factor related to abundance or distribution.

Not confirmed

Not confirmed information include a set of information and data for which there is no documented or even doubtful proof.

Globally number and distribution patterns of AIS

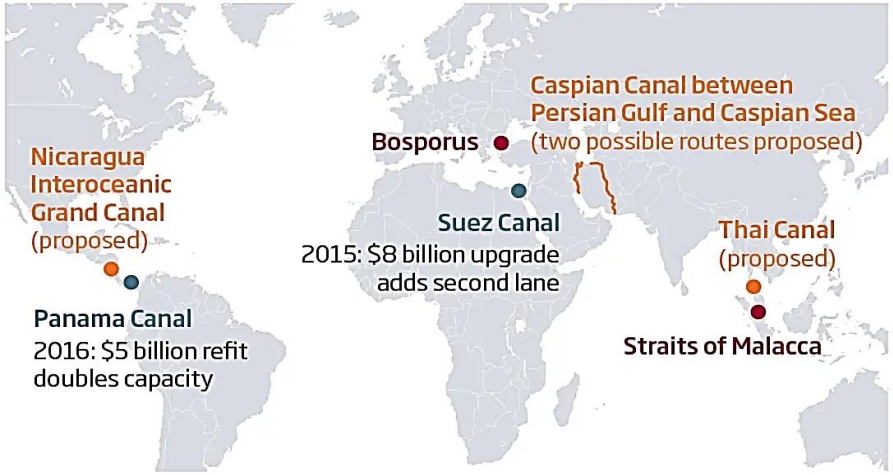


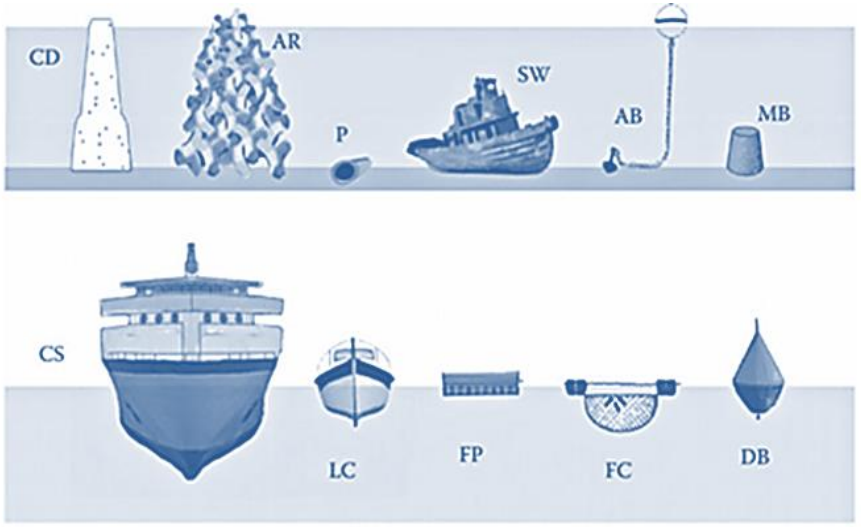
Pathways to transfer and introduce the marine AIS

- Introducing species to new areas is not a new phenomenon. This process has been happening at a very low rate for millions of years and is mostly between close neighbors and neighboring regions.

- The processes that lead to the introduction of non-native species from one geographic location to other areas are called **pathways**.

- These routes are numerous or act for introductions for presence of non-native / alien) species .
  - **Under natural conditions** (marine currents, wind, floods, rivers and border waters)
  - **By humans in accidental ways** (Anthropogenic canals, fixed / mobile artificial structures, Ballast waters)
  - **By humans in a purposeful / targeted ways** (ornamental and zoo species, laboratory and research species, economical species)





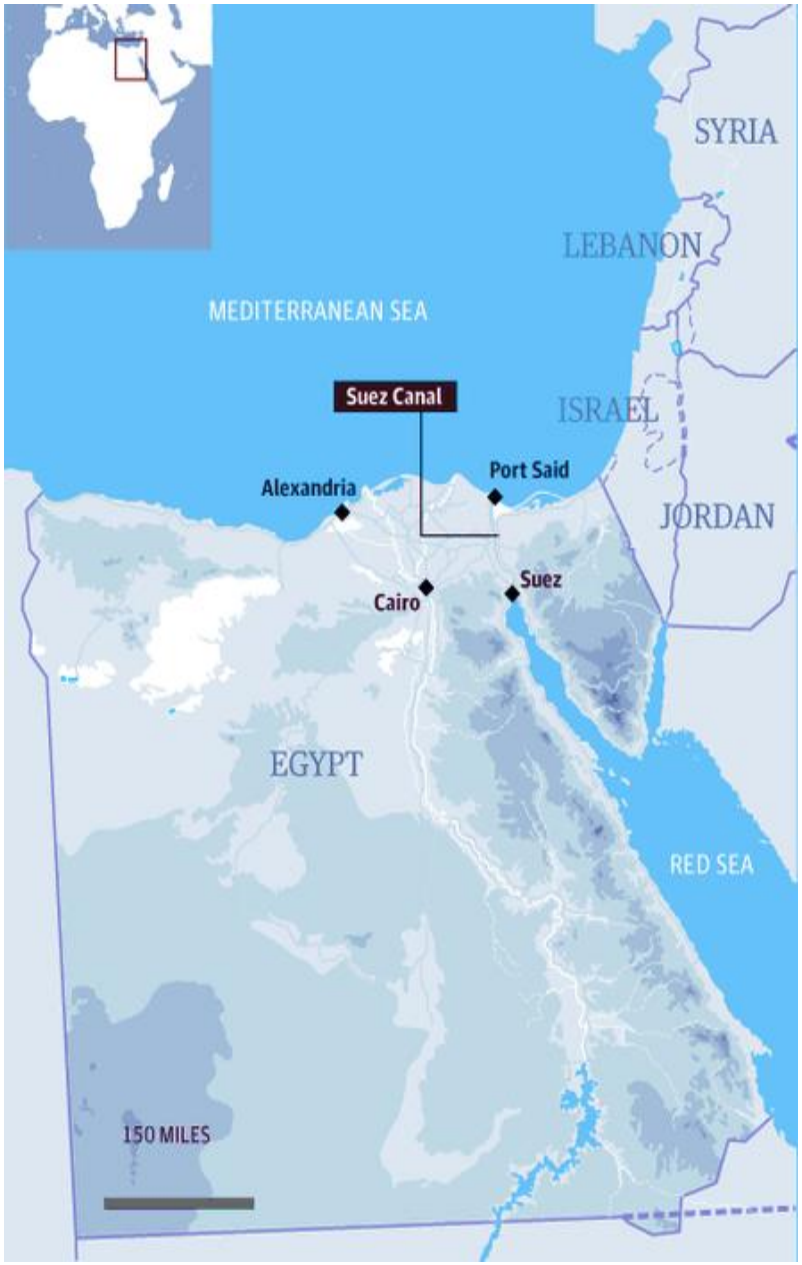
Geographical borders of the NW Indian Ocean Region

Marine basins of the NW Indian Ocean region

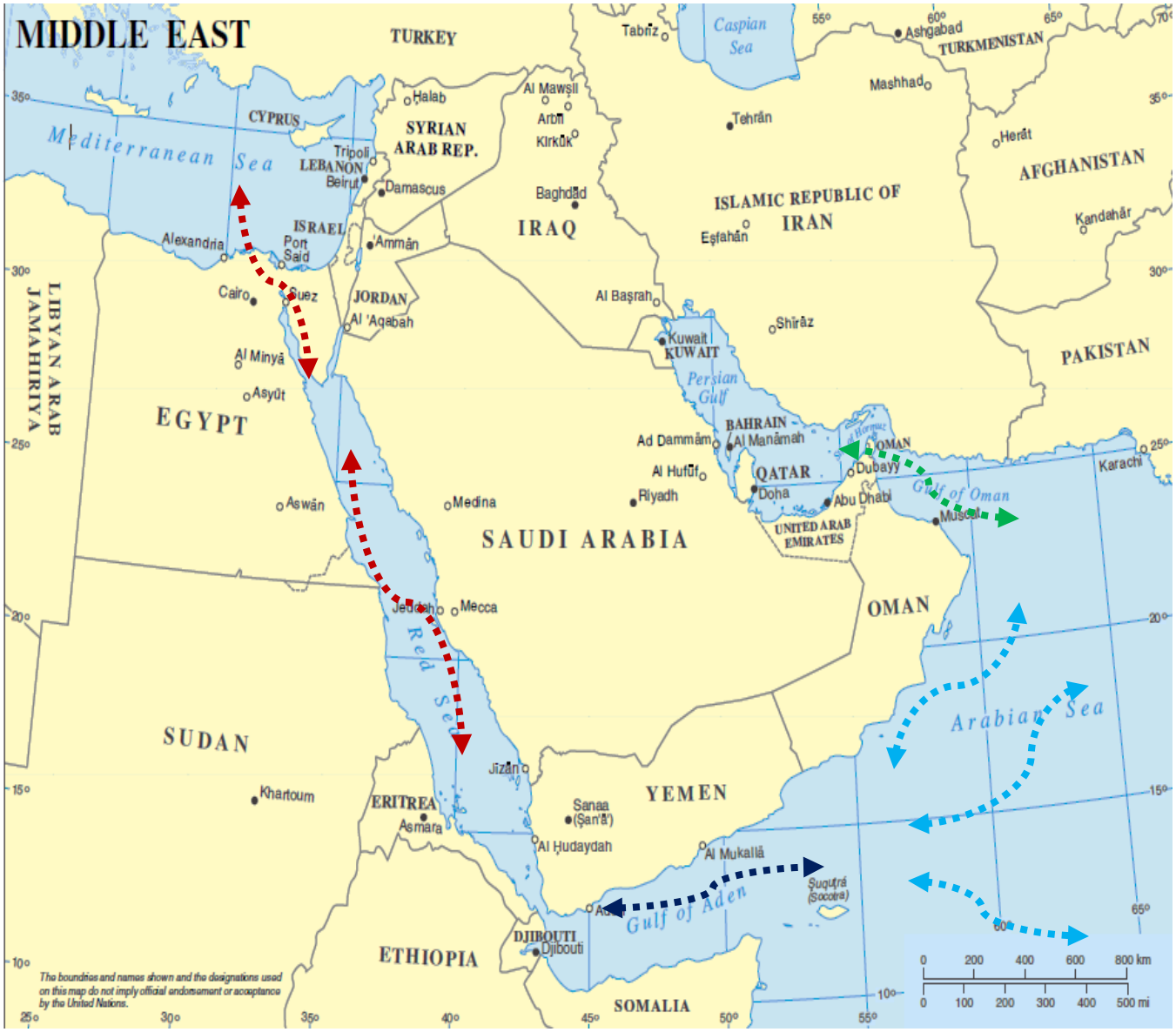
Documentation of intercontinental movement of AIS in NW Indian Ocean

Lessepsian / Anti-Lessepsian migration

- This type of migration was named after the French engineer Ferdinand de Lesseps after the construction of the Suez Canal in 1869 (193 km long) due to the process of moving a large number of marine animals.
- Many marine species, including fish, crustaceans and molluscs, which were native to the waters of the Mediterranean Sea and the Indo-Pacific Ocean basin of the Red Sea on both sides of the Suez Canal, were introduced to new waters by crossing this canal.
- Some of them spread invasively in new habitats with aggressive behavior and habitat interference with native species, which is why they are also called Eritrean invasion or Lessepsian invasion.
- This phenomenon has been developed in a wide geographical area from the east to the west of the Mediterranean Sea, the Suez Canal, the Red Sea and the Gulf of Aqaba known as the Lessepsian province.
- About 190 species have moved in this basin, and new species are identified and reported every year, especially in the Mediterranean Sea.



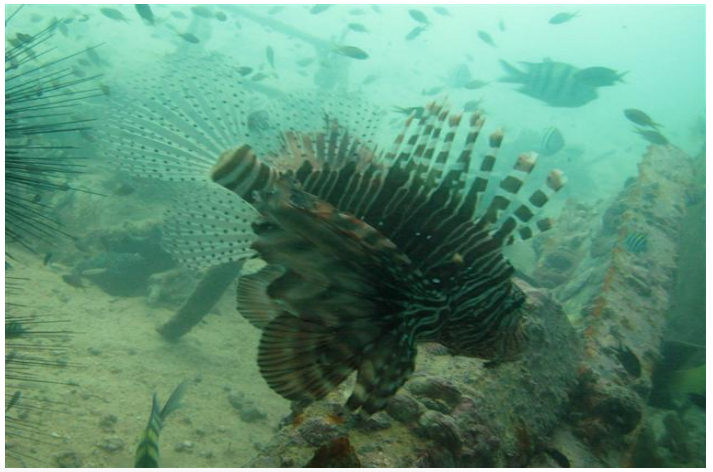
Mediterranean Sea - Red Sea - Indian Ocean transition zone (Lessepsian Migration Crossing - LMC)

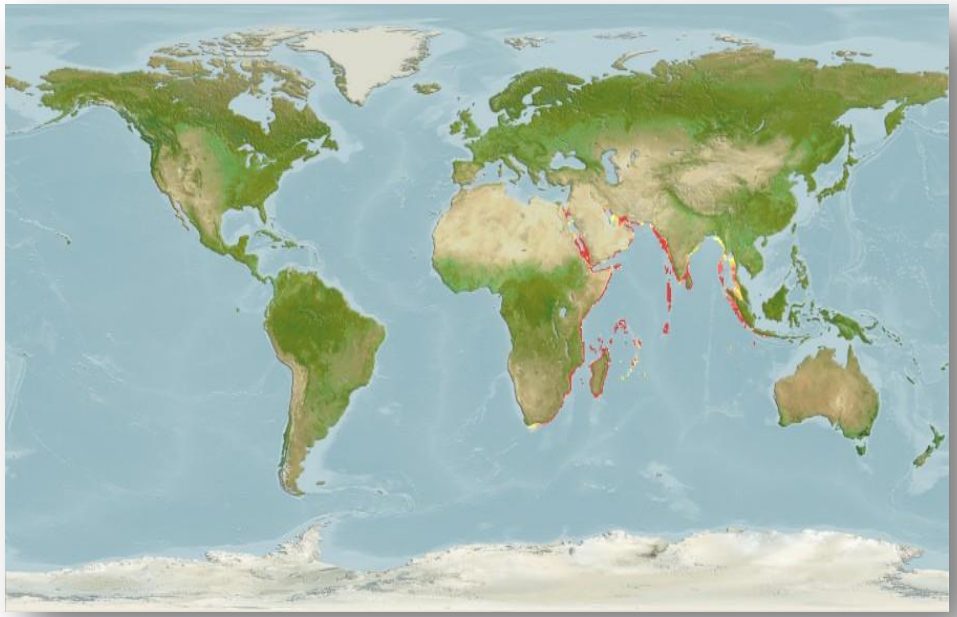


The spread of AIS in the region - Fishes

***Pterois miles* (Scopaenidae)**

Devil firefish / Common lionfish

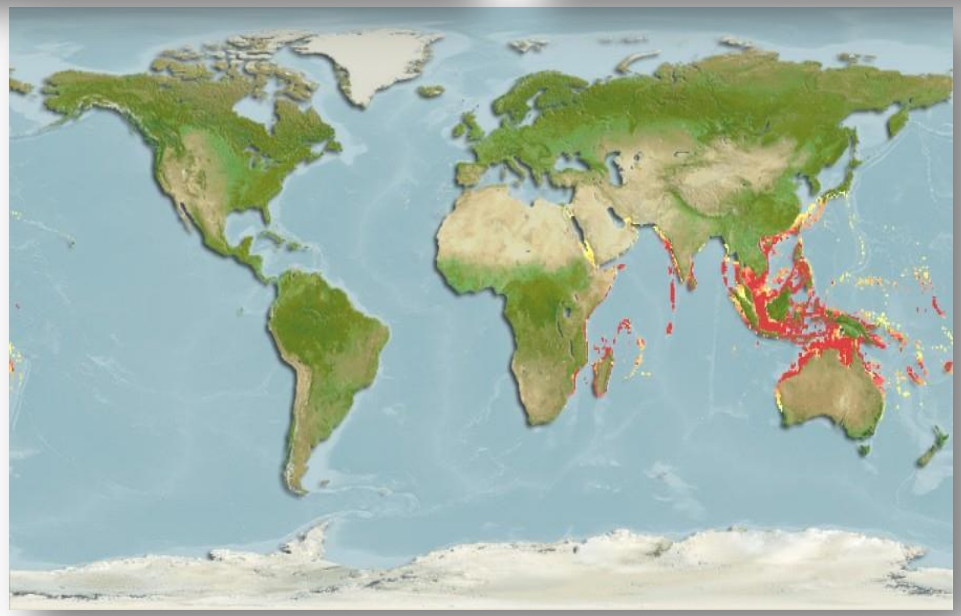




The spread of AIS in the region - Fishes

***Sargocentron rubrum* (Holocentridae)**

Redcoat fish



The spread of AIS in the region - Fishes

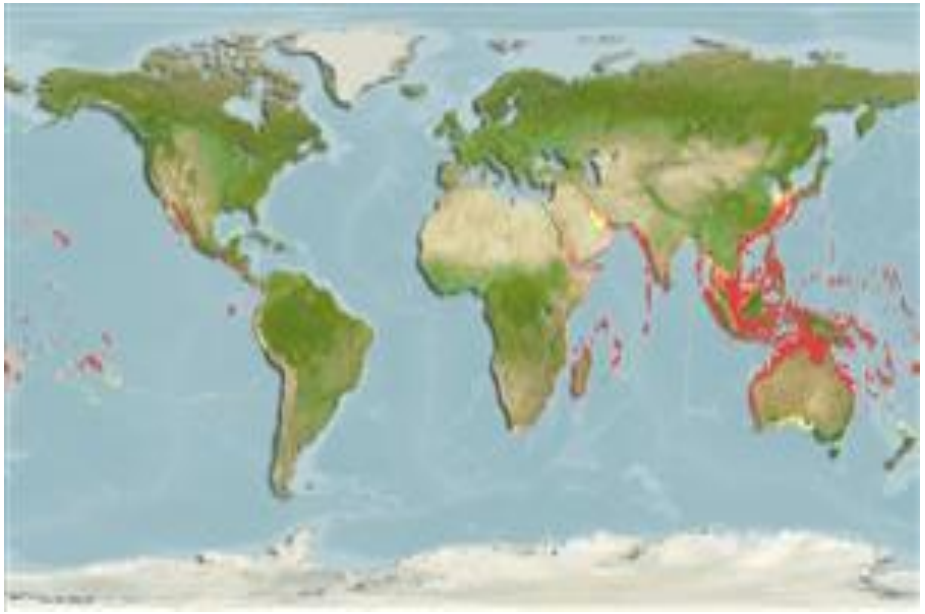
***Stephanolepis diaspros* (Monacanthidae)**

Reticulated leatherjacket

The spread of AIS in the region - Fishes

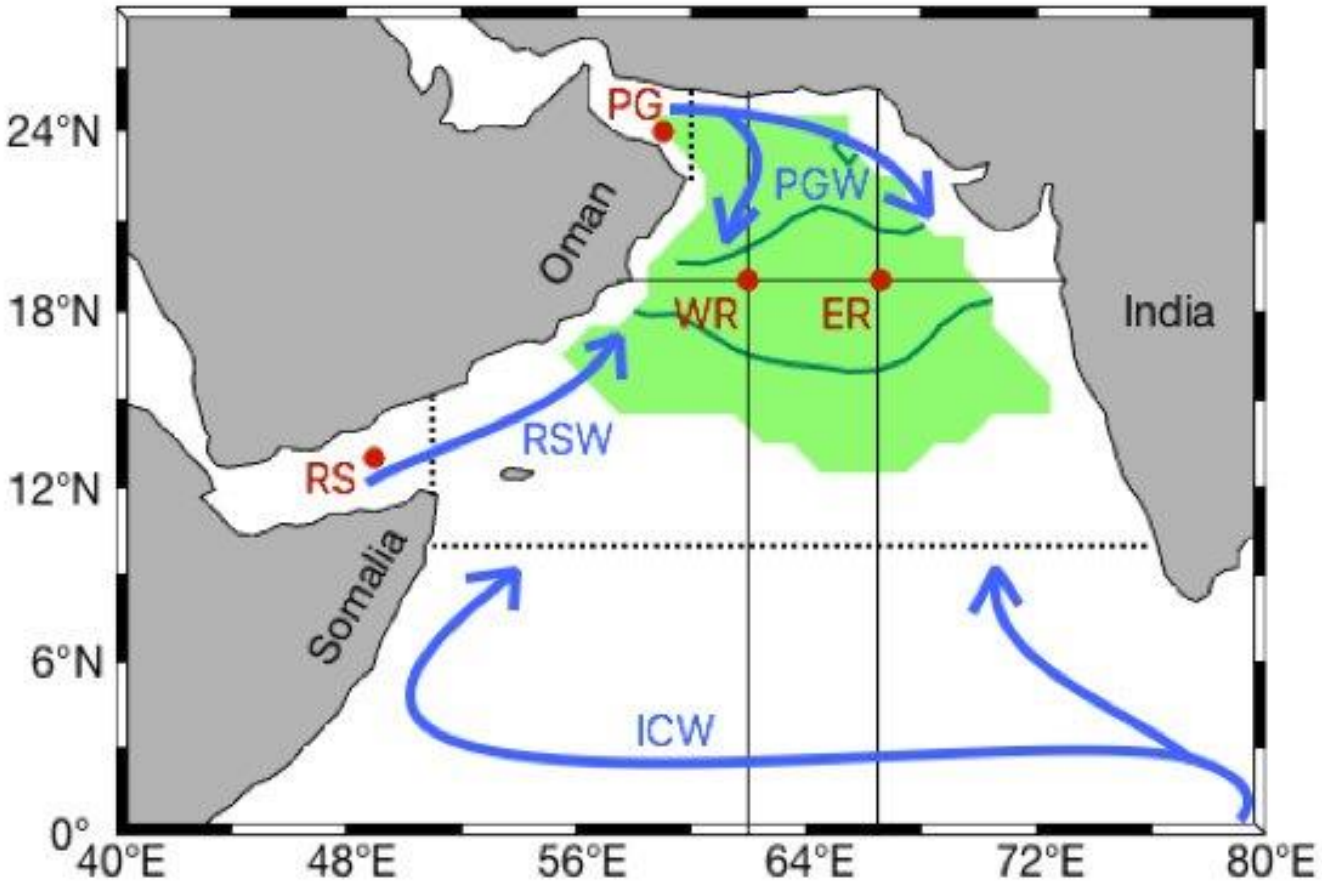
***Fistularia commersonii* (Fistularidae)**

Bluespotted cornetfish

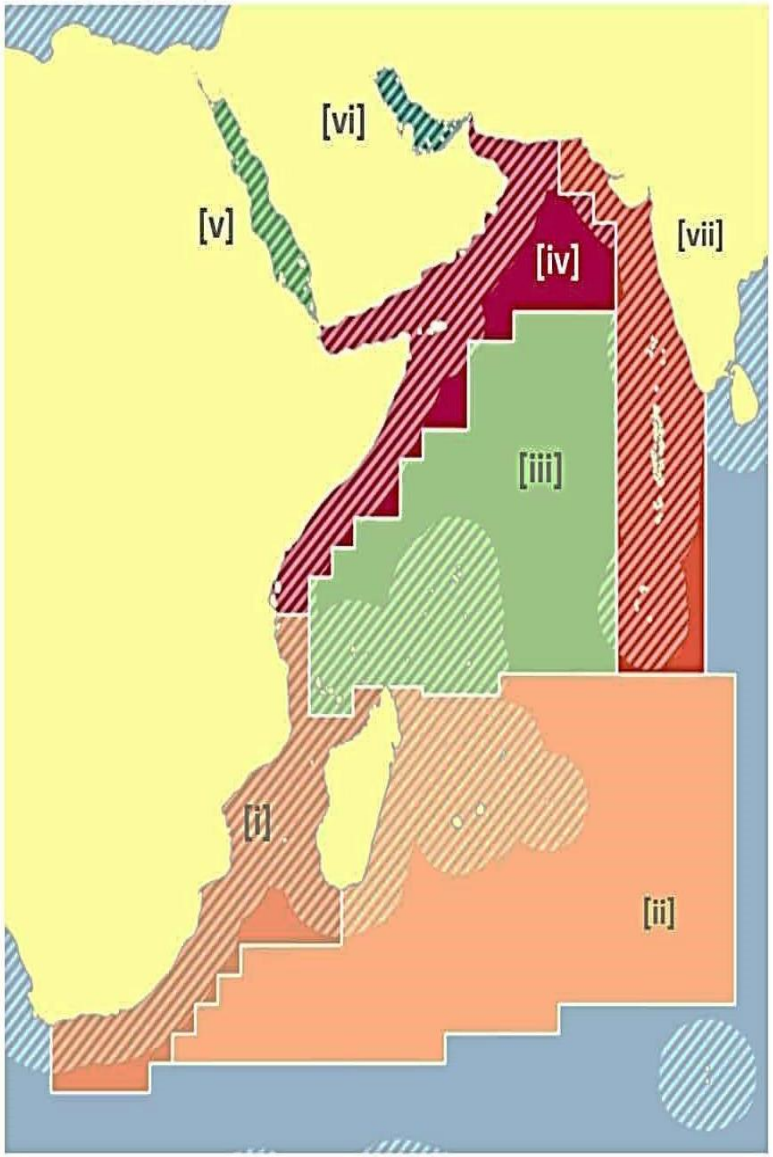


AIS risk rating of the NW Indian Ocean

The zoning of northwestern marine basins of the Indian Ocean based on the grading of risk tolerance - risk rating of the presence and spread of non-native and alien species, affected by climate change and the trend of increasing Sea Surface Temperature (SST).



NW Indian Ocean AIS risk sub-area / zonation



[i] (EAMC)
East Africa and Mozambique channel

[ii] (SWIO)
Southwestern Indian Ocean

[iii] (NIMG)
Northwest Indian Ocean and Monsoon Gyre

[iv] (EAAS)
East Africa and Arabian Sea

[v] (RESE)
Red Sea

[vi] (GULF
Persian Gulf**)**

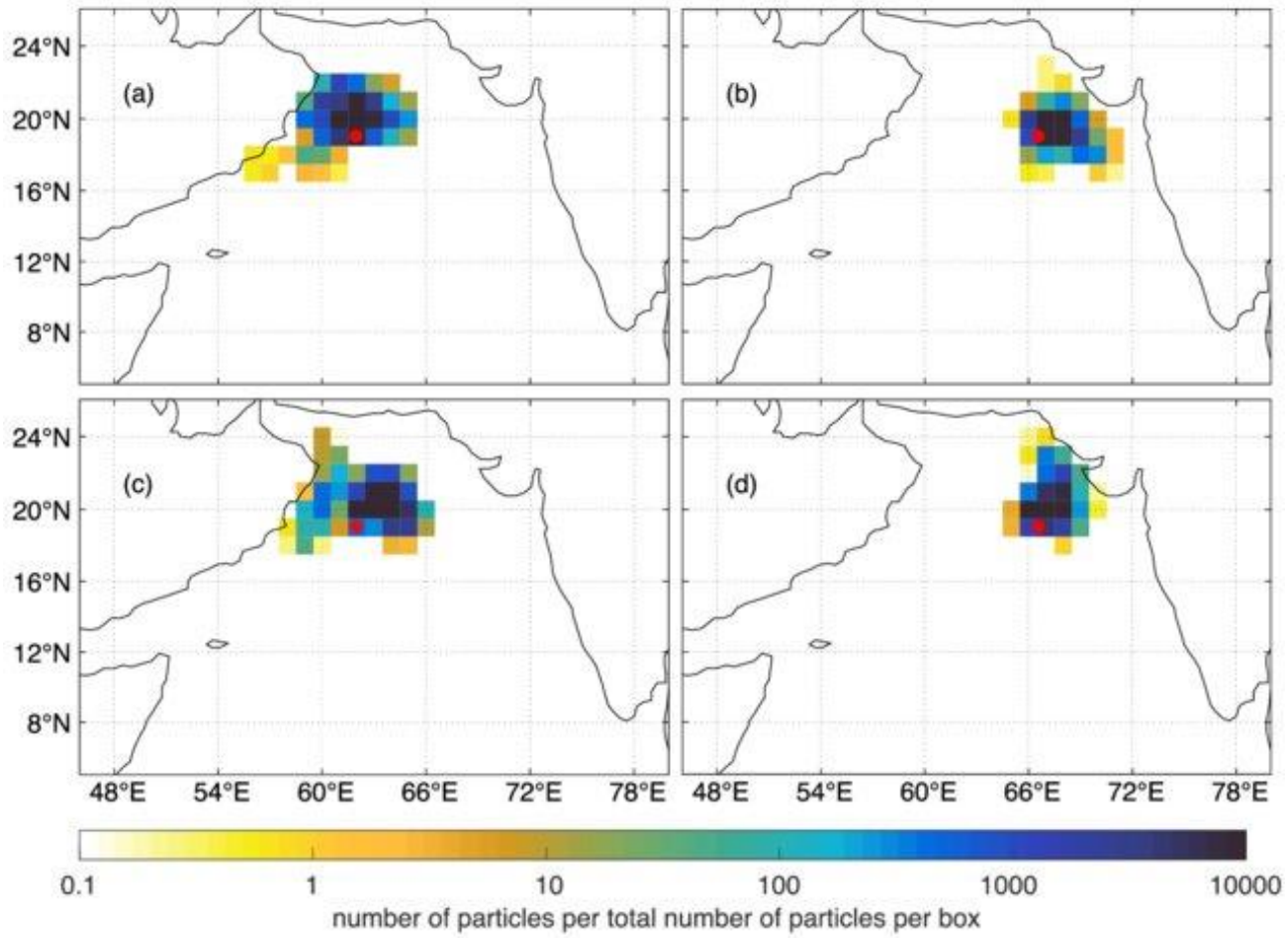
[vii] (ASOI)
Arabian Sea and Central Indian Ocean Islands

Catch zoning map of dominant AIS for NW Indian Ocean sub-area

Catch zoning map of dominant alien species (lionfish, redcoat fish, leatherjacket fish, cornetfish), has been prepared considering the:

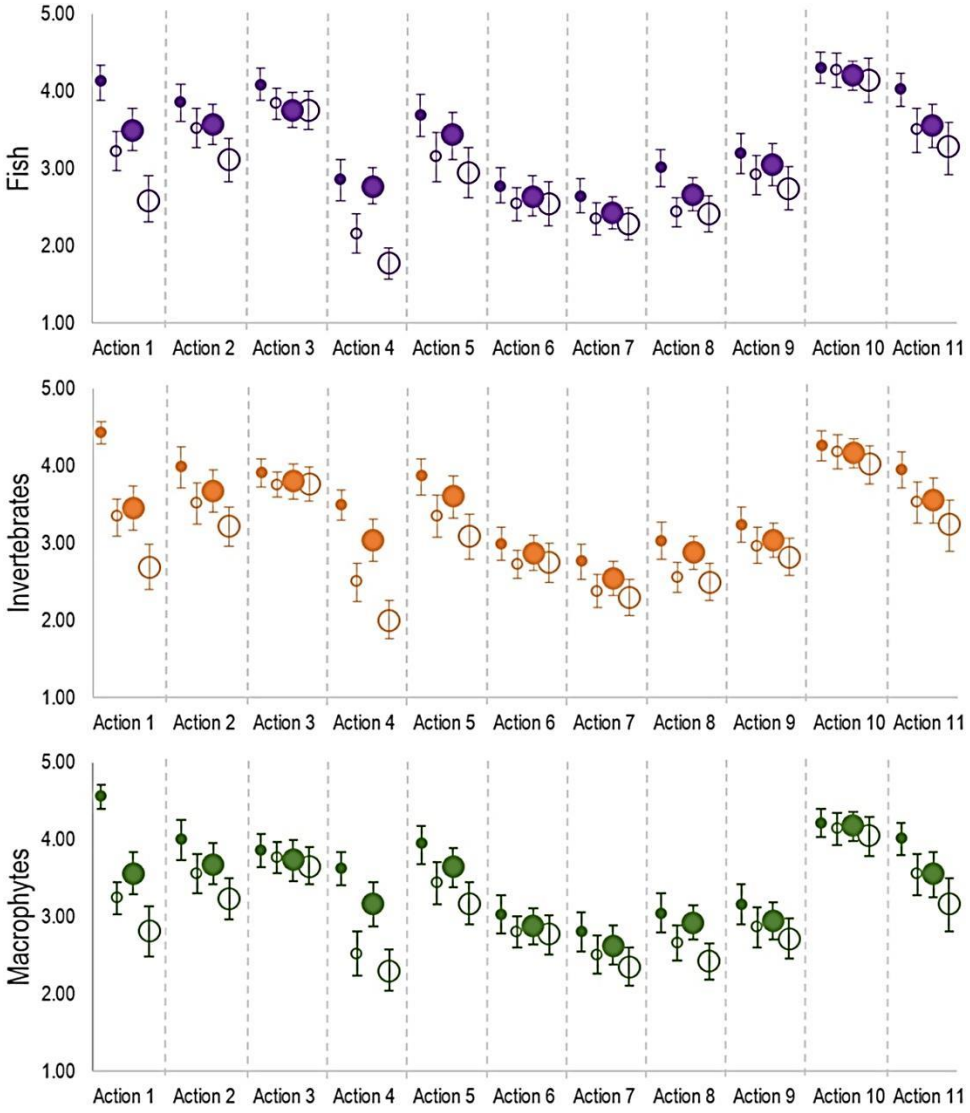
Presence and geographical distribution of the dominant fish species.

Based on the increase and abundance of the fish stocks in 50 selected territorial fishing grounds,



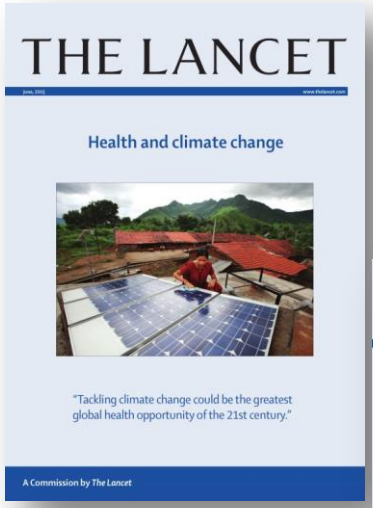
AIS action plans

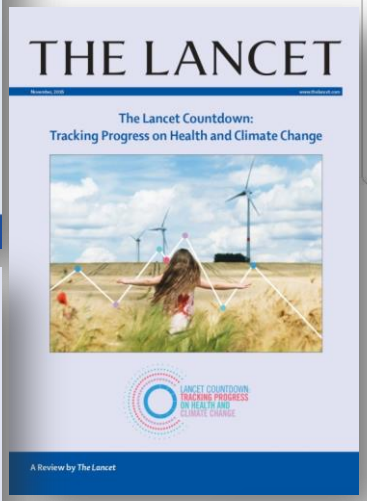
Action plans divided into three main groups of marine AIS for combat, mitigation and adaptation of the AIS distribution and spread in new areas, under different scenarios of climate change and SST increase.



For more information on Biodiversity and Ecology of AIS: IFSRI publication

For more information on Climate Change effects: The Lancet Countdown series, since 2015





The Lancet

Peer-reviewed journal

The Lancet is a weekly peer-reviewed general medical journal and one of the oldest of its kind. It is also the world's highest-impact academic journal. It was founded in England in 1823. Wikipedia

Impact Factor: 202.7 (2021)

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OCLC no: 01755507

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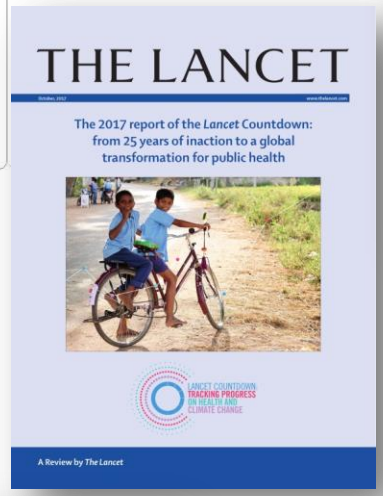
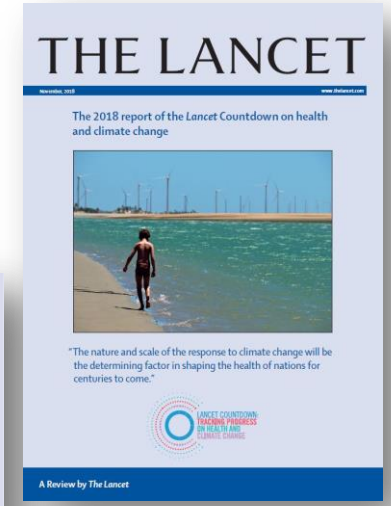
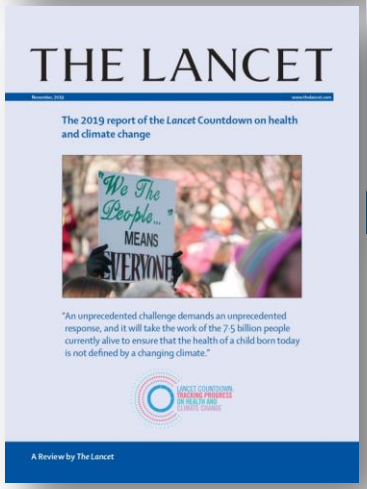
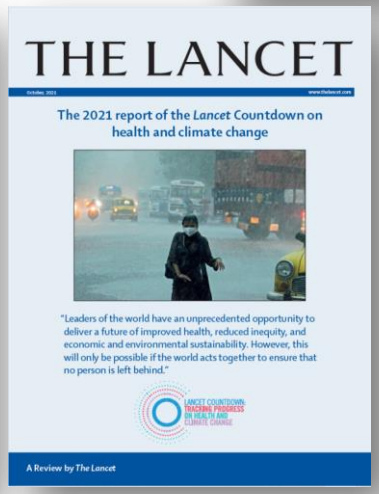
Publisher: Elsevier, Elsevier Health Sciences










Thank you for your kindly attention
&
Wishing for health


إِنَّمَا الْعِلْمُ عِنْدَ اللَّهِ وَ نَّمَا أَنَا نَذِيرٌ مُبِينٌ
علم تنها نزد پروردگار است
و من فقط آشکار کننده و هشدار دهنده هستم
The knowledge is at God,
and I am only a evident warner and giver of notice