



Università
di Catania



L-Università
ta' Malta



Fondo Europeo di Sviluppo Regionale
European Regional Development Fund

IL MEDITERRANEO SOTTO ASSEDIO



Ente Capofila

Dipartimento di Agricoltura, Alimentazione e Ambiente (Di3A), Università di Catania
via Santa Sofia 100, 95123, Catania • info@seamarvel.eu • www.seamarvel.eu

Partner 2

Dipartimento di Biologia, Università di Malta





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Fondo Europeo di Sviluppo Regionale
European Regional Development Fund

A CURA DI DOTT. FRANCO ANDALORO



Ente Capofila

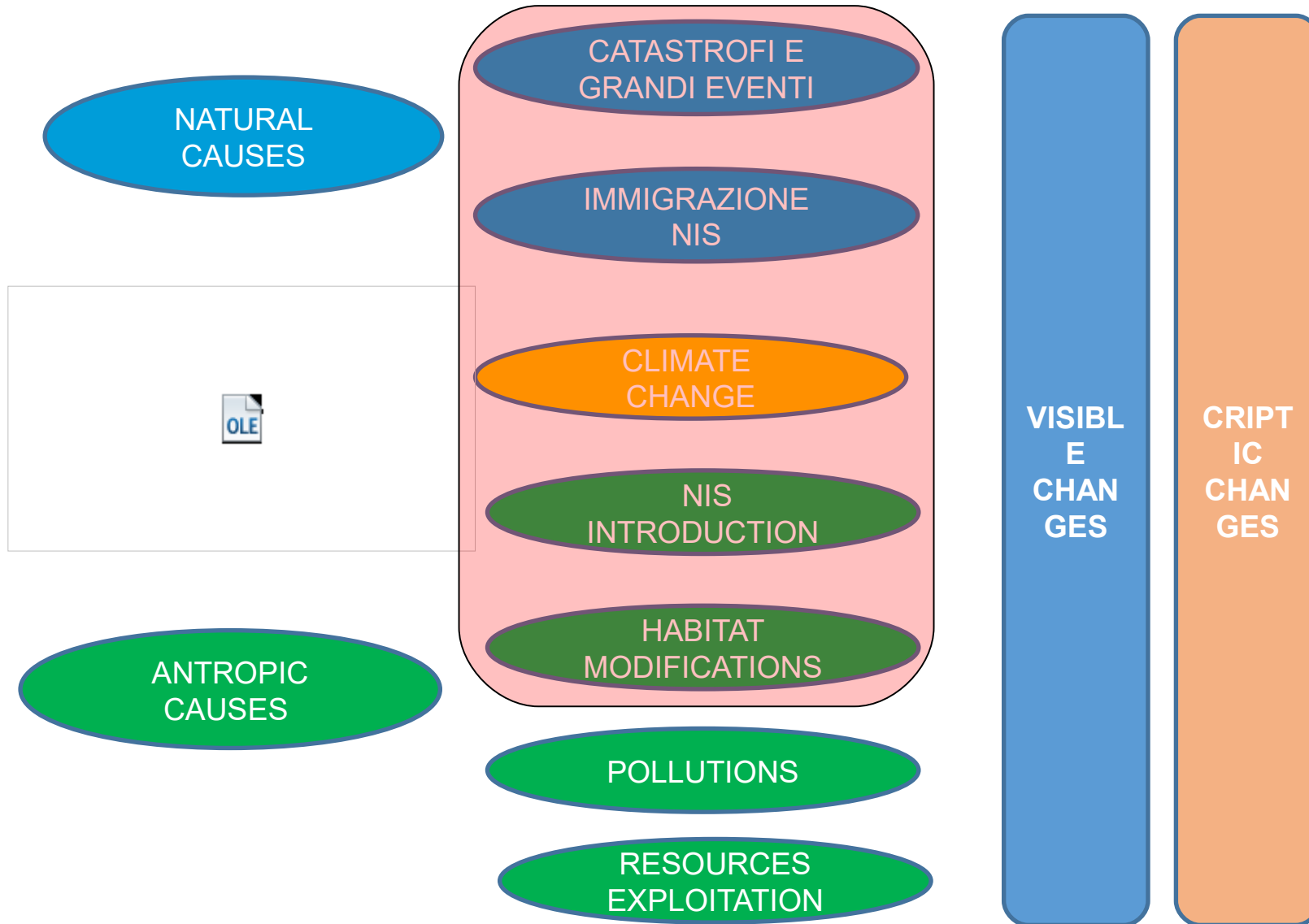
Dipartimento di Agricoltura, Alimentazione e Ambiente (Di3A), Università di Catania
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Partner 2

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MAIN CAUSES OF marine environment and biodiversity modification



..the widest marine warm-temperate region of the world

..almost a closed sea, connected with the Atlantic by the Strait of Gibraltar, the Sea of Marmara by the Dardanelles, Red Sea by the Suez Canal

Dardanelles

Wide: 0.45-7.4 km

average depth: 55 m



Gibraltar

wide: 15 km

average depth: 290 m

Max depth: 950 m

Suez Canal

Wide: 120 m

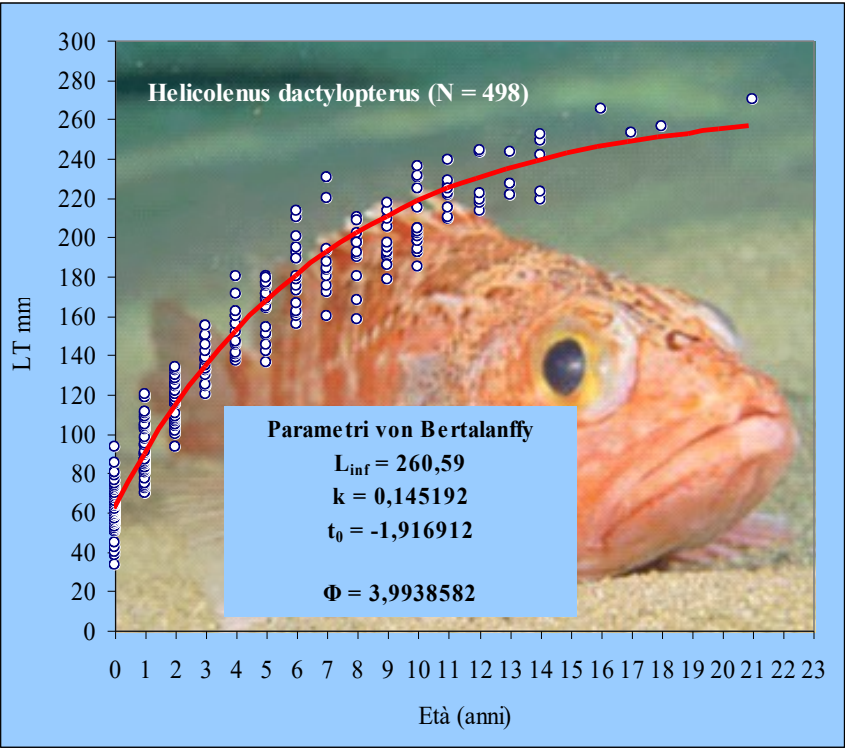
Average depth: 12 m



HG	MEDITERRANEO	BIANCO	EOLIE (NO EMISSIONE)		EMISSIONE	
MUSCOLO	<i>H. dactylopterus</i>	<i>H. dactylopterus</i>	<i>H. dactylopterus</i>	<i>S.cabrilla</i>	<i>H. dactylopterus</i>	<i>S.cabrilla</i>
EVENTO	+	+	++	+	++	++
1 ANNO DOPO	+	+	++	++	++	++
3 ANNI DOPO	+	+	++	++	++++	+++

	HG
MEDITERRANEO	+
EOLIE	++

+	CONTAMINAZIONE DA HG
++	SOPRA I LIVELLI DEL MEDITERRANEO
+++	ELEVATE CONCENTRAZIONI



LE SPECIE ALIENE



PROGETTO ALIEN.



Stretto di Gibilterra

MIGRAZIONE



Dardanelli

Canale di Suez

INTRODUZIONE
VOLONTARIA

acquacoltura



acquariofilia



esche vive

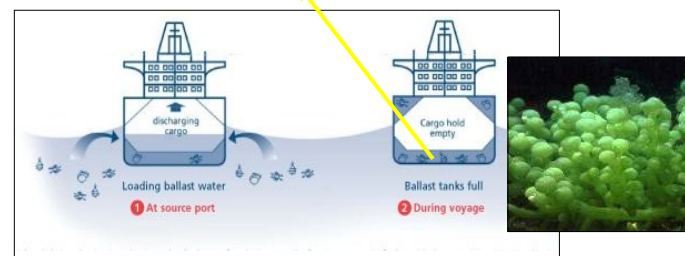


INTRODUZIONE
INVOLONTARIA

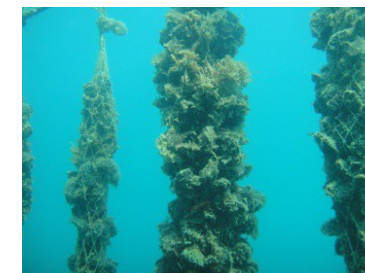
fouling



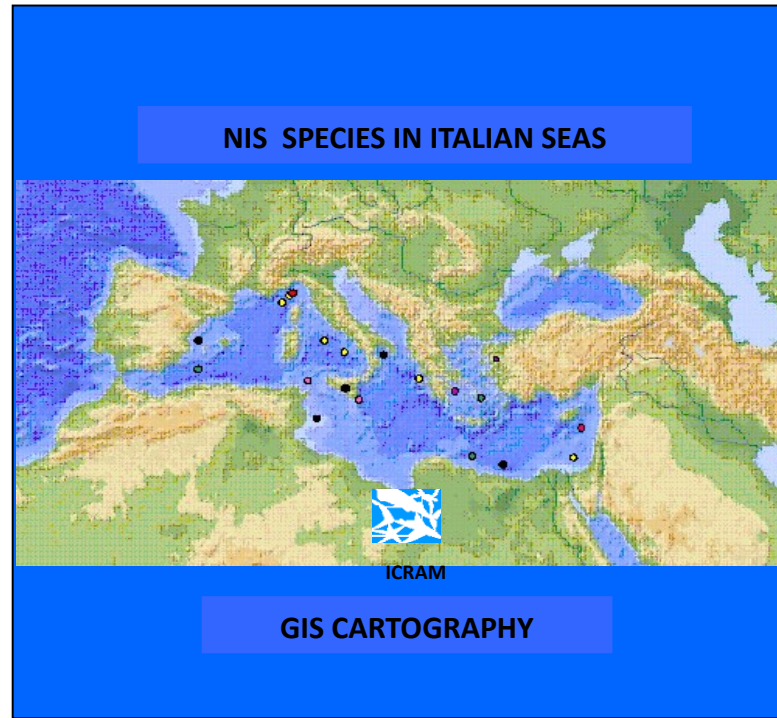
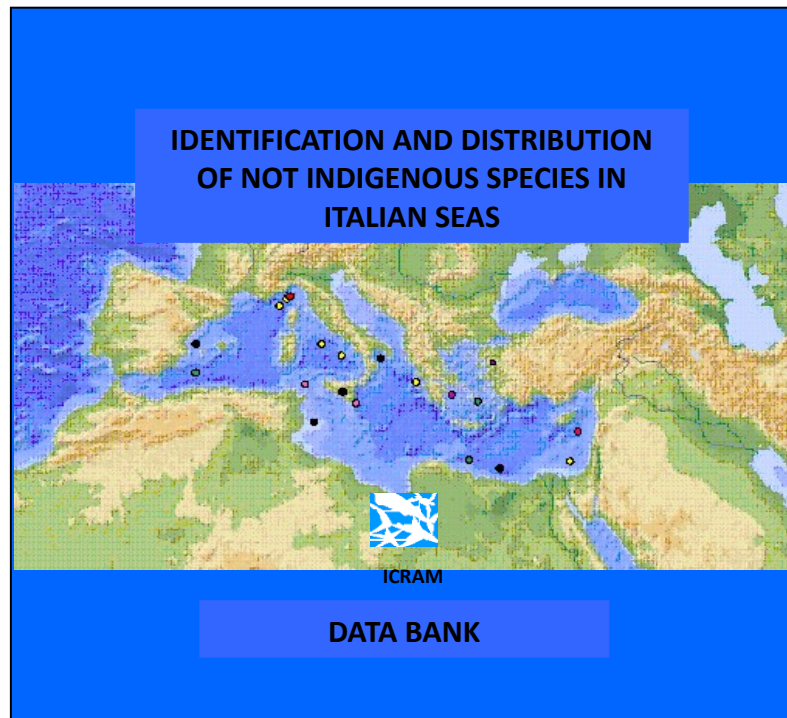
acque di zavorra



acquacoltura organismi associati



BANCA DATA E MONITORAGGIO DELLE SPECIE ALIENE:



The project born in accord to article 13 ASPIM of *Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean Sea* (Barcelona Convention) and article 8h of CBD



Alien species in Mediterranean sea

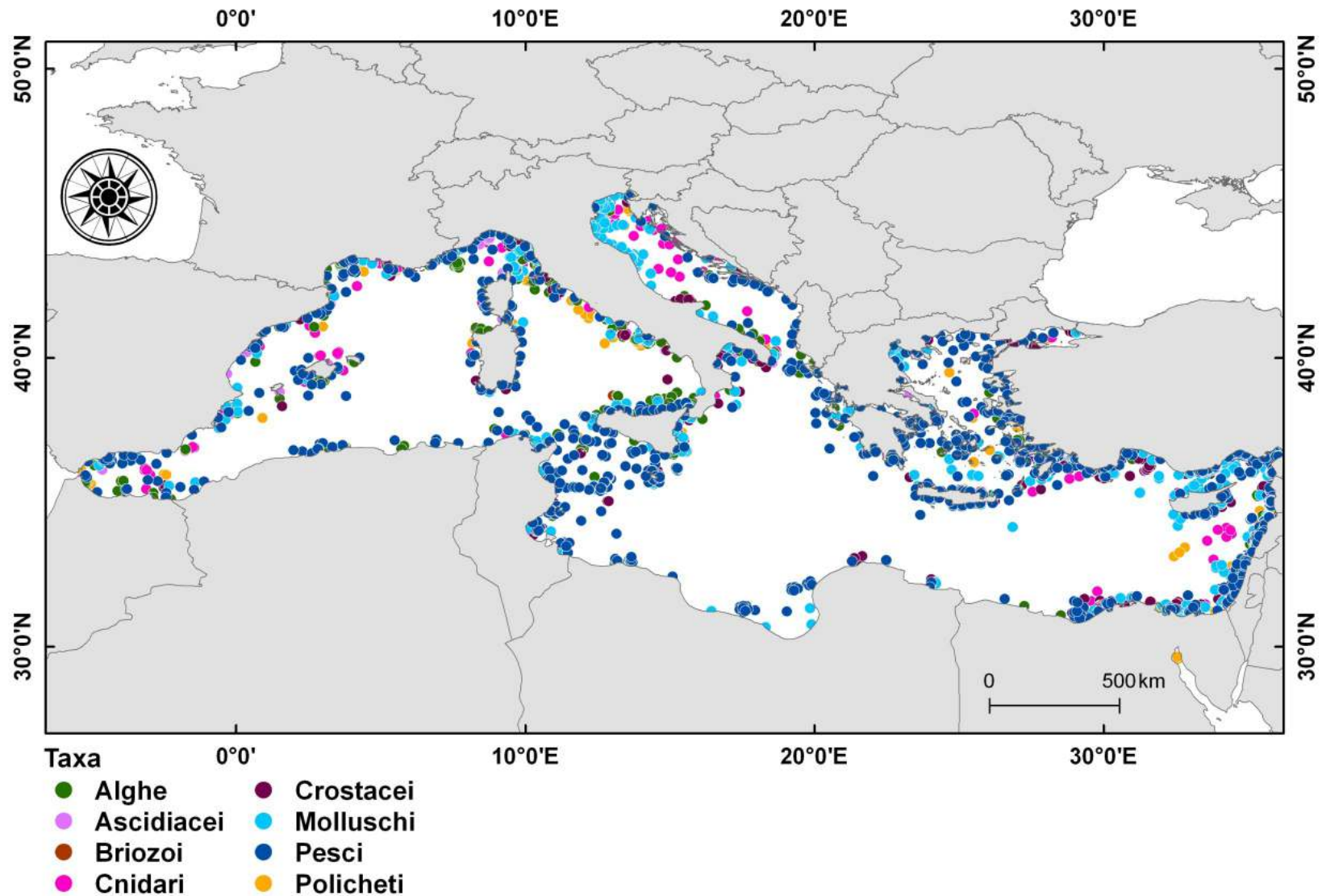
Actually 973 alien species are recorded in Mediterranean sea and 583 in the following 8 taxa,

Mollusca	150 20
Vegetalia	141 83
pisces	120 24
crustacea	60 14
Policheta	59 30
Cnidaria	25 10
Briozoa	16 5
Tunicata	12 7

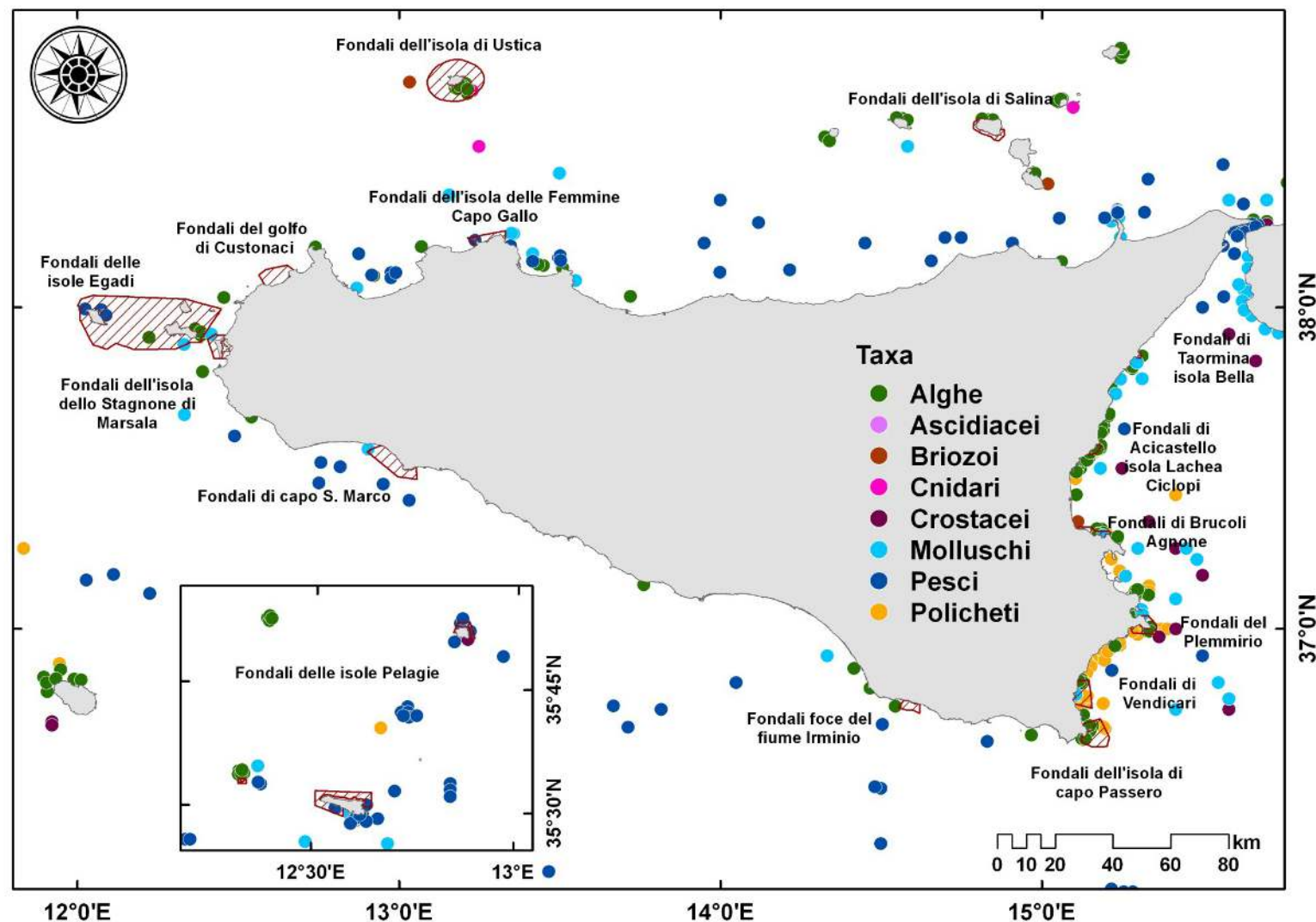
Lessepsian migration	44 %
shipping	16 %
Atlantic migration	9 %
Mariculture	8 %
Other causes	1 %.
Unknowledged causes	21 %



DISTRIBUZIONE DELLE SPECIE NON INDIGENE IN MEDITERRANEO



BIOINVASIONI IN SICILIA dati di letteratura (PR ASPIM 2011 - ISPRA)



PROGETTO CAULERPA







Caulerpa taxifolia impigliata nelle reti per la pesca costiera (Foto di Davide Campo)

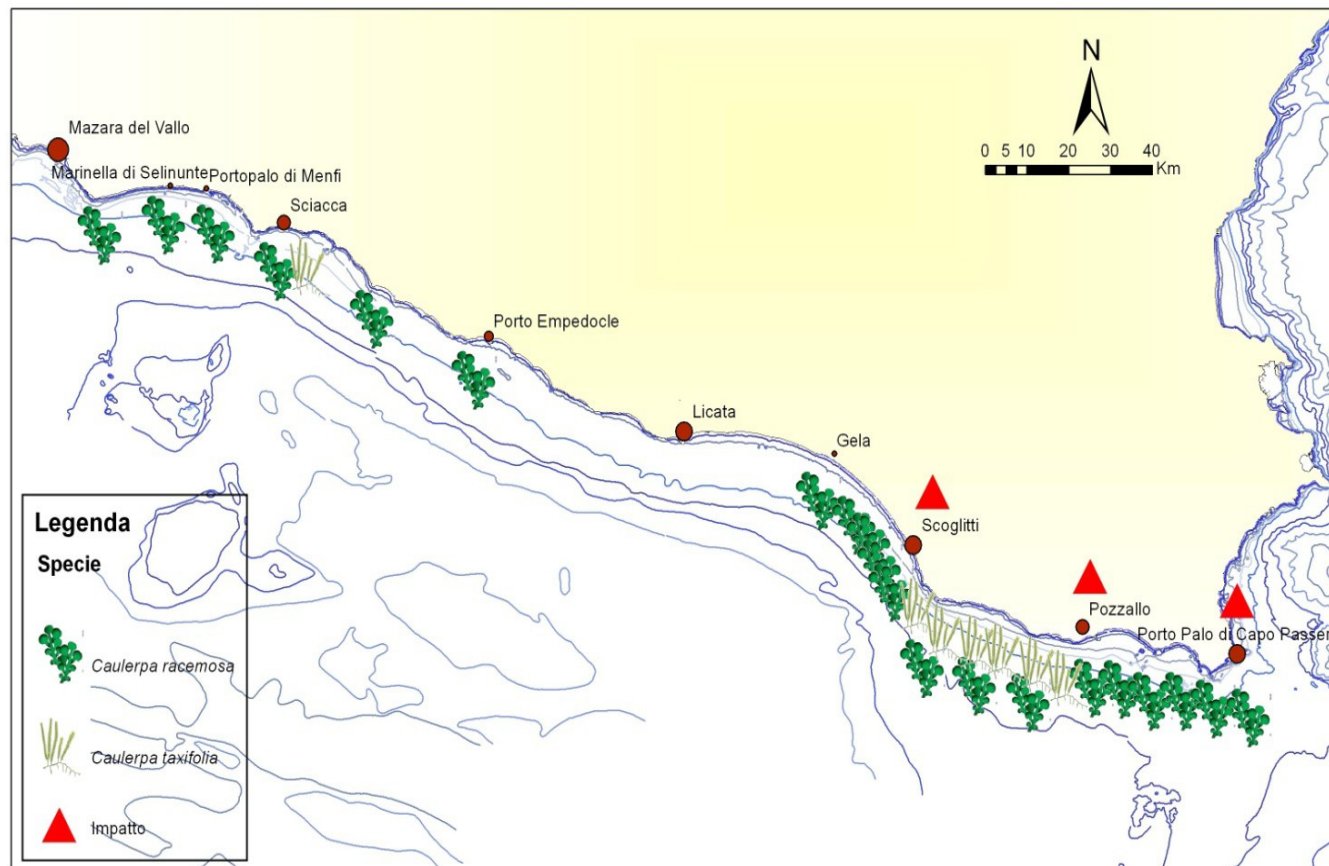
Lungo le coste meridionali siciliane, già da una decina di anni si parla di invasione da parte di caulerpe.

Nel gennaio 2008 i pescatori delle marinerie di Licata, Scoglitti, Donna Lucata, Pozzallo e Porto Palo di Capo Passero lamentarono danni ingenti provocati dalle caulerpe.

Un grande quantitativo di frammenti di *C. taxifolia* sradicati veniva intrappolato nelle reti, diminuendone notevolmente la pescosità e rendendole addirittura inutilizzabili, mettendo in crisi l'intero comparto della pesca da Scoglitti a Pozzallo.

PROGETTO CAULERPA





I risultati del presente studio hanno confermato la presenza diffusa ed abbondante delle caulerpe aliene lungo le coste meridionali della Sicilia, principalmente nel tratto sud-orientale, e nell'area dell'Isola di Lampedusa,

Mappa riassuntiva della localizzazione di *C. racemosa* e *C. taxifolia* e delle marinerie da esse maggiormente impattate

PROGETTO CAULERPA



Altri effetti

Specie velenose e pericolose

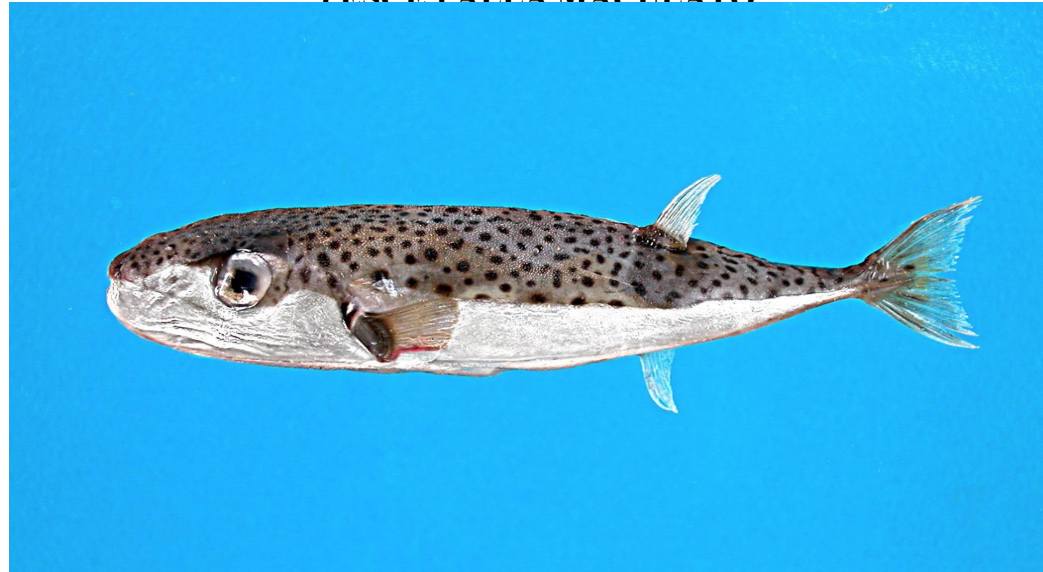


Tetradontina



ATTENZIONE

PESCE PALLA MACULATO



Specie originaria del Mar Rosso, arrivata in Mediterraneo negli ultimi anni, è stata catturata anche in acque italiane (Isola di Lampedusa).

ATTENZIONE: le sue carni sono altamente **tossiche**.

NON VA ASSOLUTAMENTE MANGIATO

In caso di cattura **dare comunicazione** alla Capitaneria di Porto locale.

Si prega di **congelare** il pesce e contattare prima possibile i seguenti numeri dell'ISPRA di Palermo:

091 6114044 – 091 7302574

Se disponibile materiale fotografico, inviare a:

alien@isprambiente.it

PROGETTO ORBS



Il Mediterraneo è considerato oggi il mare più influenzato dall'ingresso attivo di specie aliene

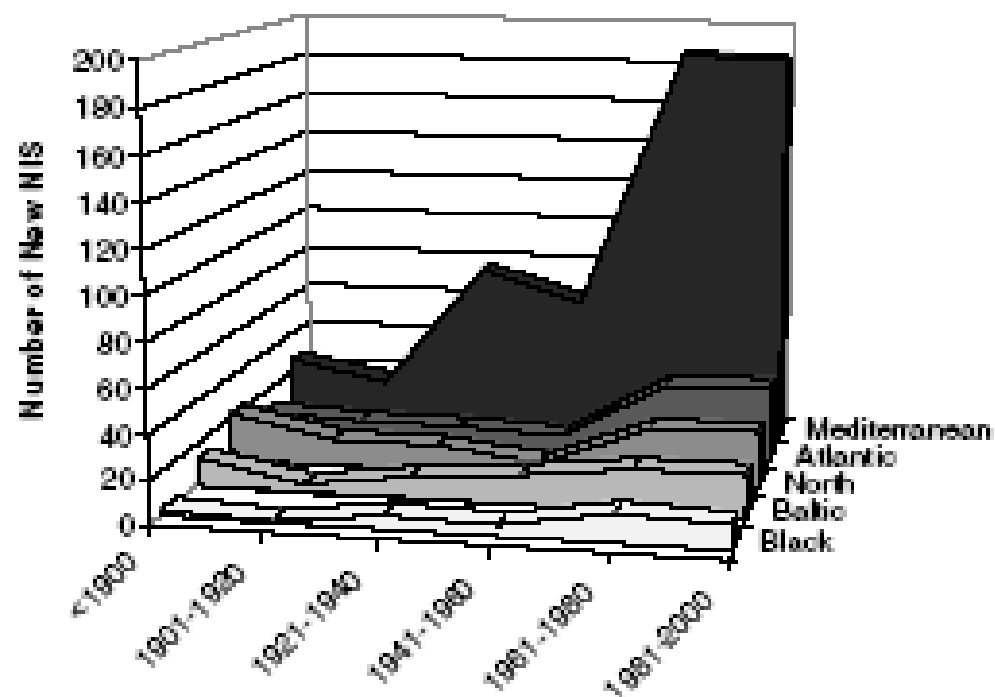
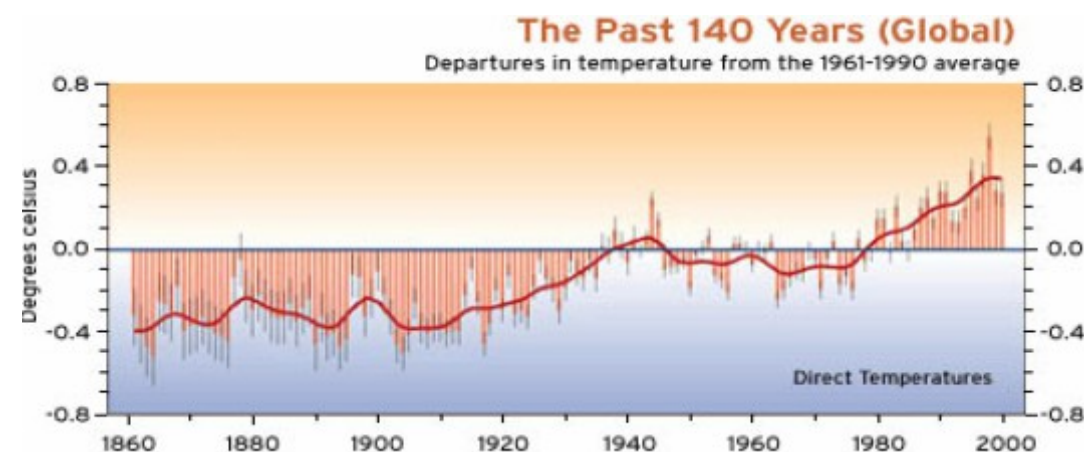
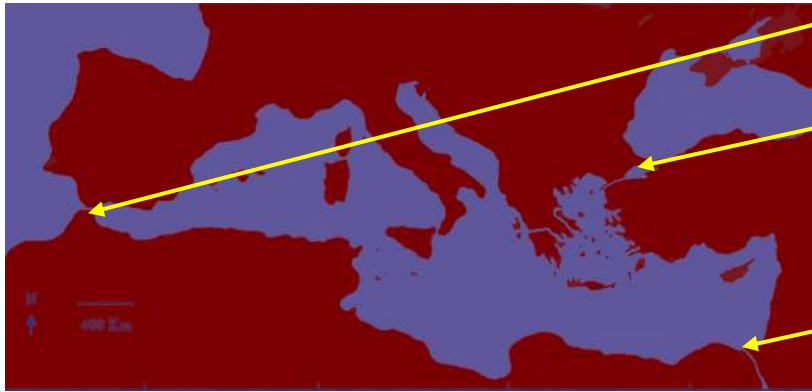


Figure 2 Rate of introduction of non-indigenous species across European seas.



ALIEN SPECIES PATHWAYS

MIGRATION



Stretto di Gibilterra

Dardanelli

Canale di Suez



VOLUNTARY INTRODUCTION

AQUACULTURE



AQUARIOLOGY



LIVING BAITS

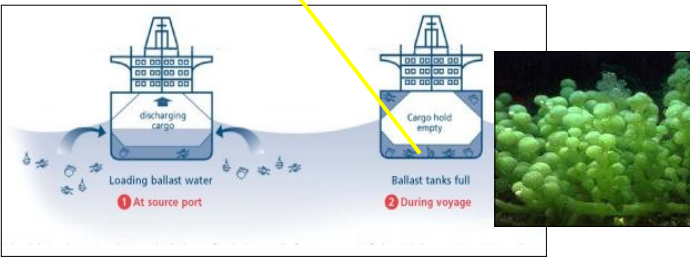


INVOLUNTARY INTRODUCTION

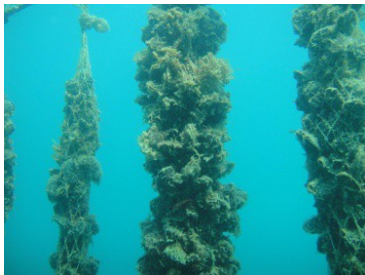
FOULING



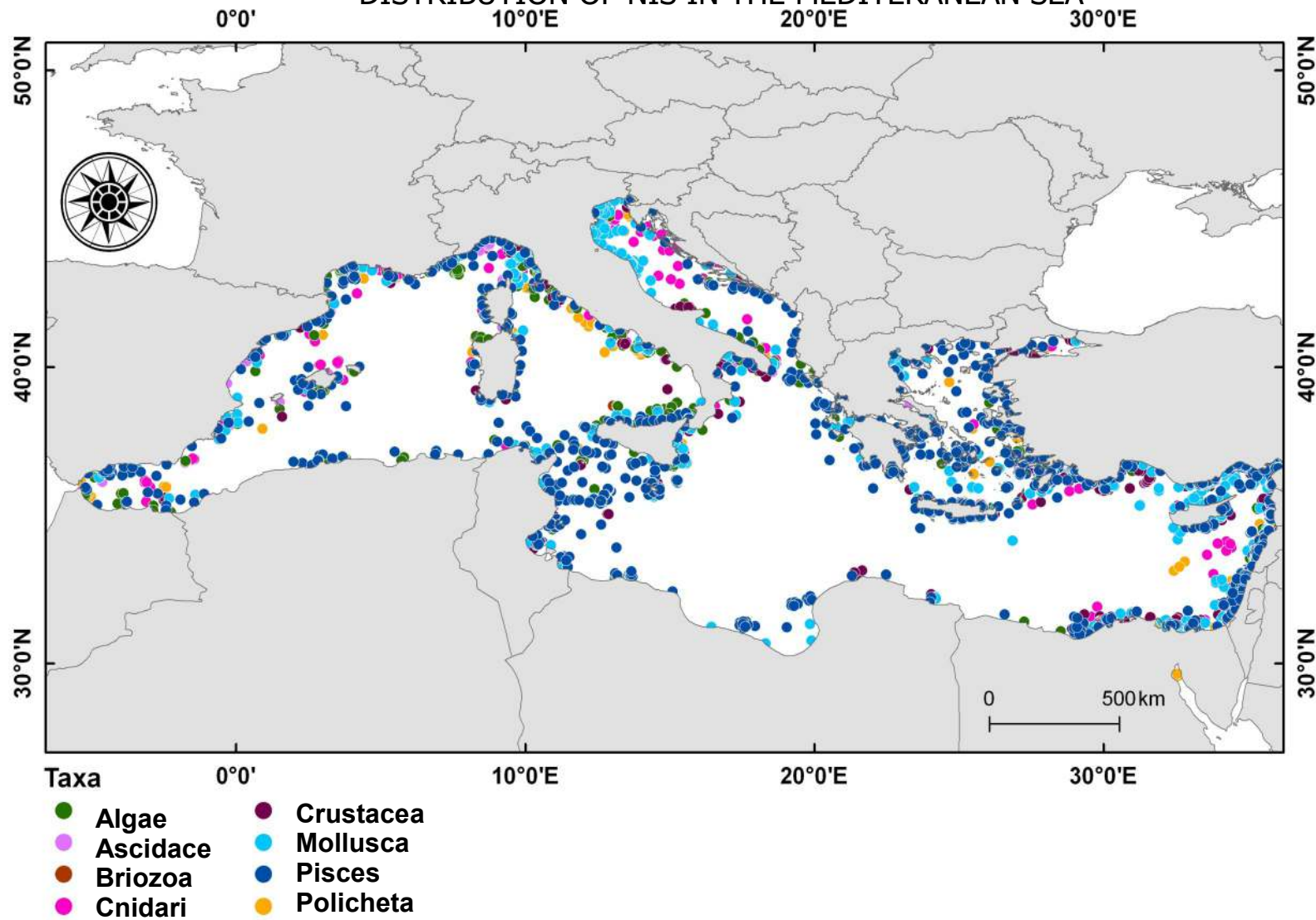
SHIP BALLAST WATERS



PATHOGENS ASSOCIATED WITH THE FISH TRADE



DISTRIBUTION OF NIS IN THE MEDITERANEAN SEA



IMPACTS ON BIOTA DUE TO CLIMATE CHANGE: NON INDIGENOUS SPECIES INVASIONS AND TROPICALISATION PHENOMENON

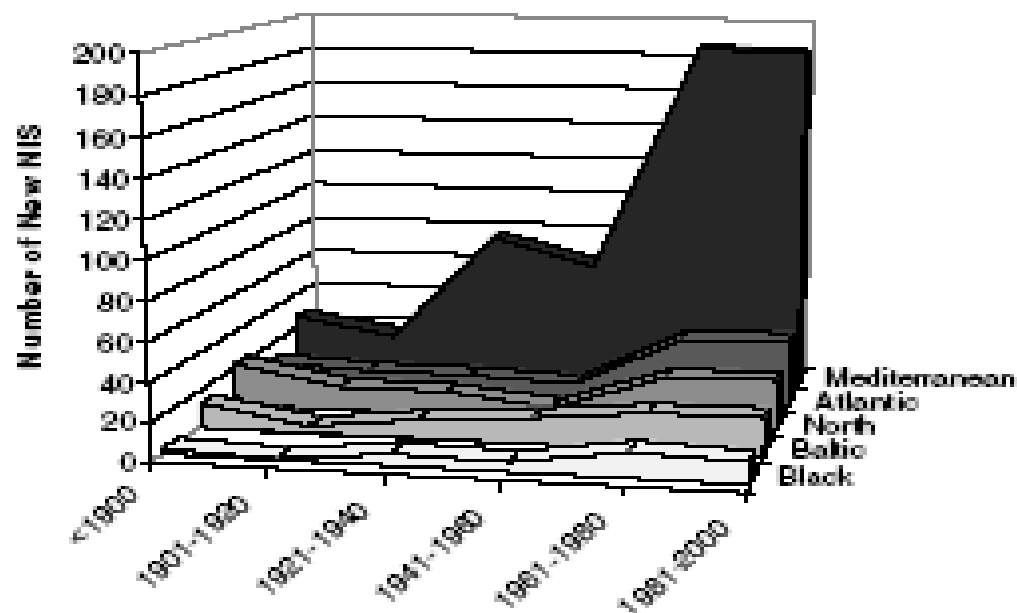
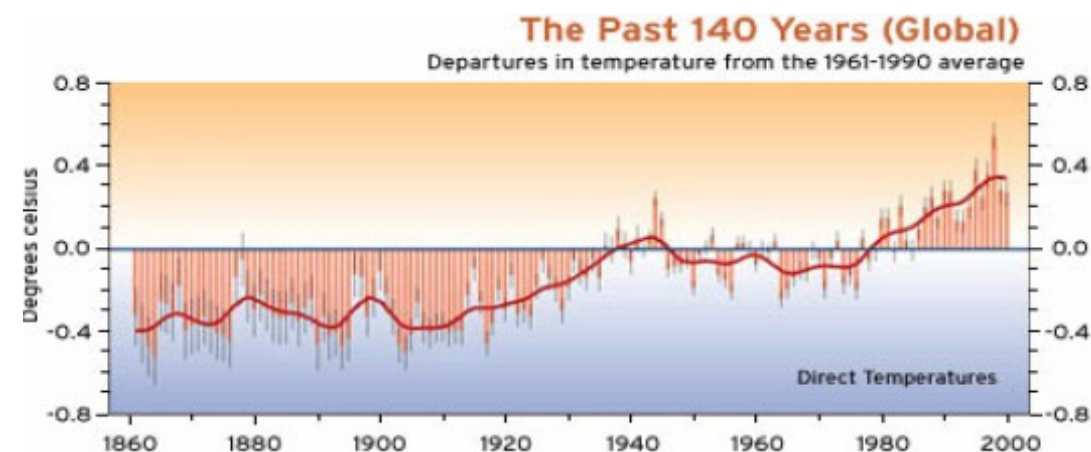


Figure 2 Rate of introduction of non-indigenous species across European seas.



**ALIEN SPECIES RECORDS ARE CLOSELY
RELATED TO THE GLOBAL WARMING**



ALMOST ALL THE ALIEN FISHES RECORDED IN MEDITERRANEAN SEA
HAVE A TROPICAL OR SUBTROPICAL AFFINITY



**MORE THAN 1500 ALIEN SPECIES
HAVE BEEN FOUND TO DATE IN
THE MEDITERRANEAN SEA**





**IN EASTERN MEDITERANEAN SEA THE
ALIEN SPECIES REPRESENT MORE THAN
50% OF TOTAL CATCHES OF FISHERY**



The strait of Sicily

Mean salinity 37.5 ‰

Mean surface temperature 18 °C



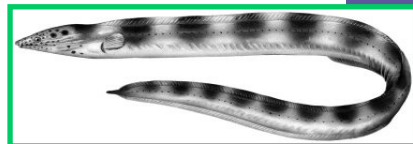
Atlantic species

Seriola carpenteri,
Seriola rivoliana,
Seriola fasciata,
Pisodonophis semicinctus,
Sphoeroides pachygaster,
Chaunax suttkusi
Solea senegalensis
Carcharinus falciformis

Indopacific species

Fistularia commersonii
Siganus luridus
Siganus rivulatus,
Stephanolepis diaspros
Leiognathus klunzingeri
Sphyraena chrysotaenia
Priacanthus hamrur
Parexocoetus mento

**CROSSROAD BETWEEN
ATLANTIC AND INDO-PACIFIC WORLDS**



The Problem:

Mediterranean biodiversity is undergoing **rapid alteration**

A growing number of evidences showed a **trend of expansion of thermophilic** species.... an **unpredictable perturbation** for local communities.

This phenomenon is considered a **biological response** to the less detectable global changes.

“MERIDIONALIZATION”

Northern extention and bionass
increase of **thermophile species**,
against the recession of “boreal” ones

“TROPICALIZATION”

“immigration and
colonization by **non
indigenous species**”



“MERIDIONALIZATION”

Colonization (extention of the distribution areas) by **thermophile species**, against the recession of “boreal” ones (Riera *et al.*, 1995)

“TROPICALIZATION”

“immigration and colonization by **non indigenous species**”



Trends of Mediterranean biogeography



“MERIDIONALIZATION”
 (extension of distribution
 ranges of thermophile fish))

Omogenization of the fish
 fauna in the Mediterranean

TROPICALIZATION

Atlantic
immigrants



Indopacific
immigrants

Biodiversity enhancement

Demediterraneization
 (change of the faunistical identity)

Increasing differences
 between western and eastern



Towards divergences

*With a different timescale and in combination with climatic events,
The “Atlantic” and “Indo-pacific” way shaped the faunistic
divergences between the western and the eastern Mediterranean.*

The incoming of Lessepsian immigrants augments the tropical character of the Levantine fauna (Ben Tuvia & Golani, 1995, Galil, 2000), increasing the faunal divergences between “Western” and “Eastern”.

The infusion of Indo-Pacific elements and the concomitant change in the indigenous fauna disrupt the zoogeographic unity of the Mediterranean.



Towards omogeneity

The spreading of thermophile species augments the “mixing” (or even the “globalization”) of the fish fauna favouring the increasing of omogeneity between south-north; western-eastern.

Particularly relevant are the records of species outside of the Levant basin, though to be the turned in a “Lessepsian province” (Por, 1990; Spainier & Galil, 1991)



distribution of Lessepsian fish species



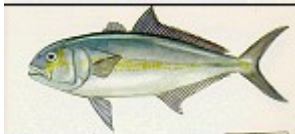
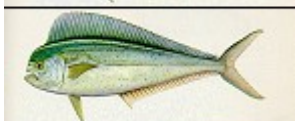
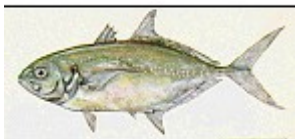
Il Mediterraneo

Riflessi antropologici della biodiversità marina





PECIE ITTICHE ASSOCIATE AI FADS



Interazioni global warming

Le risorse ittiche: dallo sfruttamento alla gestione ecosistemica



Modifica delle catture



IMPACTS ON FISHERIES DUE TO CLIMATE CHANGE : MODIFICATION OF MARINE WATER CIRCULATION

THE THERMO-HALINE CELL: THE ENGINE ON MEDITERRANEAN MARINE WATER CIRCULATION

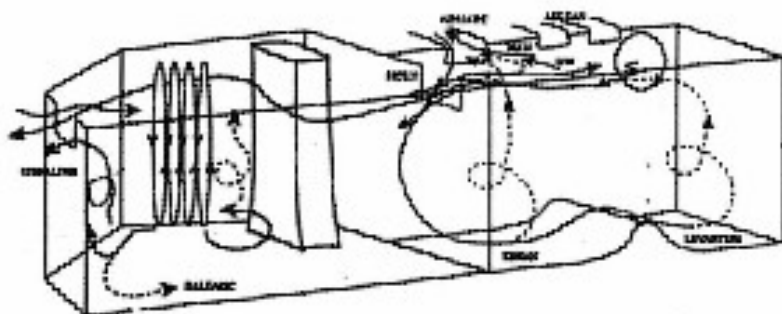
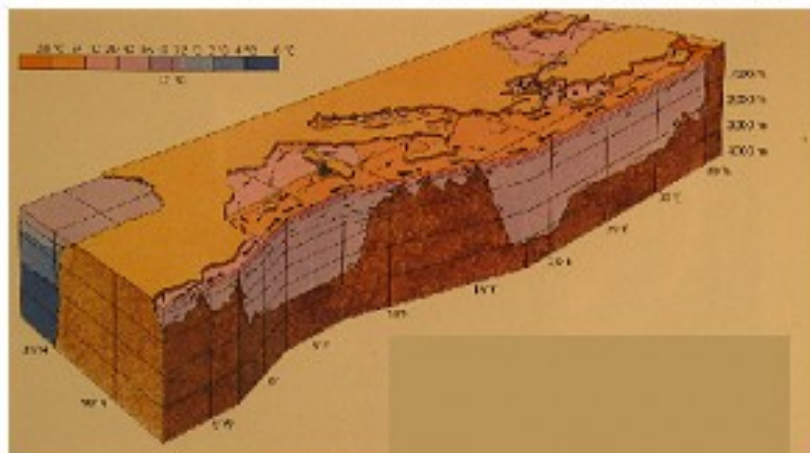
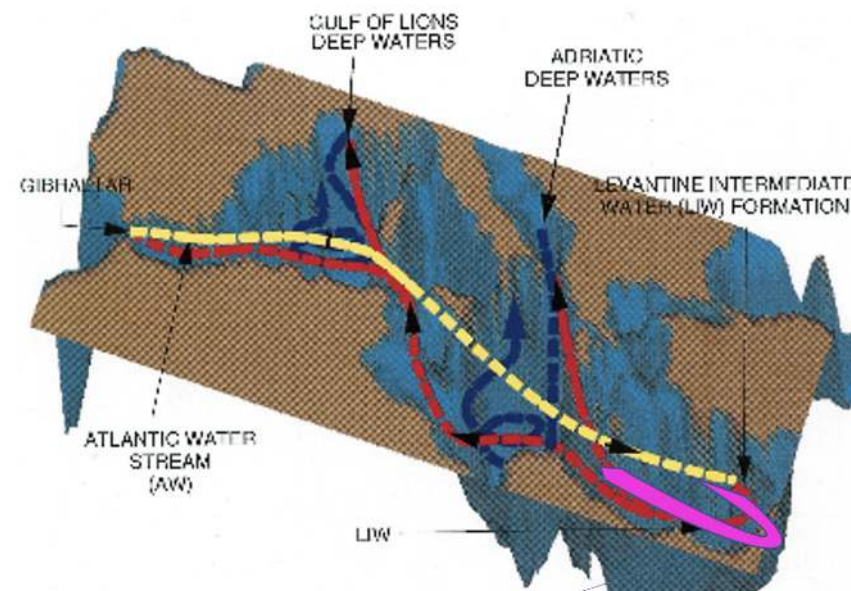


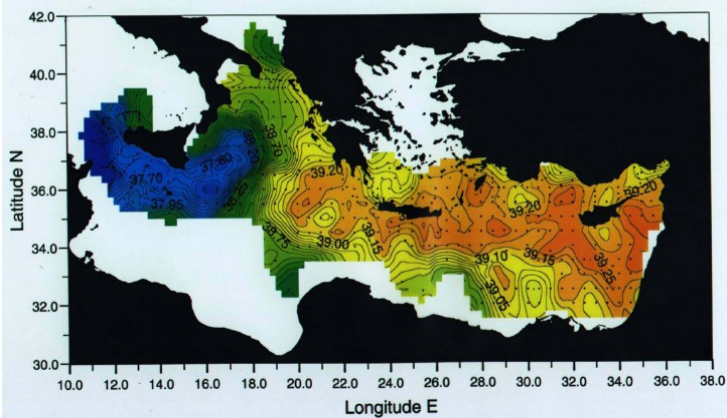
Figure 2: Schematic of thermohaline cells and path of LIW in the entire Mediterranean.



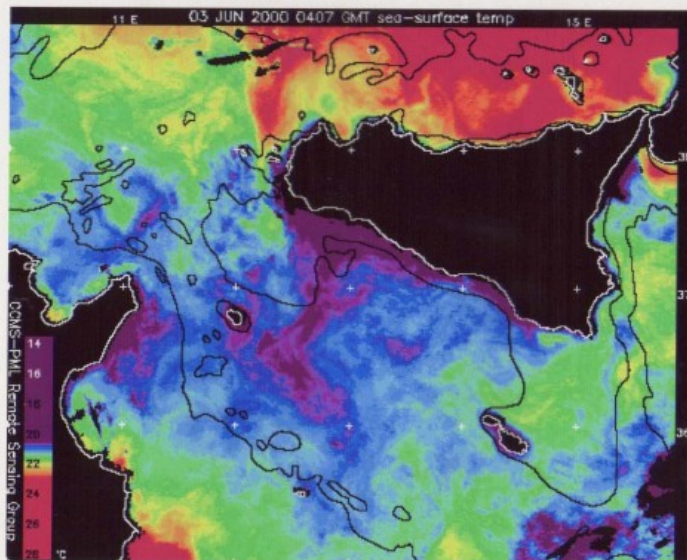
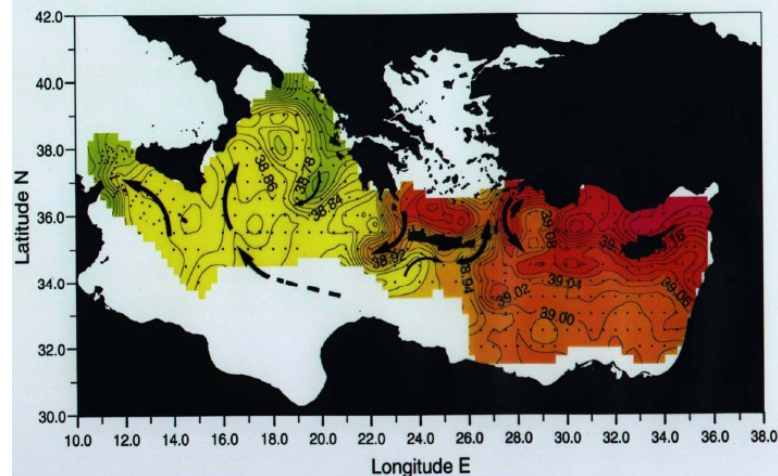
THE CHANGE OF LENVANTIN INTERMEDIATE TRANSIENT



Cruise POEM-AS87: Salinity at surface



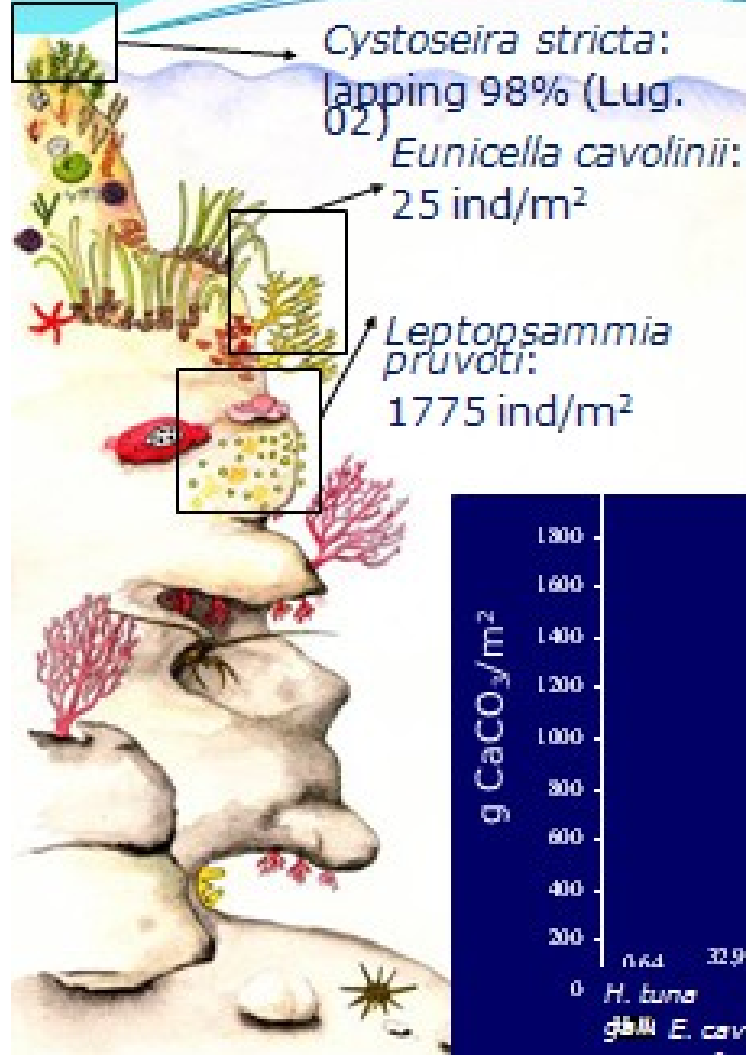
Cruise POEMBC-091: Salinity at density=29.05 kg/m³



**THE MODIFICATION OF THE LENVANTIN
INTERMEDIATE TRANSIENT (LIT):
CHANGE OF THE TROPHISM AND THE
SMALL PELAGIIC FISHES CATHES
COLLAPS IN SICILIAN STRAIT**



Vector project



Cystoseira stricta:
lapping 98% (Lug. 02)

Eunicella cavolinii:
25 ind/m²

Leptopsammia pruvoti:
1775 ind/m²

Biomass: 1776 g/m²; CaCO₃ average: 4,39%

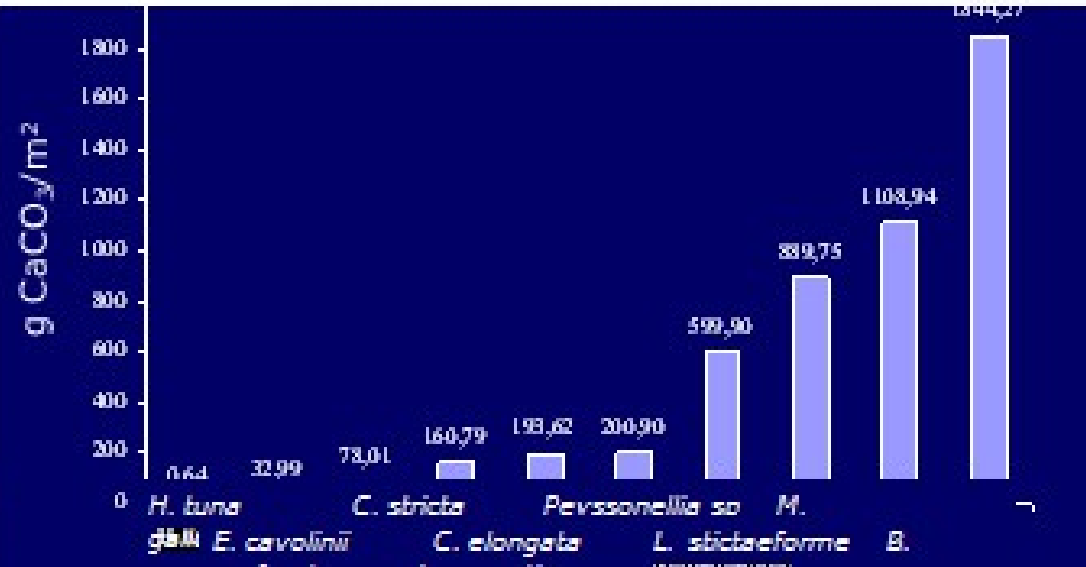
Calciummass: 78 g/m²

Biomass: 48 g/m²; CaCO₃ average : 68,65%

Calciummass : 32 g/m²

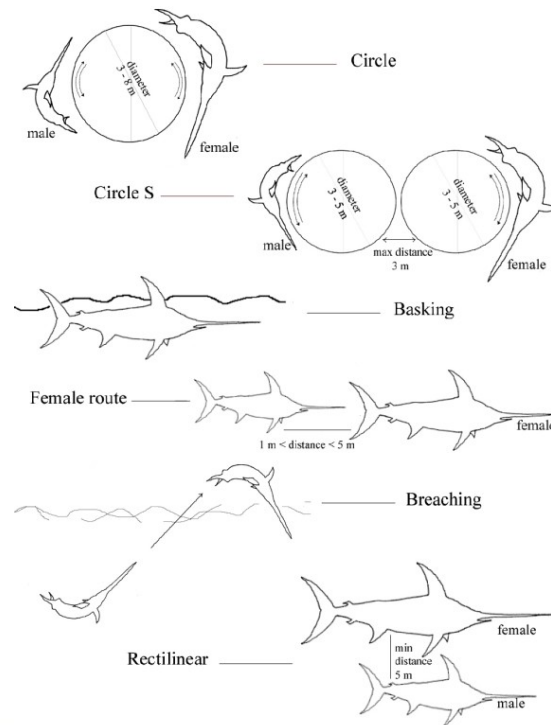
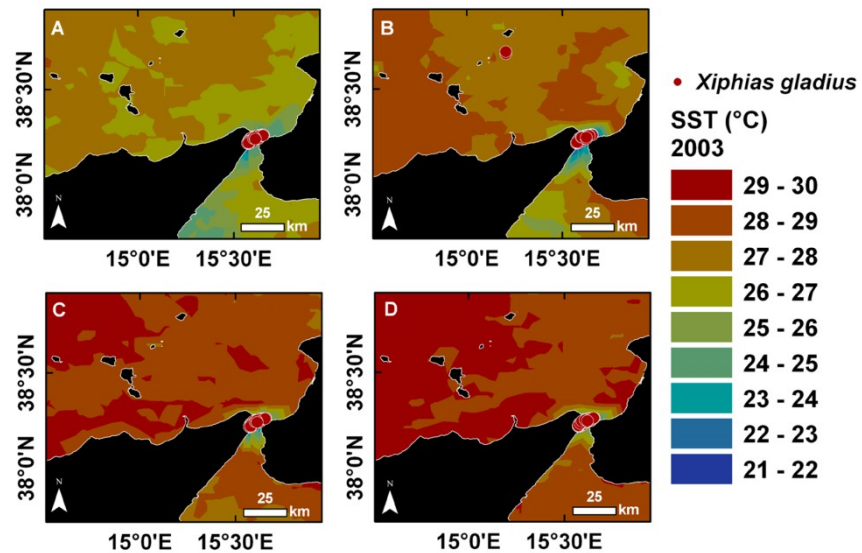
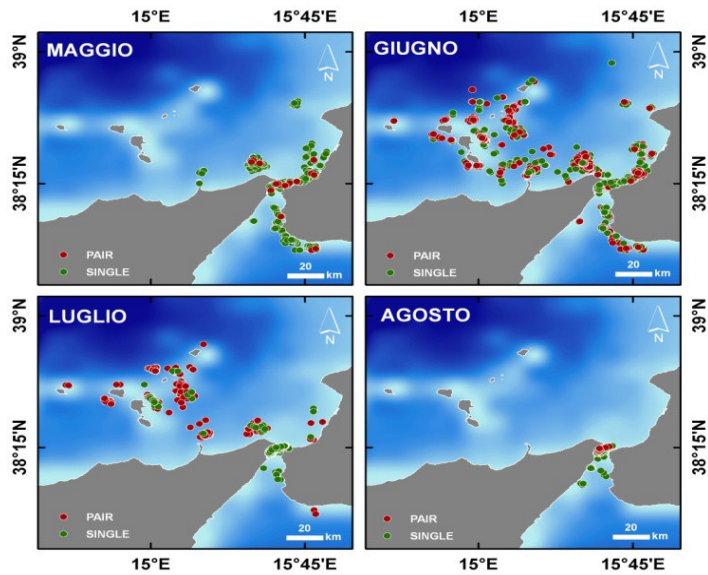
Biomass: 2220 g/m²; CaCO₃ average : 83,04%

Calciummass : 1844,27 g/m²



**IMPACTS ON BIOTA DUE TO CLIMATE
CHANGE :
ACIDIFICATION OF THE SEA**

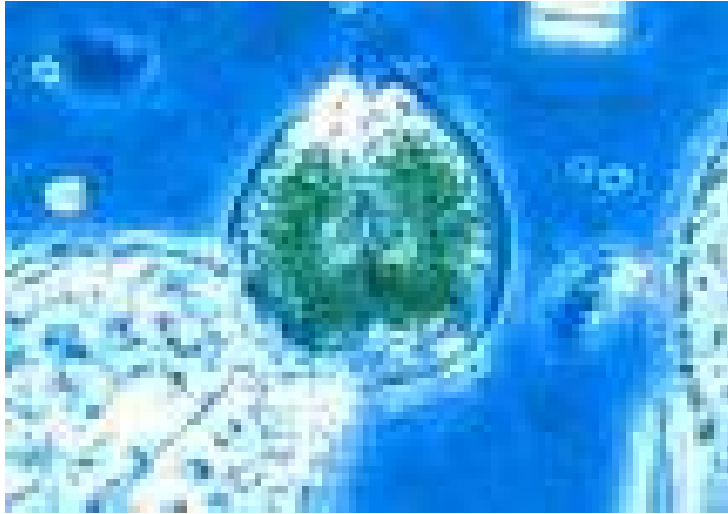




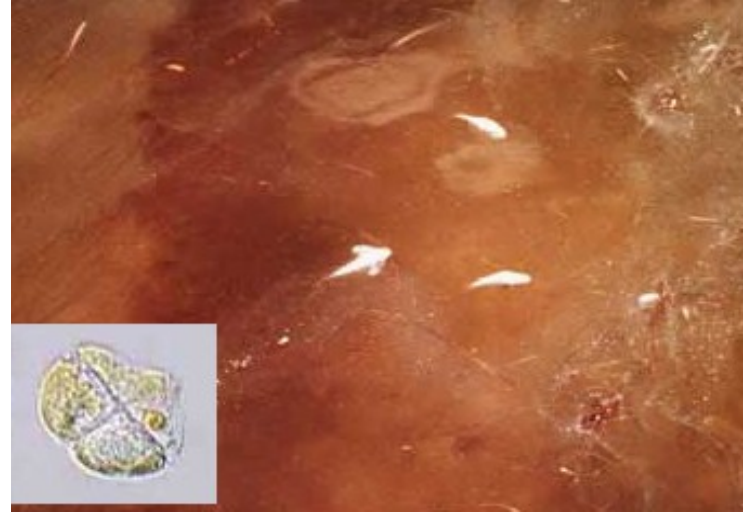
**IMPACTS OF CLIMATE CHANGE :
CHANGES OF FISHES BEHAVIOR**



Harmful algae



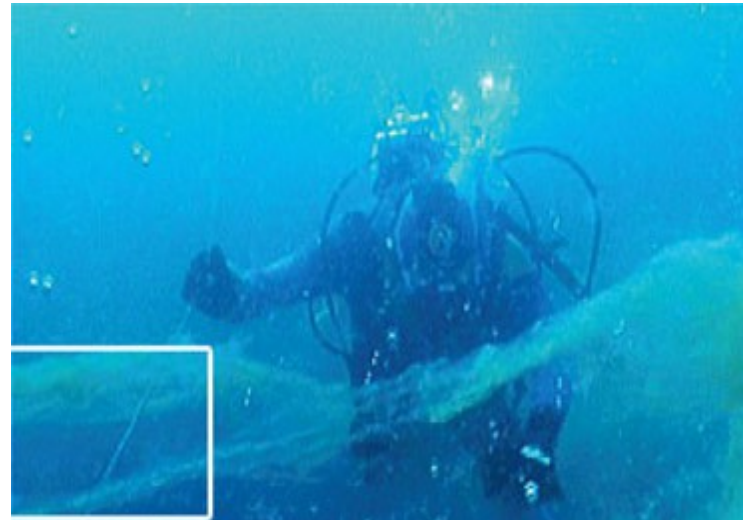
Red tide



Jellyfishes bloom

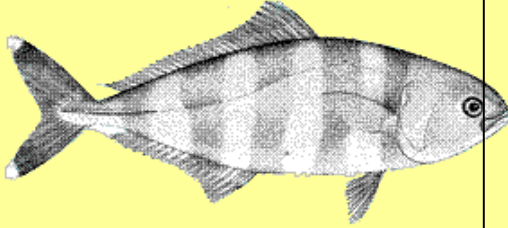


Mucilagen phenomenon



IMPACTS OF CLIMATE CHANGE :
Phenomenons connected to the low
hydrodynamism



july  21 C° 	agost  	september  	Amberjack spawn at 21C° Pilot fish spawn stimulated by photoperidism
may  21 C°	june 	july  	

16/10/23

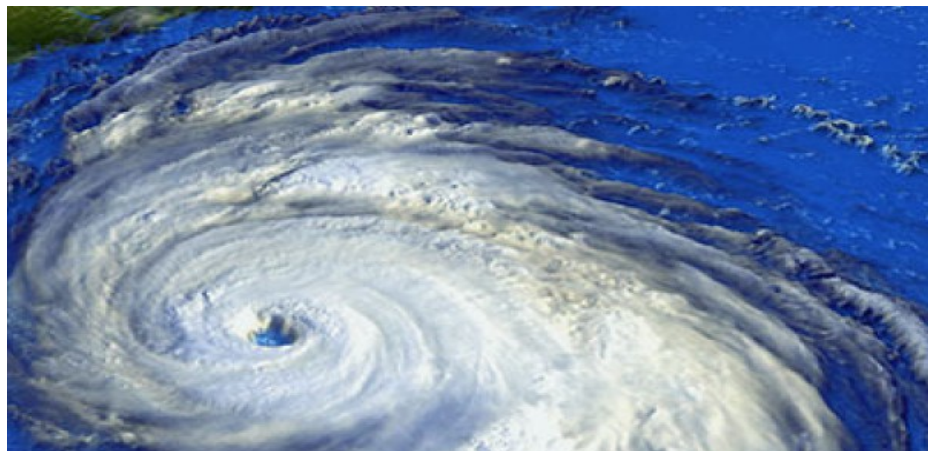
**IMPACTS ON FISHES DUE TO
CLIMATE CHANGE :**

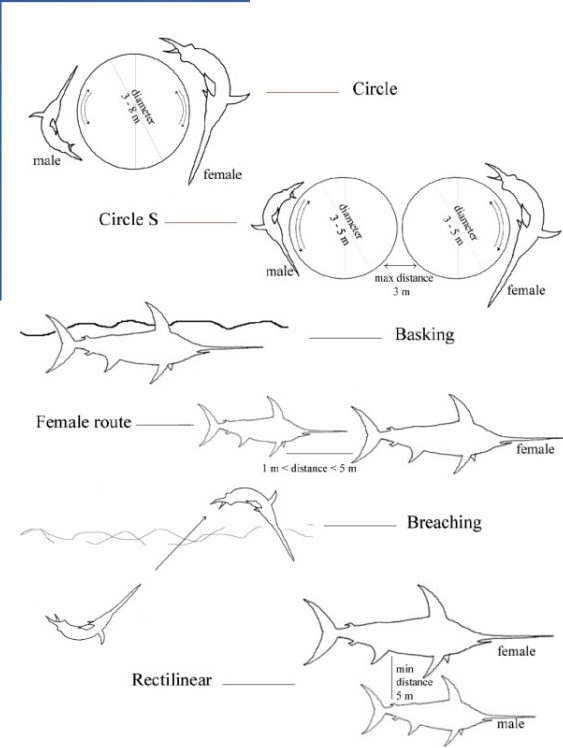
ASYNCHRONISM



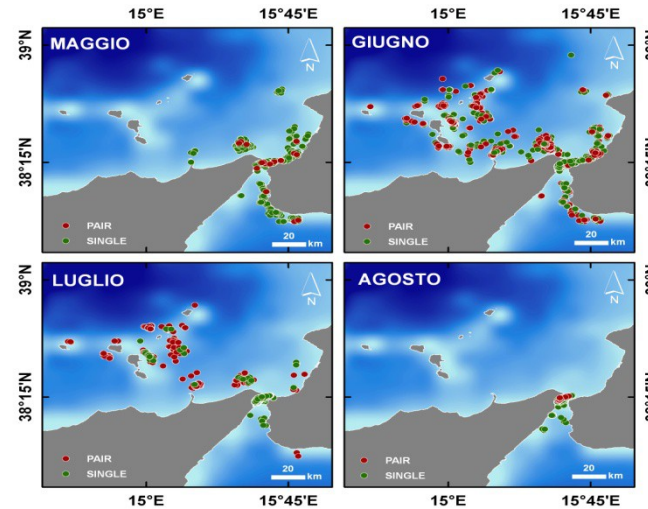


EVENTI METEOREOLOGICI ECCEZIONALI

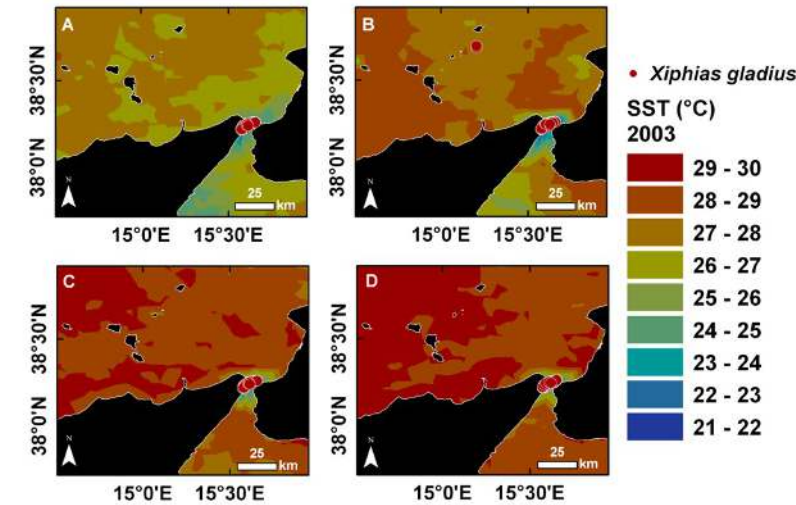




Marine Strategy – Descrittore 3 –
Fishing gear –Harpoon,
Species: *Xiphias gladius*



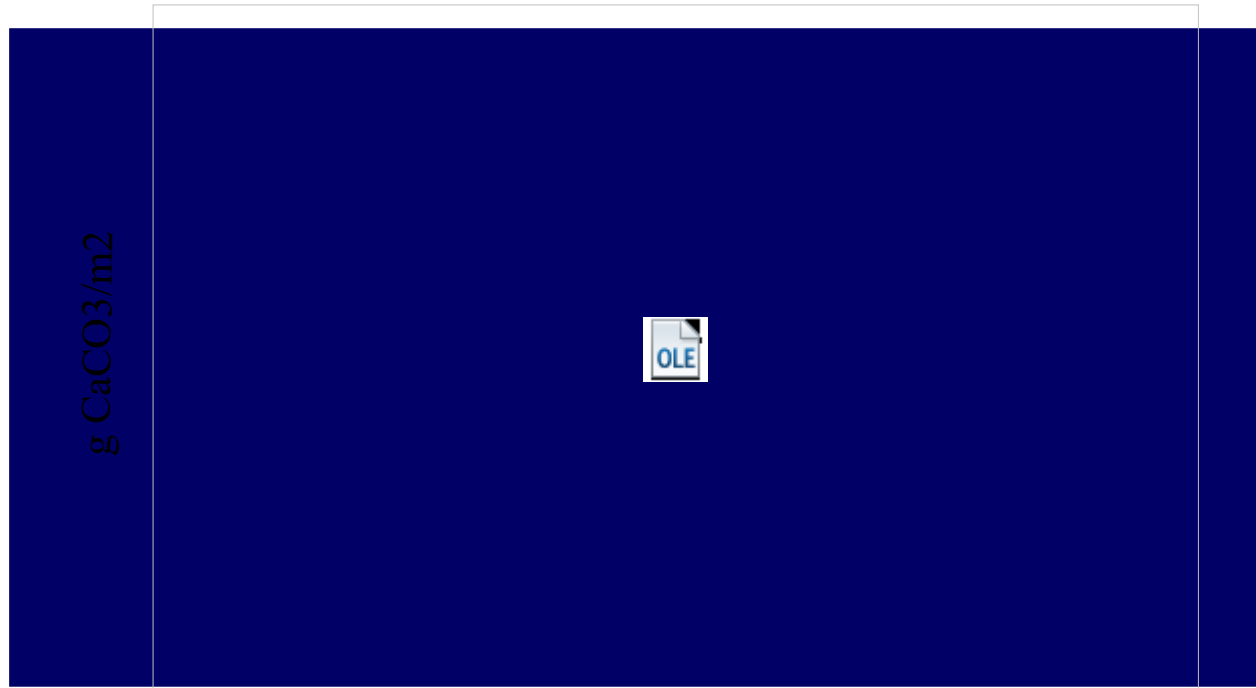
Cambiamenti climatici - Analisi delle
SST °C - Serie storiche di catture
Effetti delle anomalie di SST sul
comportamento



PROGETTO GRANDI PELAGICI



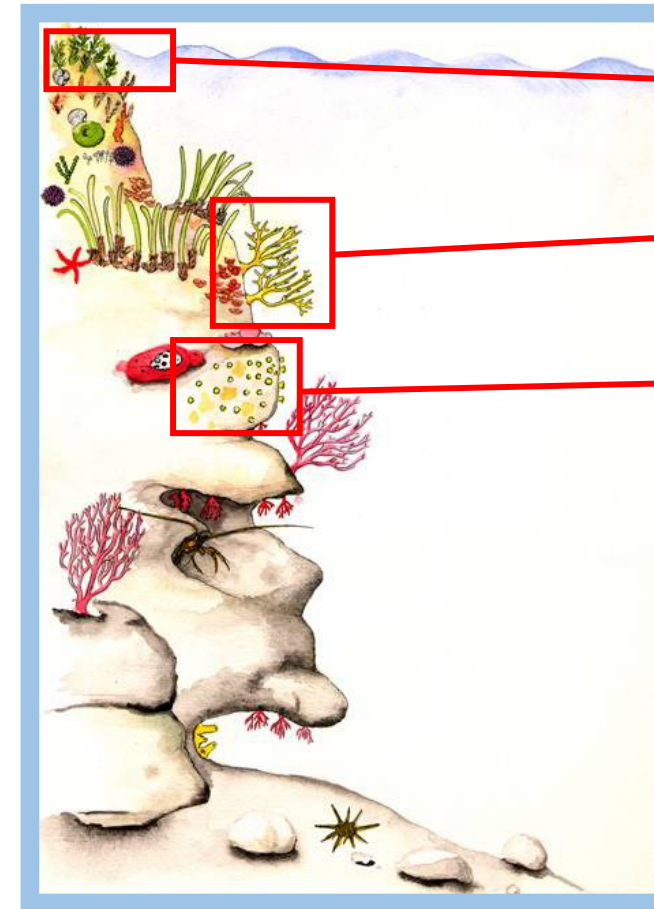
Effetti sui biocostruttori



Biomass: 1776 g/m²; CaCO₃ average: 4,39%
Calciummass: 78 g/m²

Biomass: 48 g/m²; CaCO₃ average : 68,65%
Calciummass : 32 g/m²

Biomass: 2220 g/m²; CaCO₃ average : 83,04%
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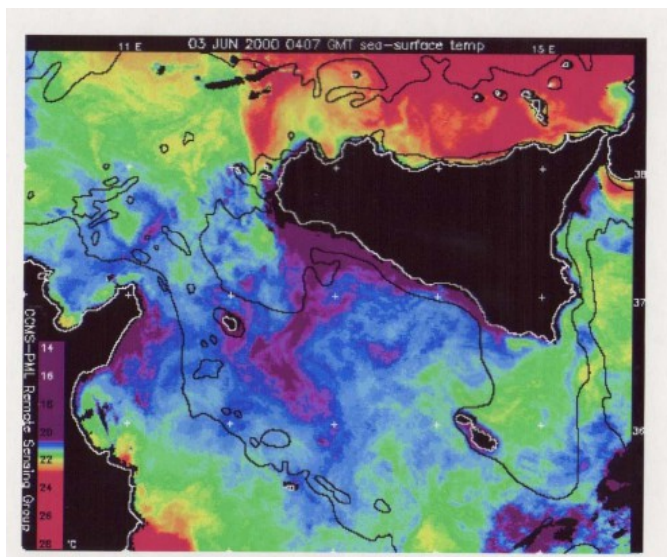
Cystoseira stricta:
lapping 98% (Lug. 02)

Eunicella cavolinii:
25 ind/m²

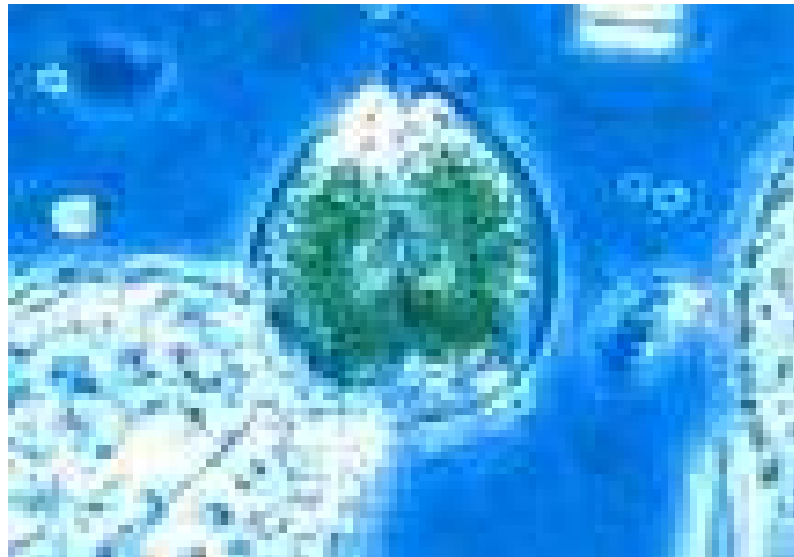
Leptopsammia pruvoti:
1775 ind/m²



MUCILLAGINI MEDUSE E CORRENTI MARINE



OSTREOPSIS E RED TIDE



PROGETTO ASPIM





Ombreggiatura



Ancoraggio



Inquinamento acustico



Collisioni



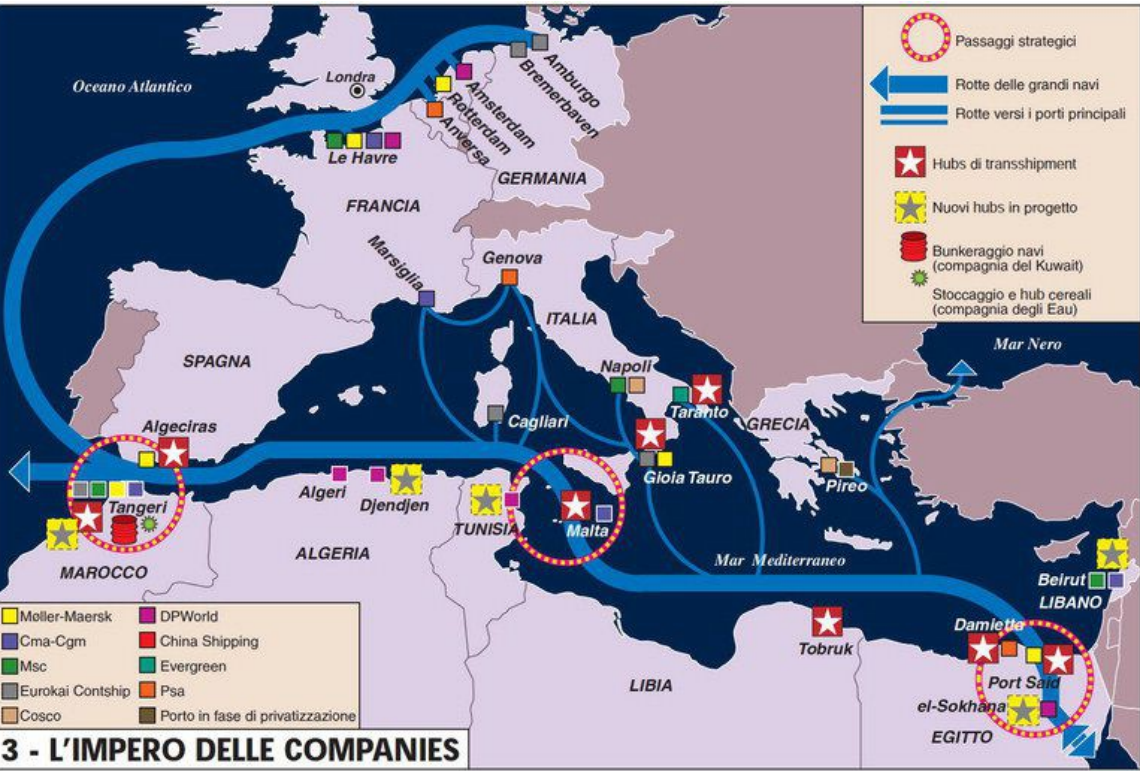
Incidenti



PROGETTO BIODIVALUE



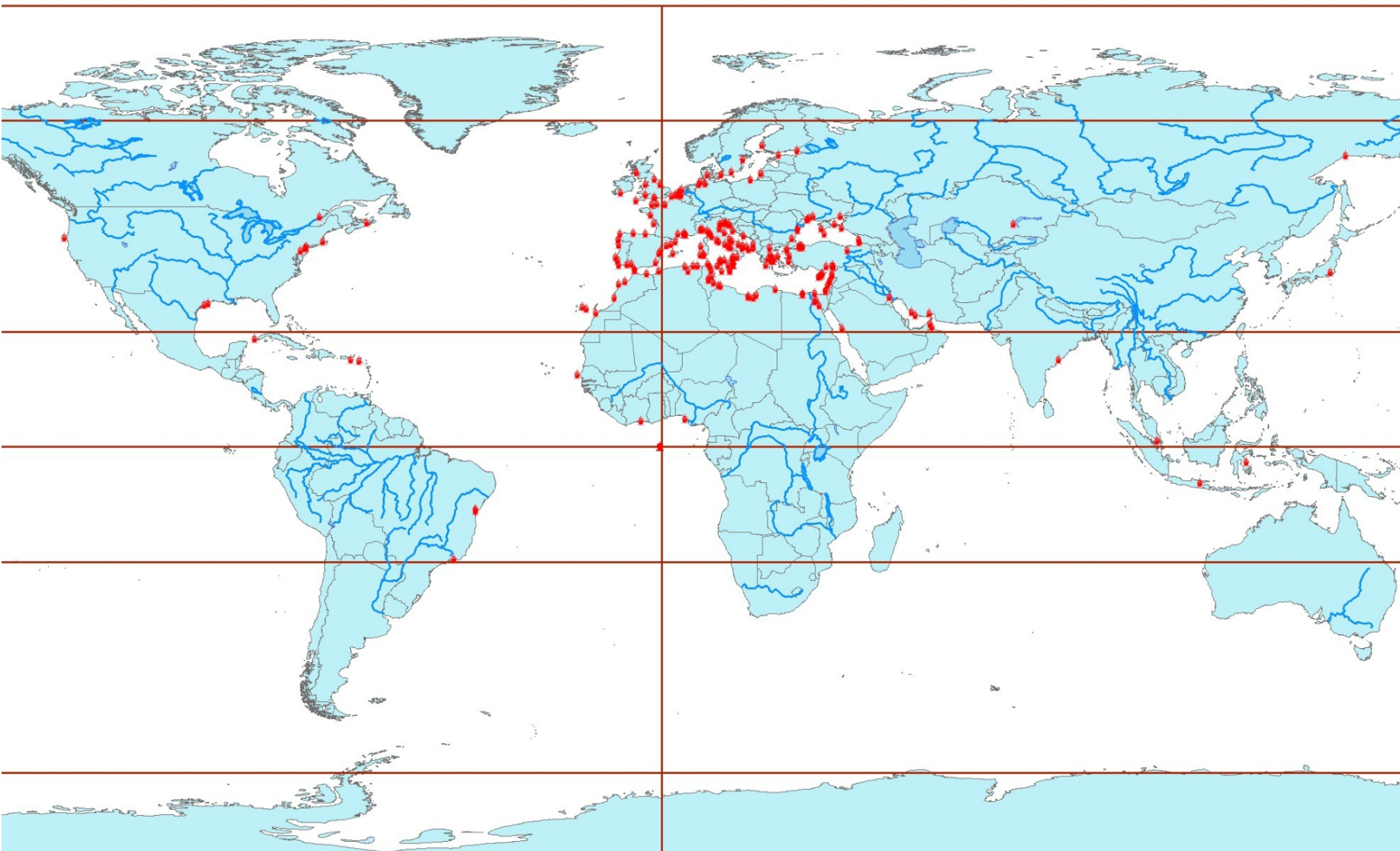
UNA DELLE PRINCIPALI ROTTE DI NAVIGAZIONE DEL MOMDO



IL MEDITERRANEO E' MENO DELL'1 % DEI MARI DEL PIANETA E HA IL 25 % DEL TRAFFICO PETROLIFERO MONDIALE DESTINATO AD AUMENTARE COL RADDOPPIO DI SUEZ



Flusso portuale dei traffici petroliferi



256 porti di provenienza
e destinazione





1 - Idrocarburi o waste liquidi galleggianti, spiaggiati o affondati



2 -Rifiuti galleggianti



3 -Rifiuti sospesi nella colonna d'acqua



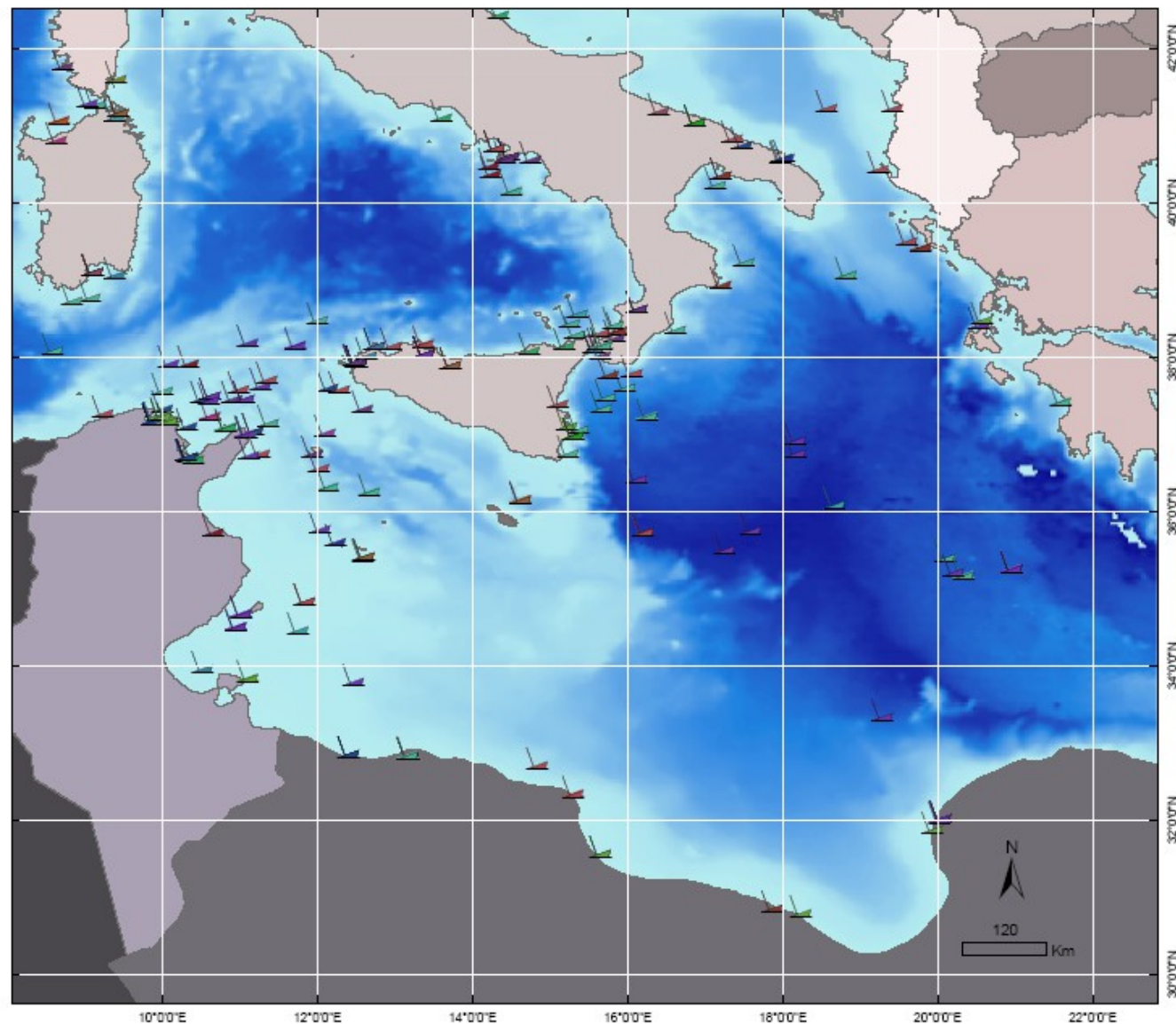
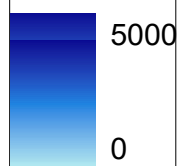
4 - Rifiuti affondati



MILITARY SHIP

-  FAST WARNING
-  DESTROYER
-  GUNBOAT
-  TANKER
-  BATTLESHIP
-  CORVETTE
-  MINESWEEPER
-  HYDROGRAPHIC
-  CRUISER
-  MOTORBOAT
-  TORPEDO MOTORBOAT
-  MOTOR TORPEDO
-  PATROL
-  LANDING CRAFT
-  SHIP
-  CABLE LAYER
-  MINELAYER
-  TOWBOAT
-  SUBMARINE
-  TORPEDO
-  CARGO
-  VEDETTE
-  ANTISUBMARINE VEDETTE

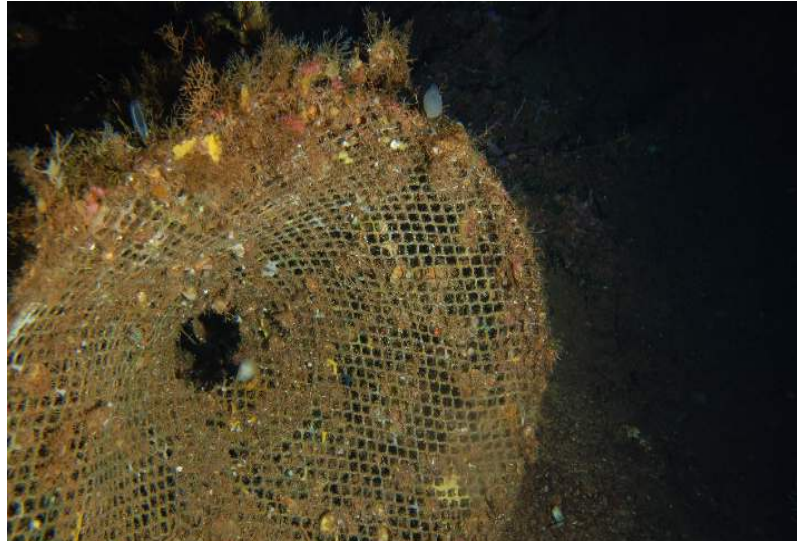
DEEP (m)



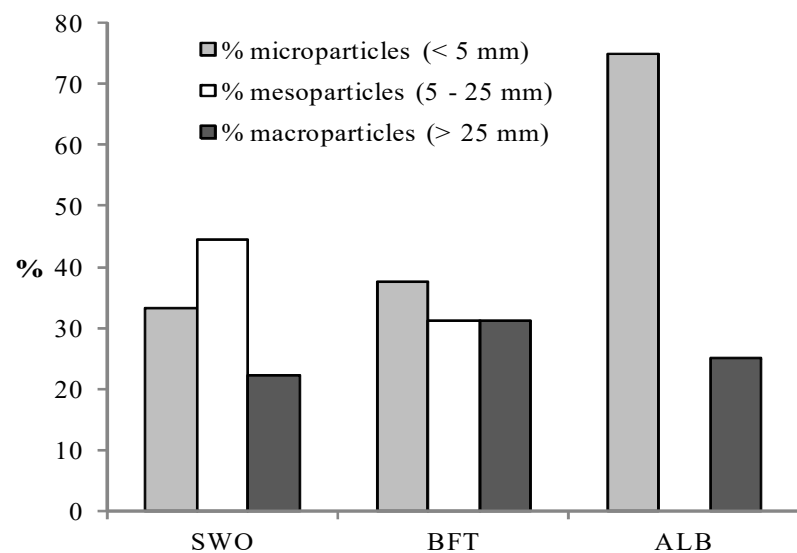
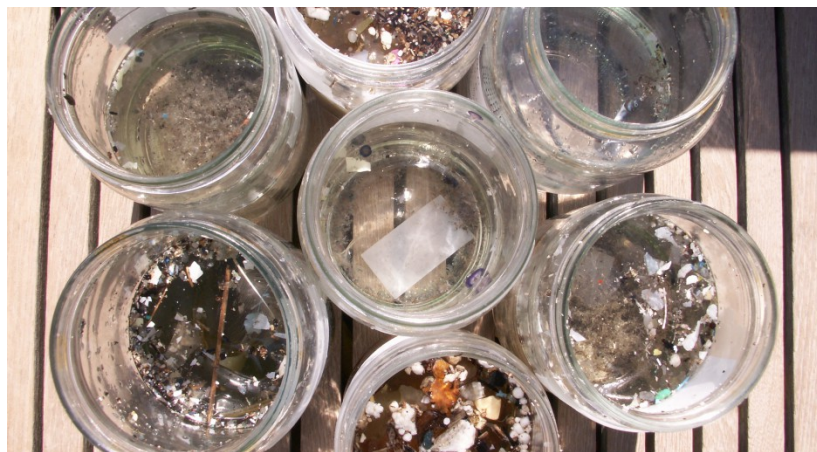
5 - Rifiuti spiaggiati

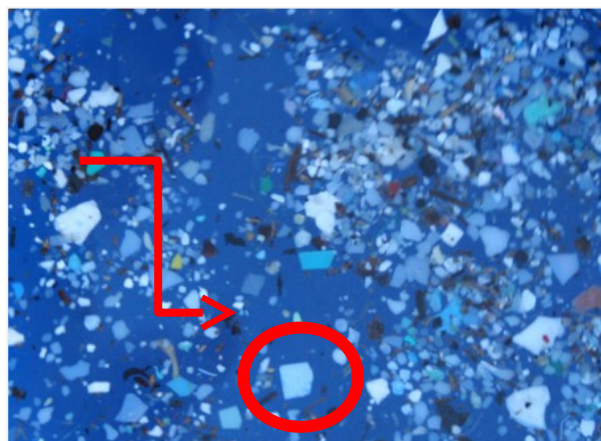
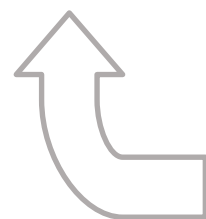


7- Reti fantasma



8 - Microplastiche





“SECONDARY MICROPLASTICS”

TINY PLASTIC FRAGMENTS DERIVED
FROM THE BREAKDOWN OF LARGER
PLASTIC DEBRIS

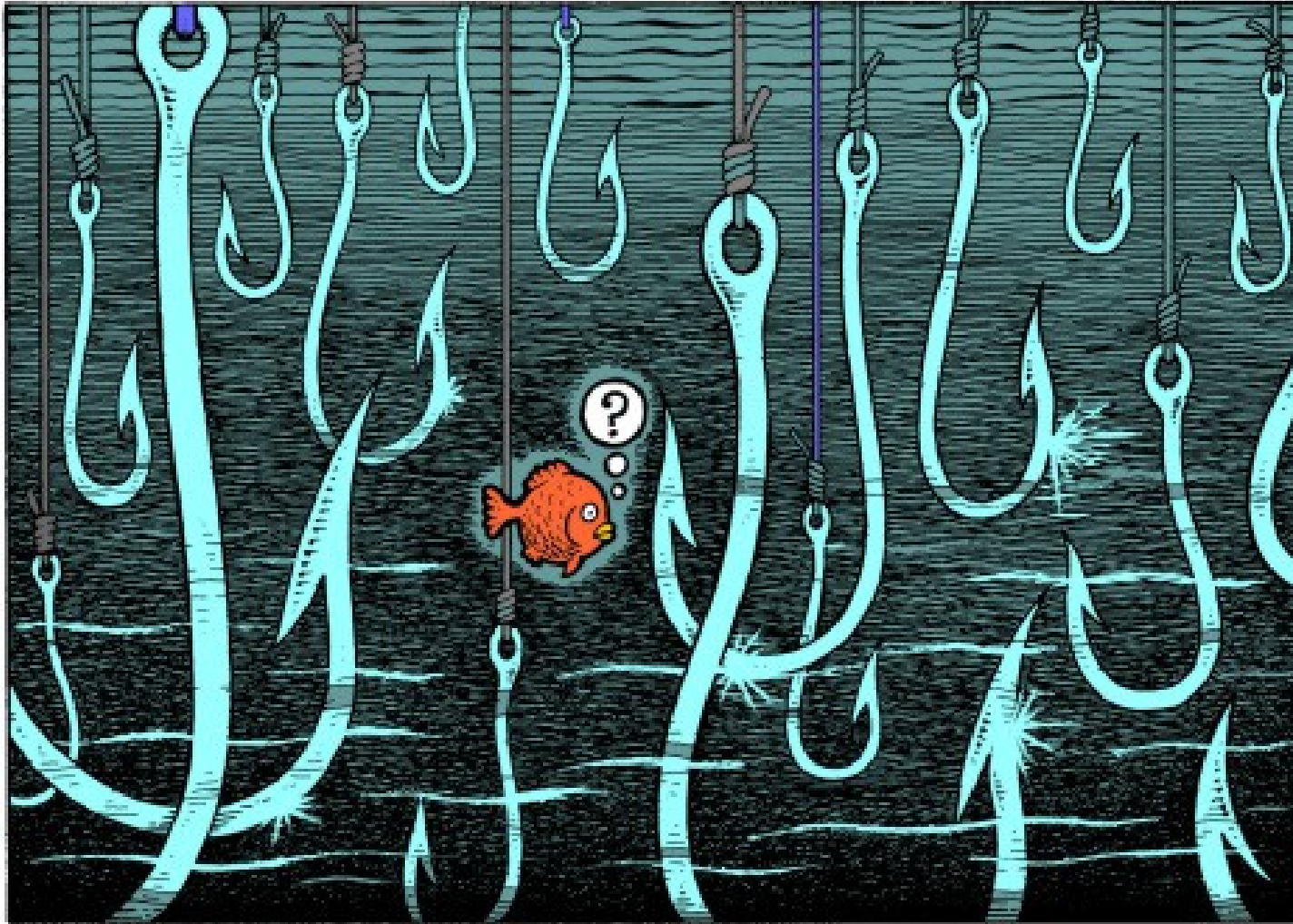






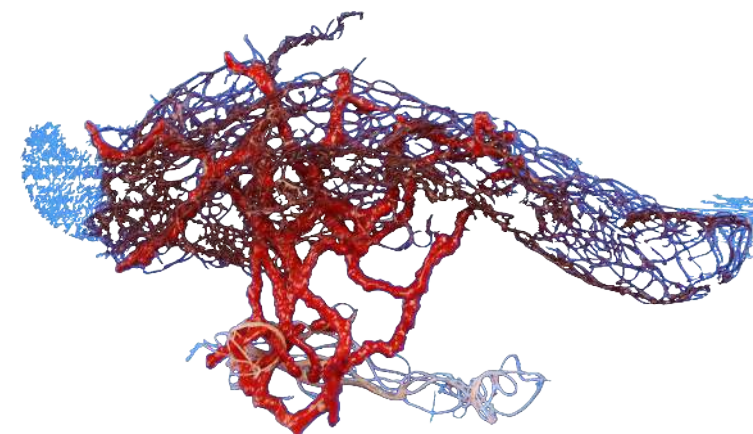
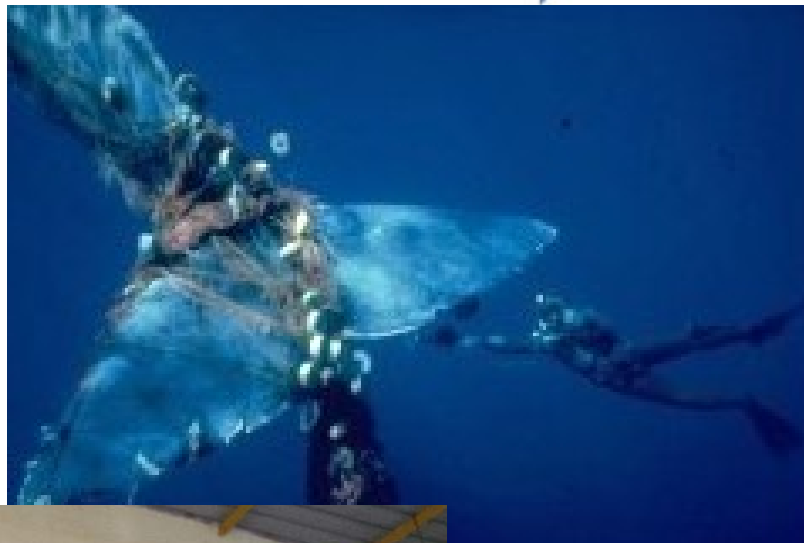
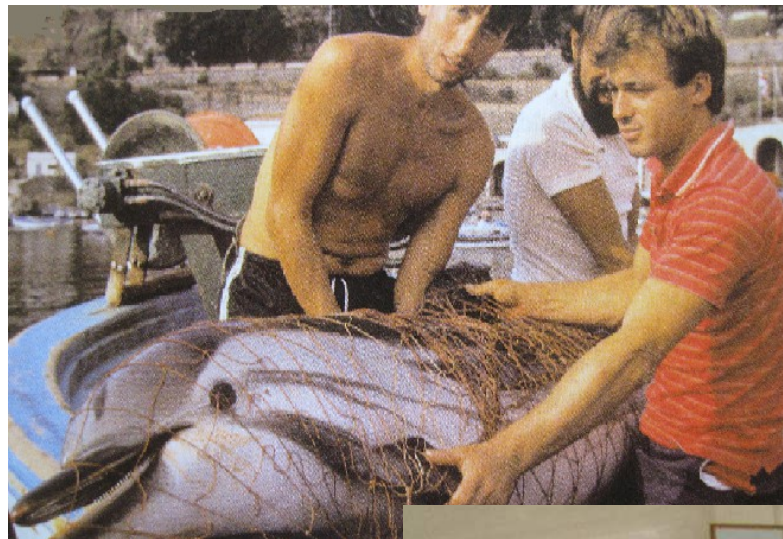
Le risorse ittiche: dallo sfruttamento alla gestione ecosistemica

Il sovrasfruttamento



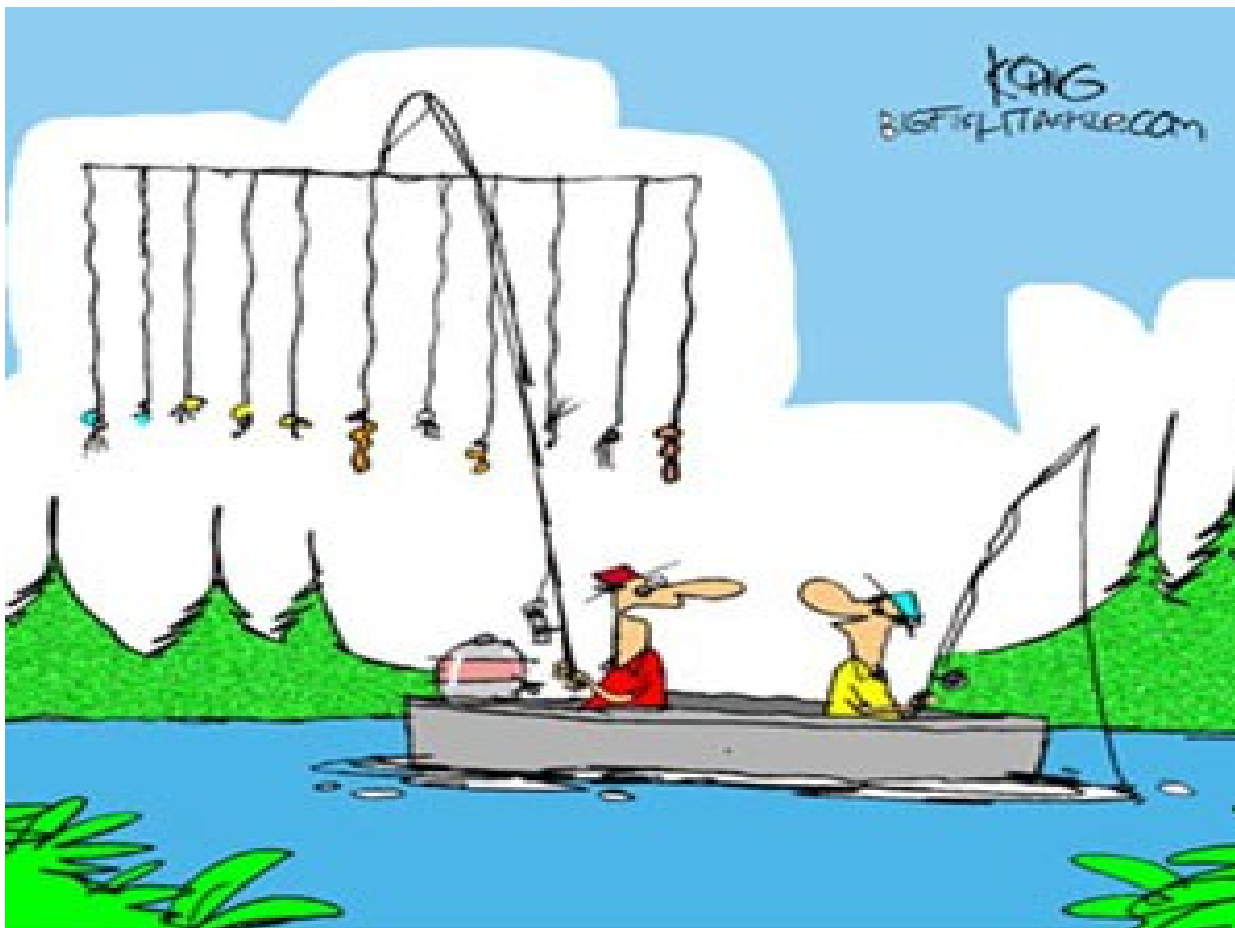
Le risorse ittiche: dallo sfruttamento alla gestione ecosistemica

I.U.U.F.



Le risorse ittiche: dallo sfruttamento alla gestione ecosistemica

La pesca sportiva



*"If people enjoy buffets, then
maybe the fish will too."*





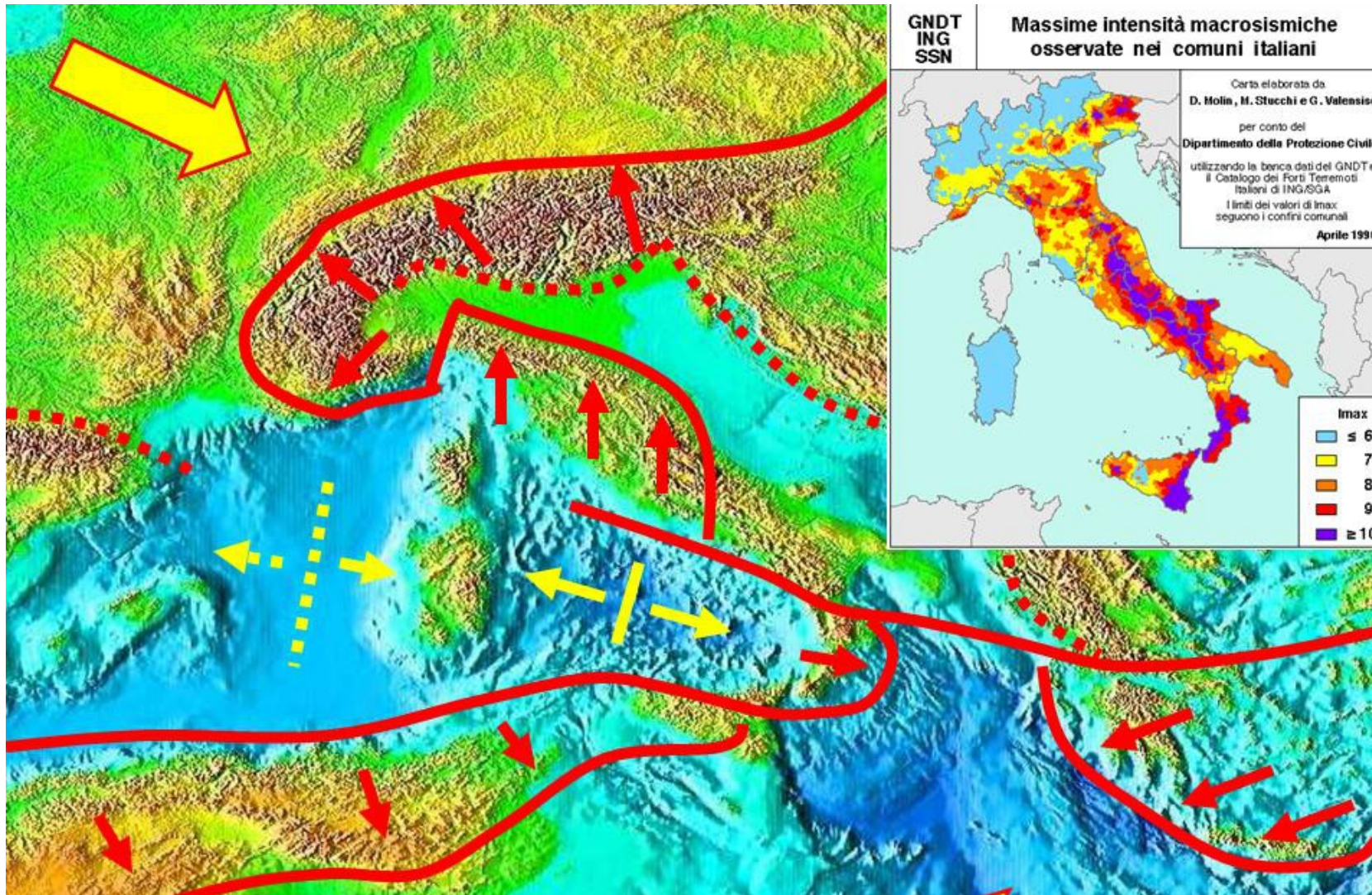
.....rischi potenziali



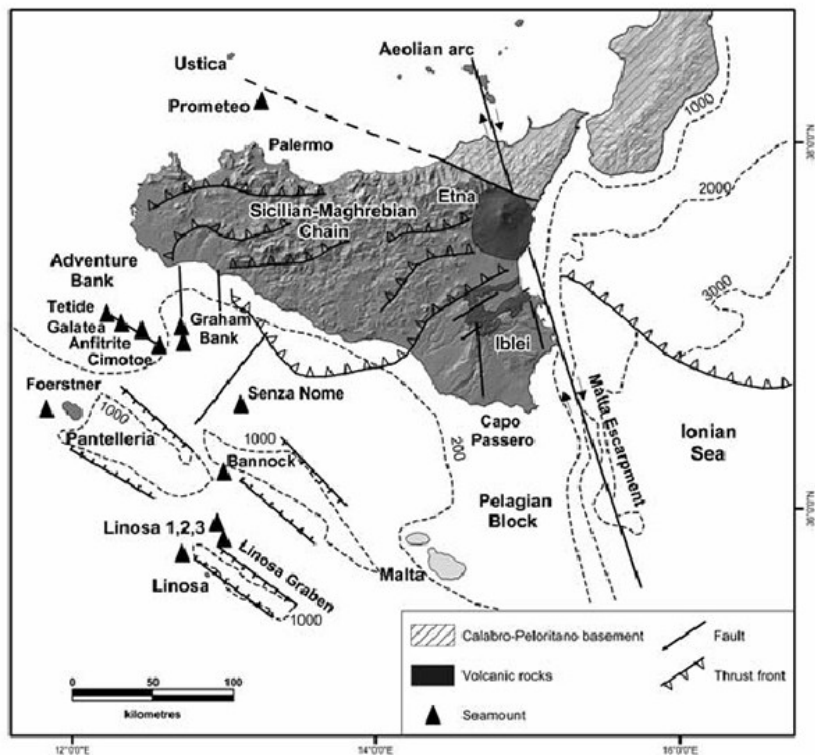
???



LA FAGLIA GLORIA E IL RISCHIO SISMICO



STRETTO DI SICILIA: VULCANISMO



Schema delle strutture geologiche del canale di Sicilia (Peccerillo 2005)

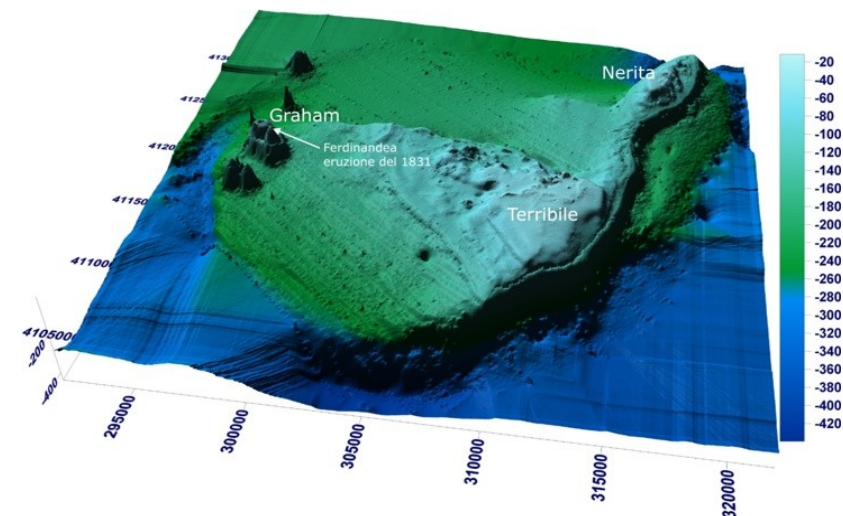
Inizio attività vulcanica: circa 8 milioni di anni fa

Pleistocene: isole-vulcano di Pantelleria e Linosa

Eruzioni storiche:

- 1831 Isola Ferdinandea tra Sciacca e I. Pantelleria
- 1891 Vulcano Foerstner a Nord di Pantelleria

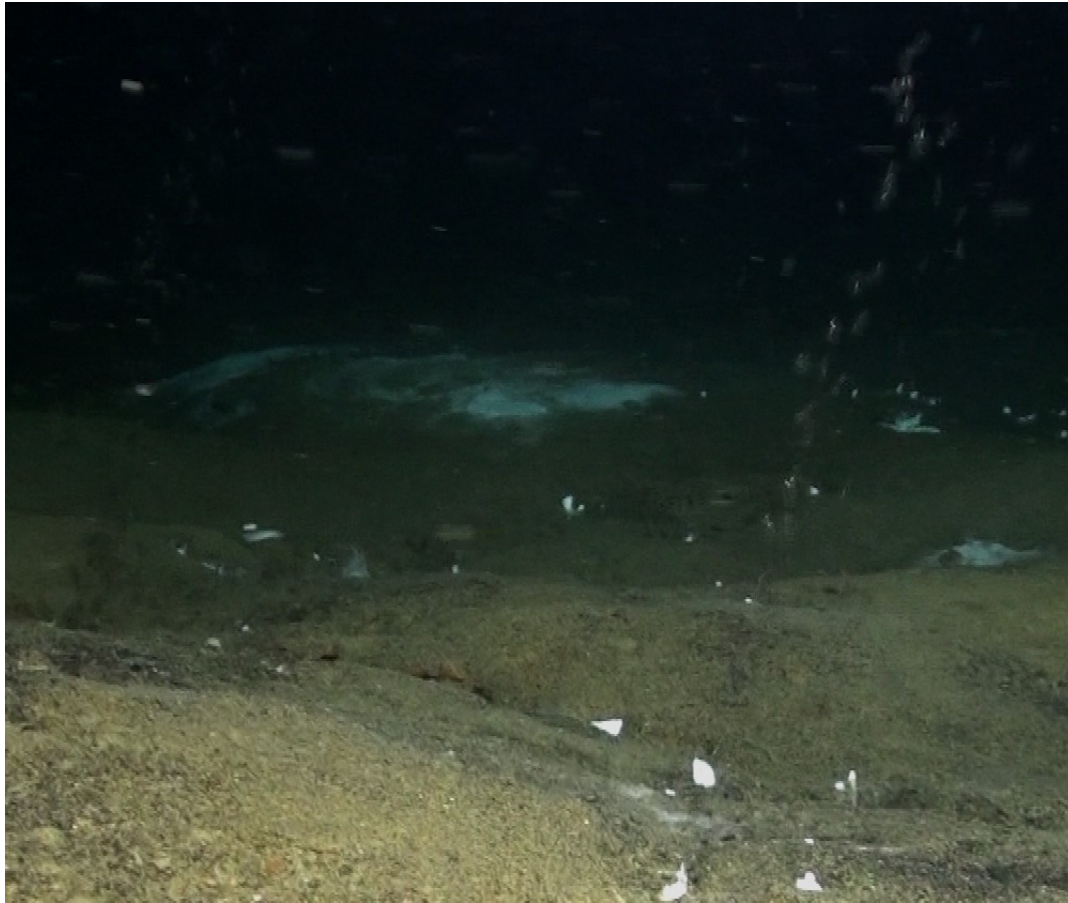
Svariati altri antichi centri vulcanici sommersi (seamounts) poco studiati.



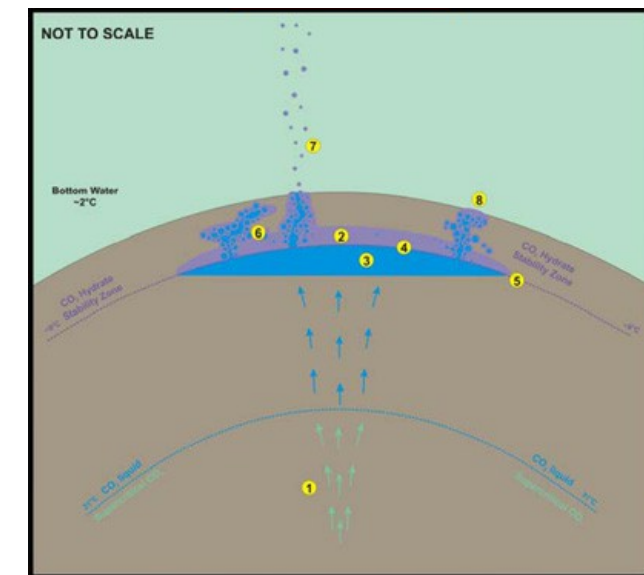
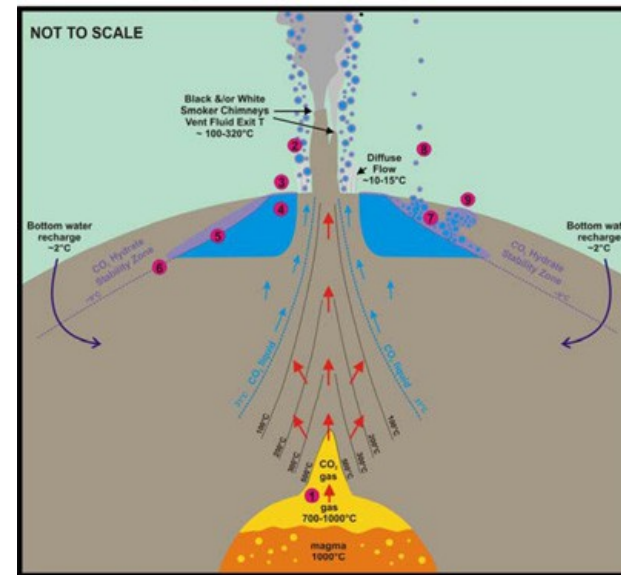
Ricostruzione batimetria attuale dell'isola Ferdinandea (dati INGV)



CAMPI DI BOLLE



Gas intrappolato in lenti negli strati di sedimenti,
mobilizzato dalle venute di CO₂ di origine vulcanica.



Schema di trasporto del metano da parte della CO₂.
1) Sistema idrotermale alta temperatura a spot
2) Sistema idrotermale bassa temperatura diffuso



RISCHIO MAREMOTI

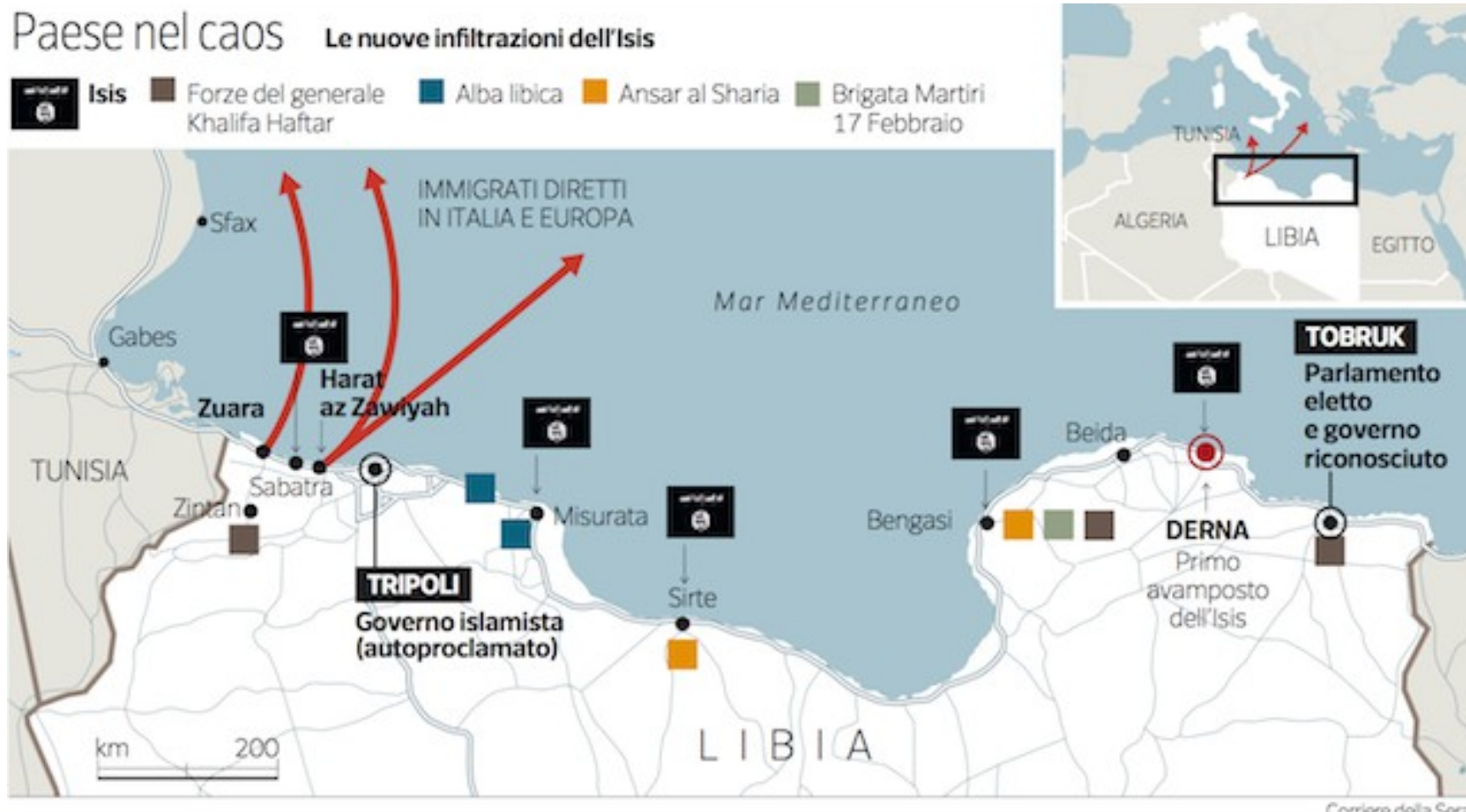


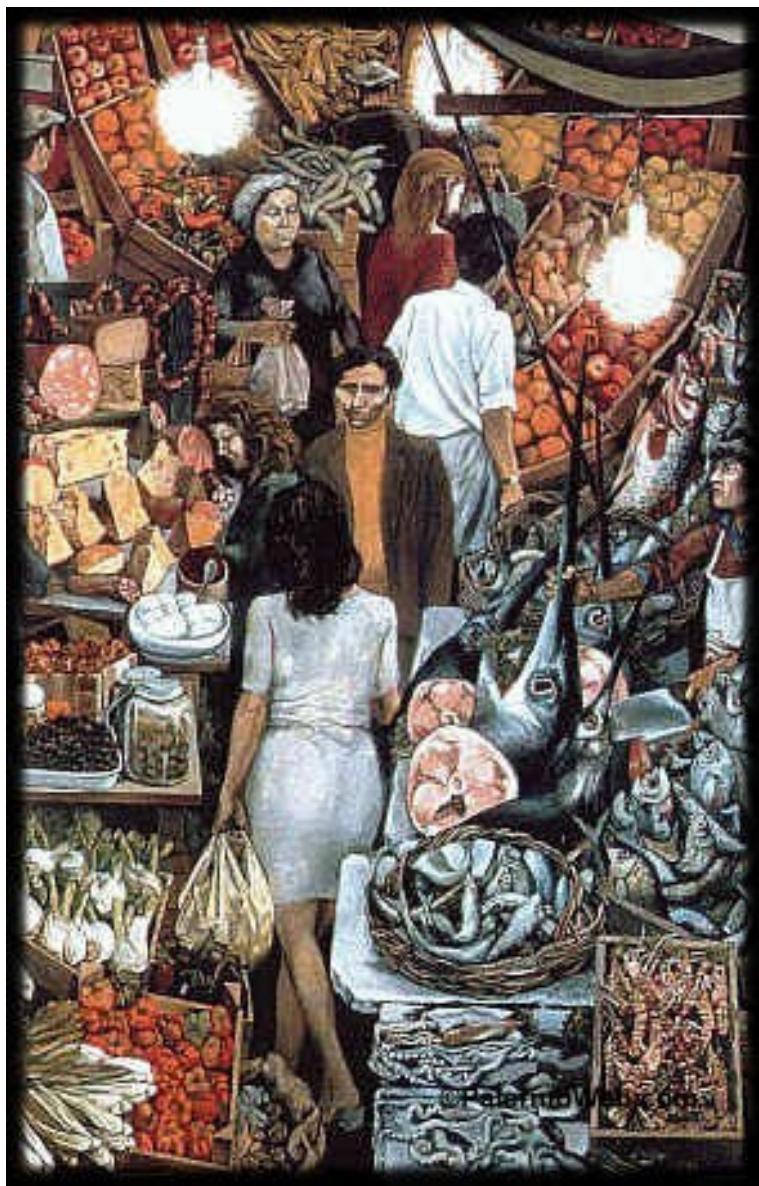
Tutte le coste del Mediterraneo sono a rischio maremoto a causa dell'elevata sismicità e della presenza di numerosi vulcani attivi, emersi e sommersi. Negli ultimi mille anni, lungo le coste italiane, sono state documentate varie decine di maremoti, solo alcuni dei quali distruttivi. Le aree costiere più colpite sono quelle della Sicilia orientale, della Calabria, della Puglia e dell'arcipelago delle Eolie. Maremoti di modesta entità si sono registrati anche lungo le coste liguri, tirreniche e

adriatiche. Le coste italiane possono inoltre essere raggiunte da maremoti generati in aree del Mediterraneo lontane dal nostro Paese (ad esempio a causa di un forte terremoto nelle acque della Grecia).



NELLA ROTTA DEI MIGRANTI A 100 CHILOMETRI DALLE BASI DEL CALIFFATO

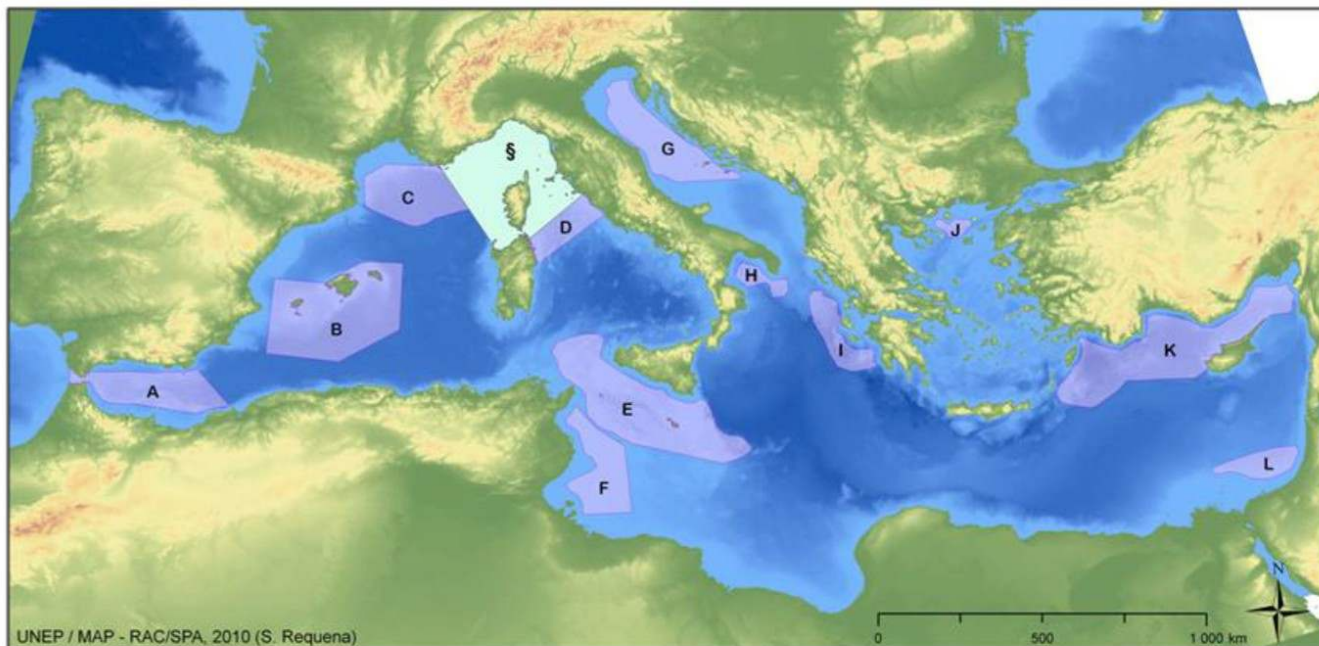




UNEP SPAMI



Priority conservation areas in the open seas, including the deep seas, likely to contain sites that could be candidates for the SPAMI List

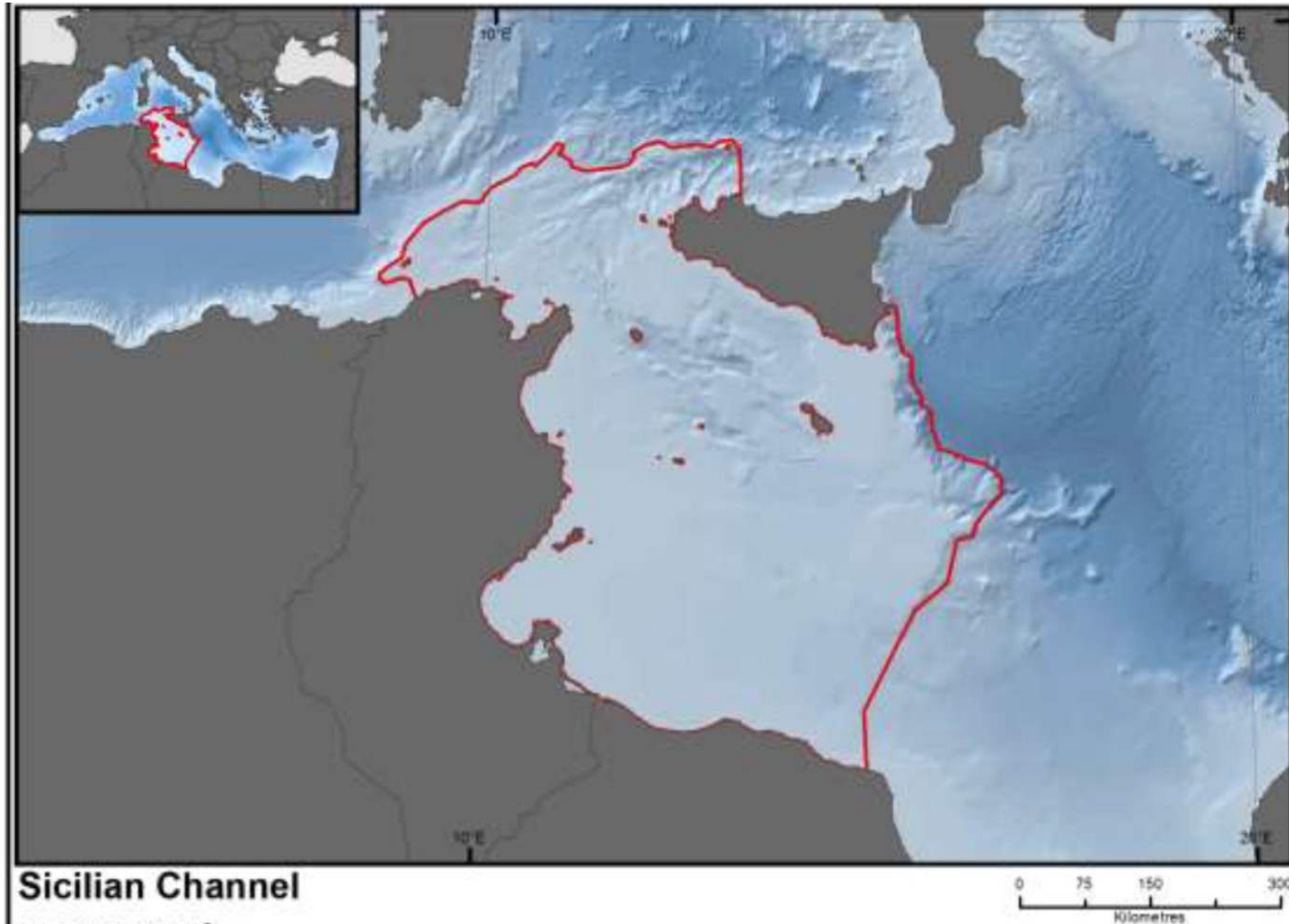


UNEP / MAP - RAC/SPA, 2010 (S. Requena)

A: Alborán Seamounts; B: Southern Balearic; C: Gulf of Lions shelf and slope; D: Central Tyrrhenian; E: Northern Strait of Sicily (including Adventure and nearby banks); F: Southern Strait of Sicily; G: Northern and Central Adriatic; H: Santa Maria di Leuca; I: Northeastern Ionian; J: Thracian Sea; K: Northeastern Levantine Sea and Rhodes Gyre; L: Nile Delta Region (S: Pelagos Sanctuary)



EBSA CBD



VERSO LA RISERVA DELLA BIOSFERA DELL'UNESCO



PREVENZIONE MITIGAZIONE E ADATTAMENTO

- Cooperazione internazionale
- MFSD e ECAP
- Sviluppo di sistemi bottom up e smart communication
- Ricerca e innovazione tecnologica
- Sinergia tra gli attori
- Utilizzo specifico di horizon 2020 e della nuova programmazione
- Rete mediterranea della ricerca in mare e di sistemi
- Early warning Istituzione di una ZPE in Mediterraneo centrale e modifica della normativa



