


# The use of artificial reefs for fisheries management in the Mediterranean Sea

Gianna FABI, Fabio GRATI, Alessandra SPAGNOLO, Giuseppe SCARCELLA




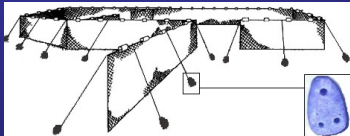
CNR – Institute of Marine Sciences (ISMAR), Ancona - Italy

**GFCM - SAC - Sub-Committee on Marine Environment and Ecosystems (SCMEE) - 11th Session**




The setting up of ARs to attract fish in Mediterranean goes back to around 3,000 years ago.







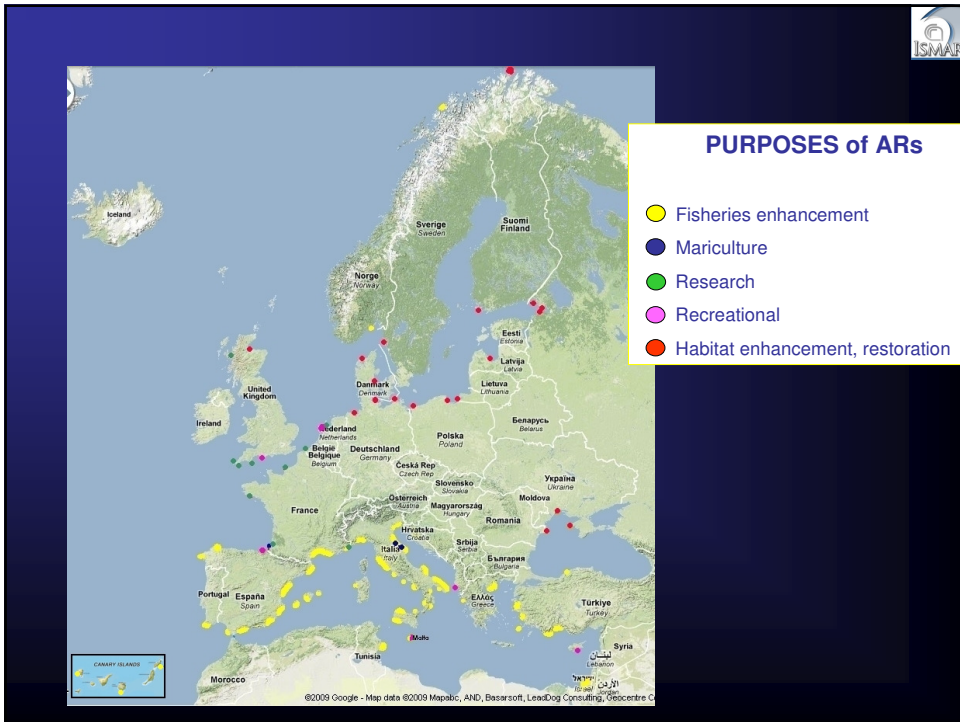
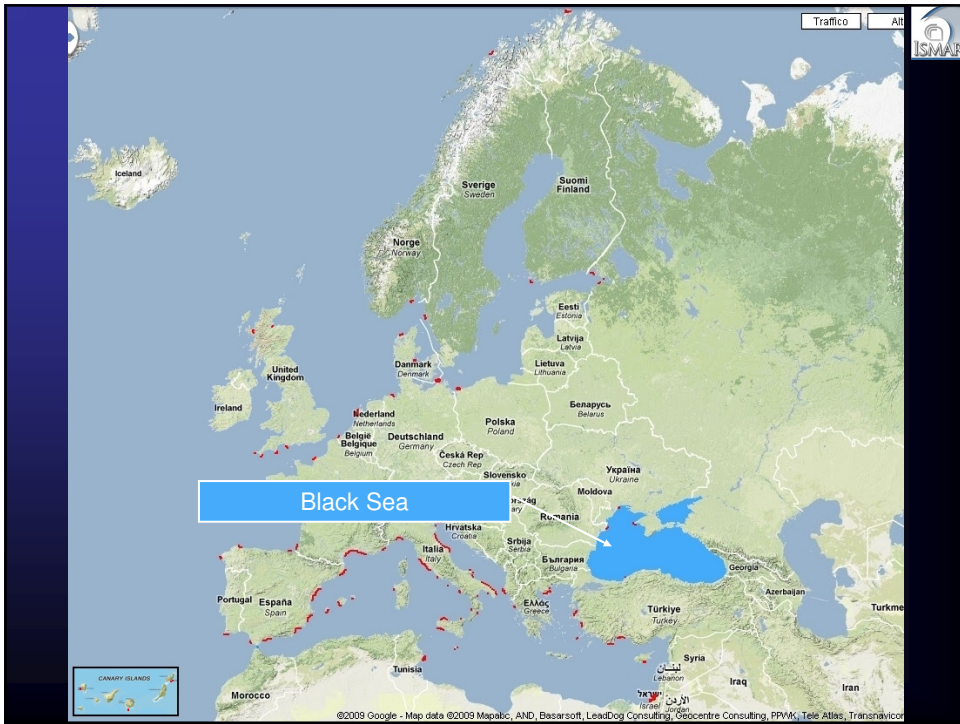


The rocks used as anchors for the tuna fishery nets in the Mediterranean Sea were left on the seabed at the end of each fishing season, accumulated over time and made new rocky habitats populated by benthic fauna and fish which were exploited by local fishermen during the intervals between the fishing tuna seasons

 In the middle of the 17th century artificial reefs were used in Japan under various shapes for fish attraction.

Modern concept of "Artificial Reef"

1900s    1800s 



**BARCELONA CONVENTION** 1977

**LONDON CONVENTION** 1972

**BUCHAREST CONVENTION** 1992  
(entry into force: 1994)

**Convention on the Protection of the Black Sea Against Pollution**

**BUCHAREST CONVENTION** 1992  
(entry into force: 03\_1998)

**HELSEINKI CONVENTION** 1992  
(entry into force: 2000)

**Convention on the Protection of the Marine Environment of the Baltic Sea Area**

**LAW**

**UNEP-MAP 2005**  
**Guidelines for the Placement at Sea of Matter for Purpose other than mere Disposal (Construction of Artificial Reefs)**

**UNEP-MAP 1975 (Mediterranean Action Plan)**  
The MAP is a regional cooperative effort involving 21 countries bordering the Mediterranean Sea and the EU. Through the MAP, these Contracting Parties determined protocols to protect the marine and coastal environment through regional and national plans to achieve sustainable development.

**IMO-UNEP 2008**  
**London Convention and Protocol / UNEP guidelines for the placement of ARs**

**FAO - Code of Conduct for Responsible Fisheries (1995)**  
**Articles 8.11.1 - 4: Artificial reefs and fish aggregation devices**

8.11.3 States should, within the framework of coastal area management plans, establish management systems for artificial reefs and fish aggregation devices. Such management systems should require approval for the construction and deployment of such reefs and devices and should take into account the interests of fishers, including artisanal and subsistence fishers.



**OSPAR 1999**  
Guidelines on Artificial Reefs in relation to Living Marine Resources 1999

**UNEP-MAP 2005**  
Guidelines for the Placement at Sea of Matter for Purpose other than mere Disposal (Construction of Artificial Reefs)

**IMO-UNEP 2008**  
London Convention and Protocol / UNEP guidelines for the placement of ARs

**AR DEFINITION**

AR is a submerged structure **deliberately** placed on the seabed to mimic some functions of a natural reef, such as protecting, regenerating, concentrating and/or enhancing populations of living marine resources

The term **EXCLUDES** artificial islands, cables, pipelines, platforms, mooring, and other structures for coastal defence (e.g. breakwaters)

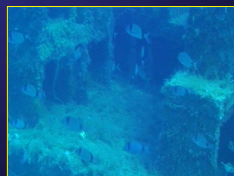
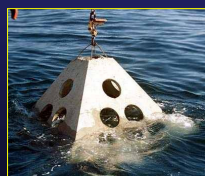
Materials, design, placement, administrative action, monitoring, scientific experiments, management and liabilities



**GUIDELINES PURPOSE**

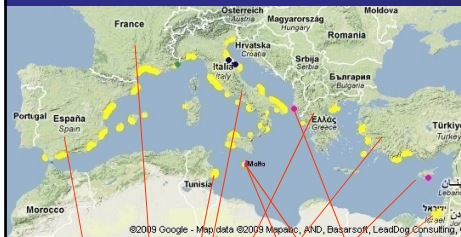
To give assistance Contracting Parties in:

- ✓ Assessing proposals for the placement of ARs on the basis of scientifically sound criteria and developing an appropriate regulatory framework
- ✓ Implementing regulations on the AR construction
- ✓ Preventing of pollution or degradation of the marine environment as a consequence of waste deployment

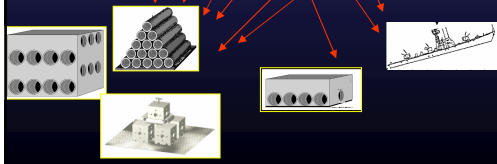




# MEDITERRANEA SEA



- ✓ Spain
- ✓ France
- ✓ Principality of Monaco
- ✓ Italy
- ✓ Albania
- ✓ Greece
- ✓ Turkey
- ✓ Israel
- ✓ Cyprus
- ✓ Malta
- ✓ Tunisia



# ITALY

## PURPOSES



more than 70 ARs

- ✓ To protect the coastal nursery areas or other sensitive habitats from illegal trawling;
- ✓ To reduce conflicts between different fishermen categories (e.g. small-scale fishers and trawlers);



developing new populations of edible bivalves (i.e. mussels) in eutrophic waters

- ✓ To enhance small-scale fisheries




increasing local finfish populations





**ITALY**

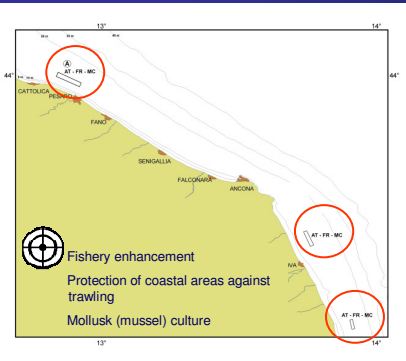


**MARCHE Region**



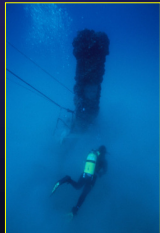

Seven ARs  
The oldest one deployed in 1974-75


The last three large-scale ARs constructed by Regional Authority in the framework of the **Regional Programs** in 2001-2005

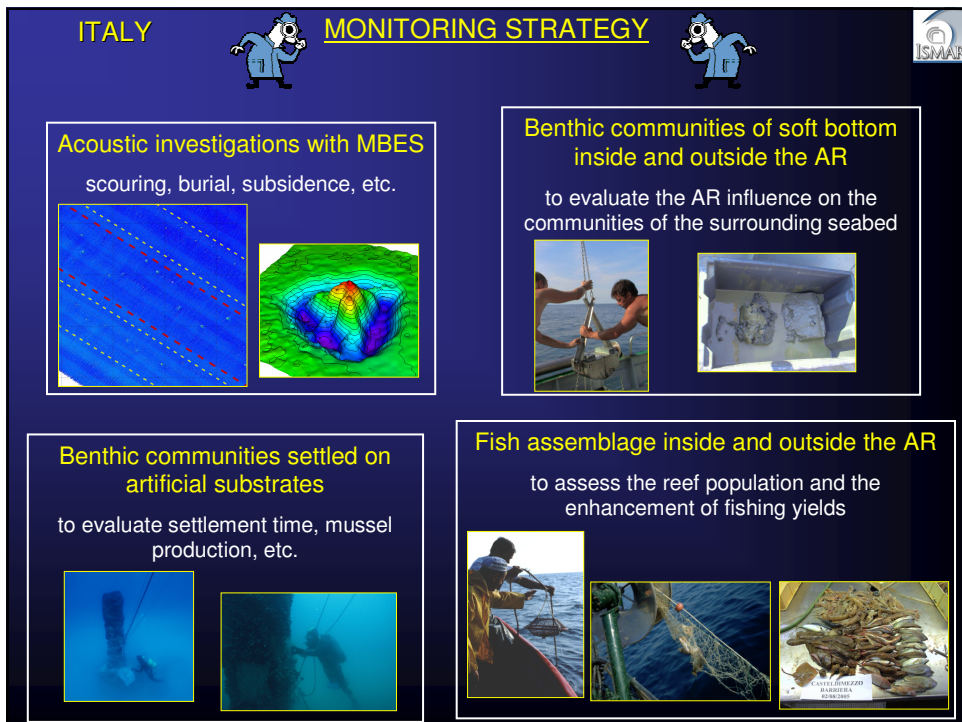
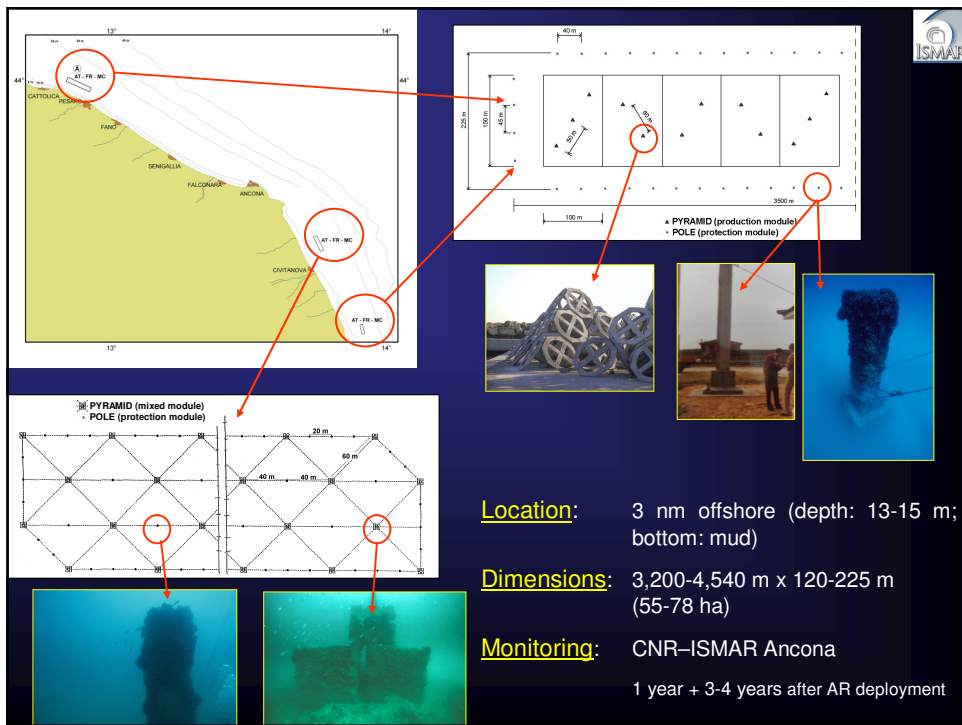
**AR planning and design:** CNR-ISMAR Ancona



Fishery enhancement  
Protection of coastal areas against trawling  
Mollusk (muschel) culture














**ITALY**



**APULIA Region**







- ✓ Protection and enhancement of marine living resources
- ✓ Enhancement of coastal fisheries
- ✓ Protection of coastal sensitive habitats (e.g. coralligenous, seagrass beds)

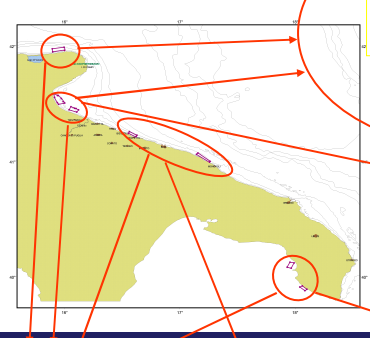
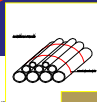
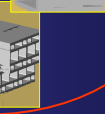
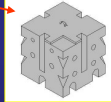
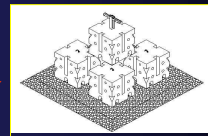
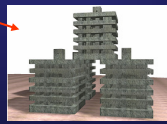


Seven ARs deployed from 2005 and 2008 under **Regional Plan 2000-2006**

**Promoters:** Apulia Regional Authority on request of Scientific Institutes, Local Authorities, and/or Fishery Associations

**AR construction:** APULIA Region


**ITALY**

**Locations:** from 100 m to 5.5 km offshore (depth range: 10-36 m)

**Dimensions:** from 800 to 3,600 ha

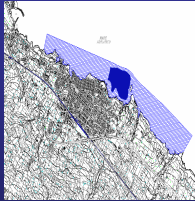
**Monitoring:** Laboratory of Marine Biology, Bari  
5 years after deployment



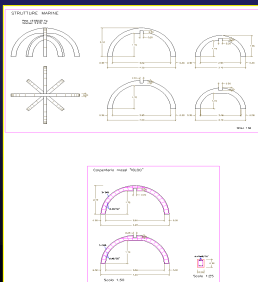
## ITALY



The Apulia Region also funds projects for tourism enhancement / development with P.I.S. (Integrated Sectorial Projects) funds.



One of these projects is a BLUE OASIS at Polignano a Mare



- ✓ conservation of sensitive habitats (coralligenous, seagrass beds, submerged caves, etc.)
- ✓ finfish attraction



increase diving tourism

## GREECE



Construction of ARs started in 1999



MULTIANNUAL PROGRAM FOR FISHERY DEVELOPMENT



Protection and management of fisheries resources

MINISTRY OF AGRICULTURE → Construction, monitoring and funding

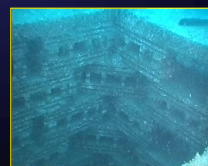
Site identification

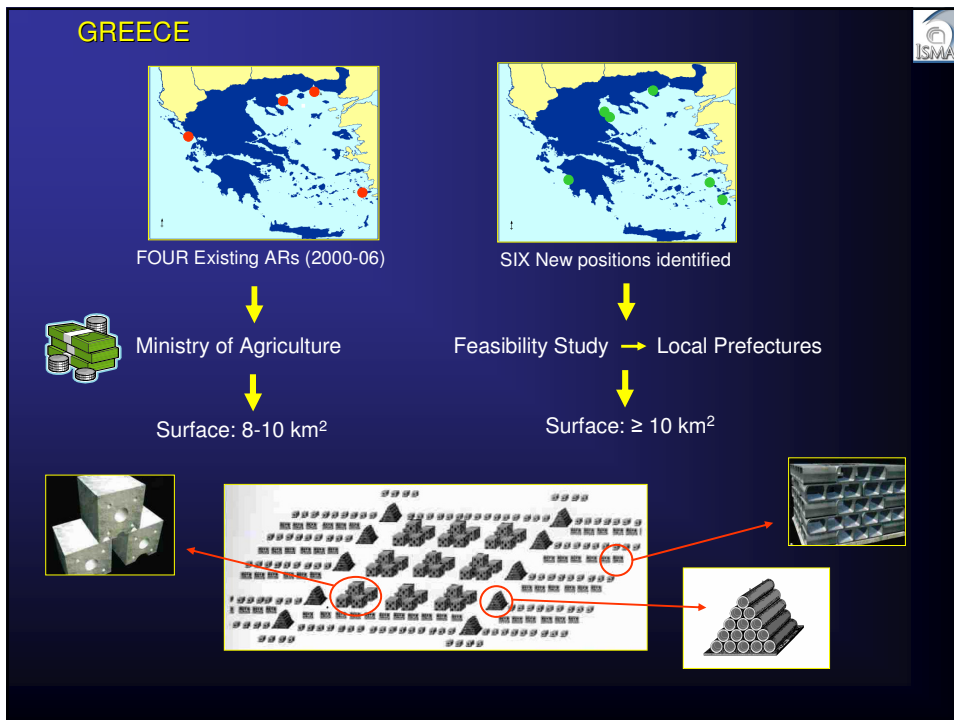
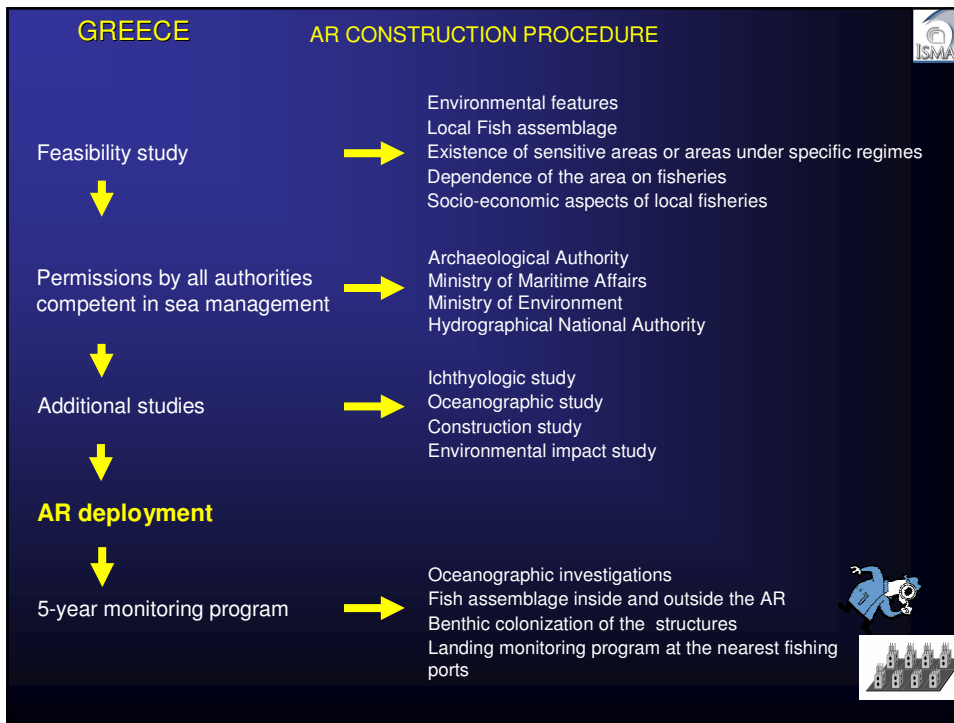
before 2004

MINISTRY OF AGRICULTURE

after 2004

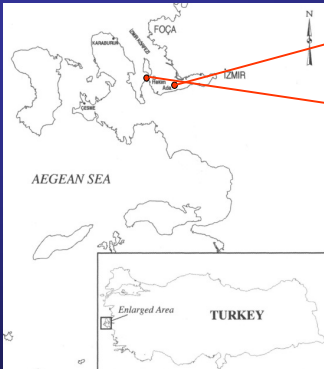
LOCAL FISHERY ASSOCIATIONS,  
through Local Prefectures







## TURKEY



1989 → IZMIR Bay → 10 old bus

**FIRST SCIENTIFIC AR PROJECT**

1991 → HEKIM Island → six 5-block pyramids




↓

New projects with the COOPERATION among



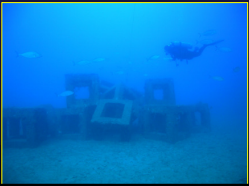
- ✓ Government / Local Authorities
- ✓ Universities
- ✓ Fishery Associations

↓

- ✓ to protect coastal nursery areas and small-scale fisheries from illegal trawling
- ✓ to create new sites for recreational fishing and diving
- ✓ to carry out research

## TURKEY

**UNTIL 1999: NO SPECIFIC REGULATION**

2001: REGULATION

↓

**Project Guide for AR Application**


↓

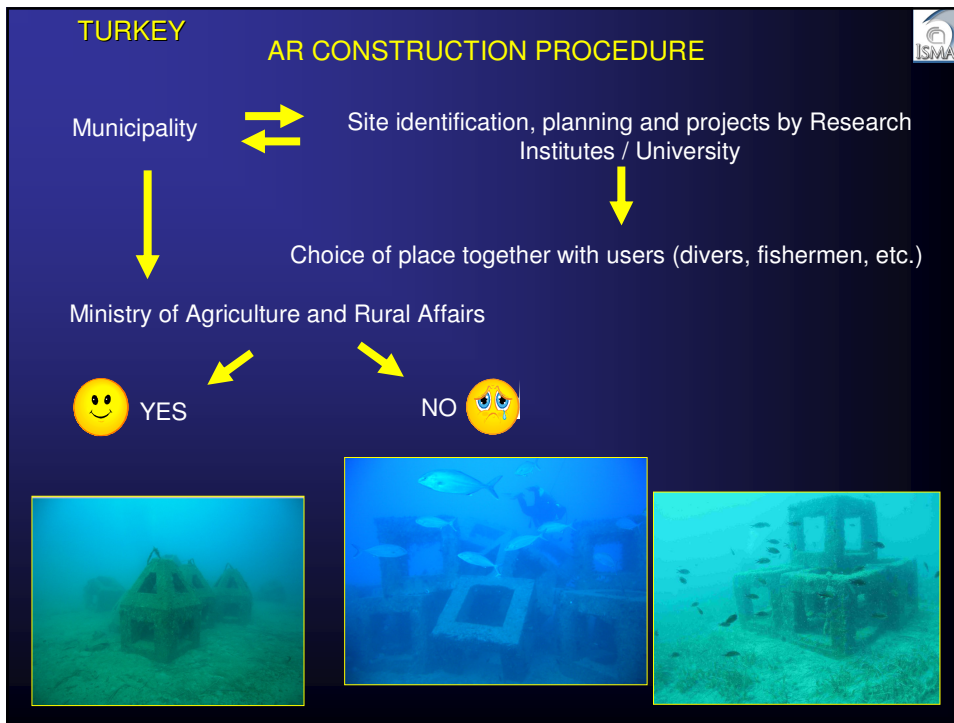
- Description
- Procedures
- Objectives
- Site selection criteria
- Construction materials
- Design

2009: NATIONAL PROGRAM

↓

- ✓ to support small-scale fisheries
- ✓ to protect marine biodiversity





**TURKEY AR CONSTRUCTION UNTIL 2009**

**17 ARs deployed**

**Depth range:** 14-21 m and 30-31 m


**Materials:** 2,210 concrete blocks  
10 bus  
3 steel vessels  
1 wooden vessel  
2 aircrafts

4 ARs planned and semi-deployed

4 ARs planned

**MUNICIPALITIES**

**TURKEY** AR NATIONAL PROGRAM started in 2009

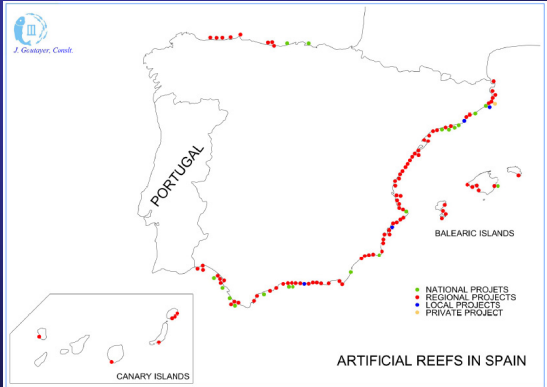


10 new investigated sites  
 ↓  
 8 selected sites  
 ↓  
 1 year of preliminary study at each site (2010) → biological, engineering, social-economic, fisheries  
 ↓  
 Construction will start in 2011

**AR NATIONAL PROGRAM has not deadline**  
 It will be carried out on the basis of MONEY availability  
 100% Government

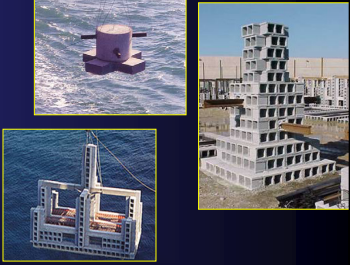
OTHER ARs can be constructed on behalf of MUNICIPALITIES out of the NATIONAL PROGRAM

**SPAIN**



Leading exponent of the deployment and use of ARs in EUROPE

MORE THAN 103 ARs



- ✓ to protect and enhance fish stocks
- ✓ to impede illegal trawling
- ✓ to protect sensitive ecosystems and natural habitats important for fisheries
- ✓ to reduce conflicts between different commercial fisheries



## SPAIN



1982 → First legal and policy regulation → no public funds



1986 → Entry into the European Community



Interest in ARs increased



1987 → Promotion of a policy of deploying ARs



EC



National & Regional Spanish budgets

## SPAIN




### Currently

#### NATIONAL AR PROGRAM

and

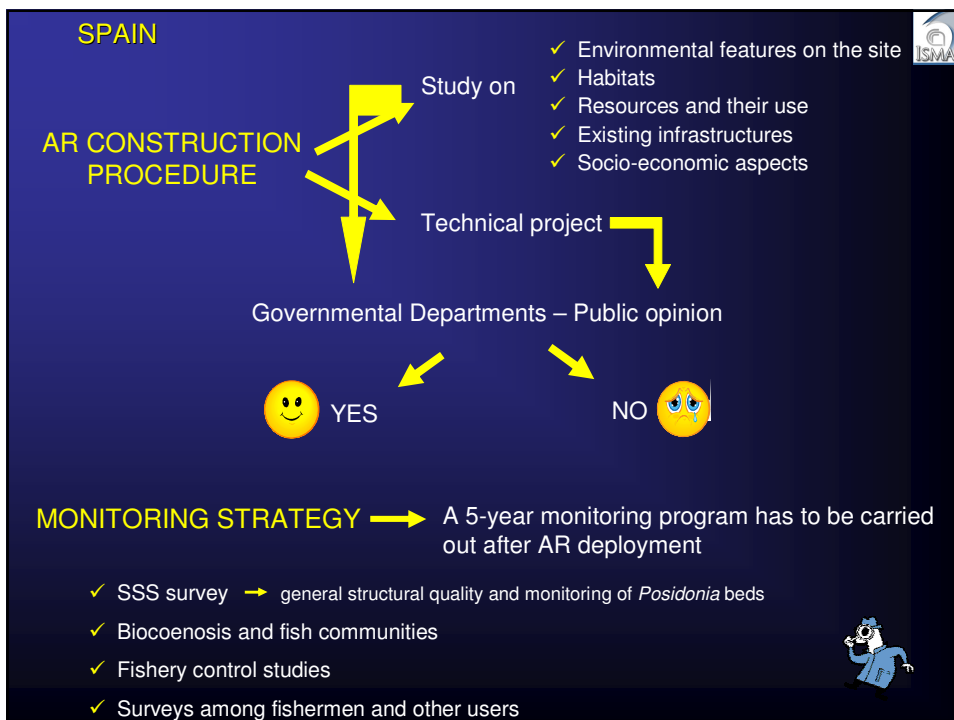
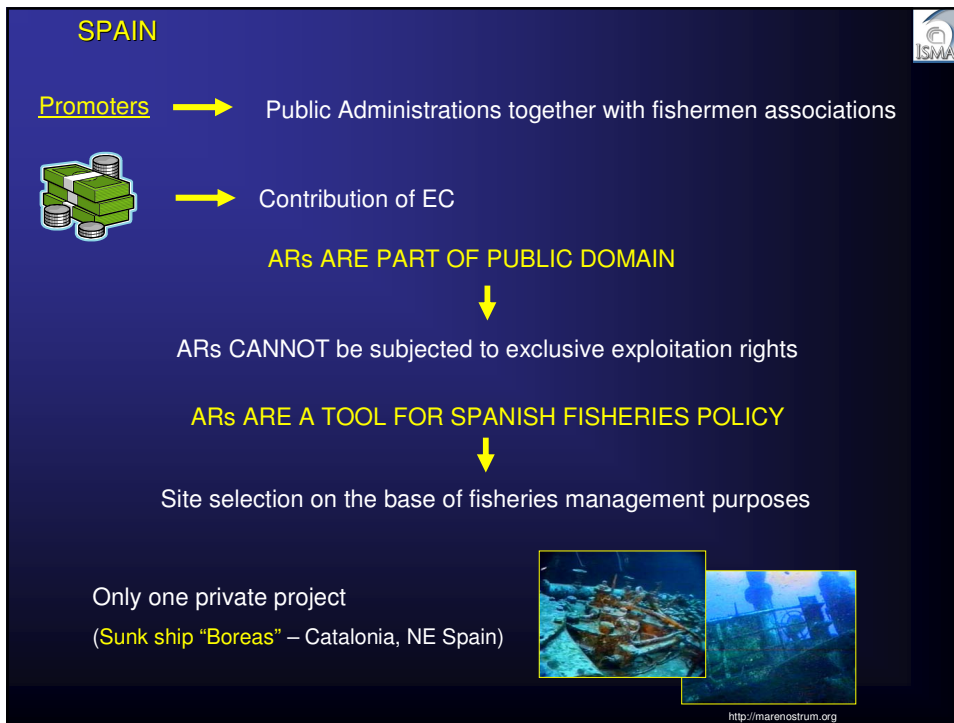
#### REGIONAL AR PROGRAMS

#### Placement regulated by

- ✓ 1995 → Royal Decree 798/1995 
- ✓ 2008 → "Methodological Guidelines for AR Placement"  
(Spanish Ministry of Environment and Rural and Maritime Affairs)



- ✓ Analysis of different categories of ARs
- ✓ Effects on environment
- ✓ Establishment of methodology for the installation
- ✓ Administrative procedures
- ✓ Advices on the post placement monitoring program



SPAIN



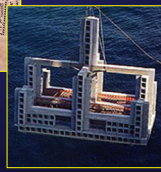
TYPES OF ARs

Protection ARs

- ✓ Protect fisheries resources
- ✓ Reduce conflicts between users
- ✓ Protect ecosystems and natural habitats important for fisheries
- ✓ Protect human infrastructures



Protection units



Production units



Mixed units

Production ARs

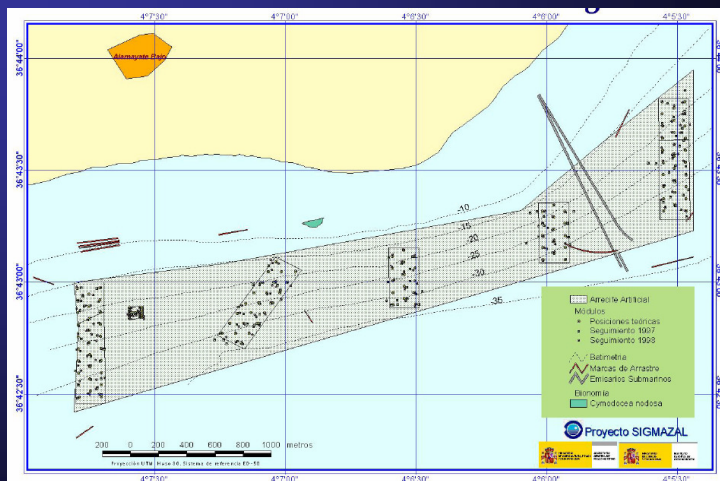
- ✓ To increase fish stocks and exploitable biomass by providing shelter and food
- ✓ To attract marine organisms and spatially redistribute the fish populations

SPAIN



The PUNTA VÉLEZ AR (Malaga)

from: Revenga S. 2007

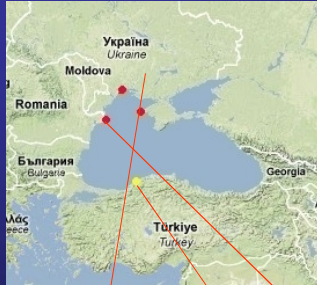


**Deployment:** 1997

**Dimensions:** 360 ha

**Type:** 125 mixed modules, 111 protection modules, and 14 production modules

## BLACK SEA



- ✓ Ukraine
- ✓ Romania
- ✓ Turkey



## BLACK SEA

- ✓ Nearly 87% of the Black Sea is anoxic with high levels of hydrogen sulphide due to past geological events.
- ✓ Deep pelagic and benthic organisms are largely absent.
- ✓ The wide diversity of biotopes provides for favourable conditions for invasion of alien species.
- ✓ Many alien species have been introduced by aquaculture.
- ✓ Composition and structure of marine communities is constantly changing.
- ✓ Increasing salinity due to inappropriate water management and pollution represents a risk for endemic species.
- ✓ Due to overfishing the anchovy stock has collapsed and most valuable species disappeared. No overall management of fish stocks is in place.



ARs



- ✓ Habitat restoration through bio-filtration
- ✓ Improving marine life

## BLACK SEA



The construction of ARs began in the 1970s

ROMANIA (1 AR)

UKRAINE (2 ARs)

TURKEY (1 AR)



Habitat restoration (biofiltration)  
Improving local fish biomass



## ROMANIA



COASTAL PROTECTION PLAN FOR SOUTHERN COSTAL UNIT

Completed in 2007; time horizon 2020



Installation of new coastal protection infrastructures such as groins, breakwaters, beach nourishments and **ARs**

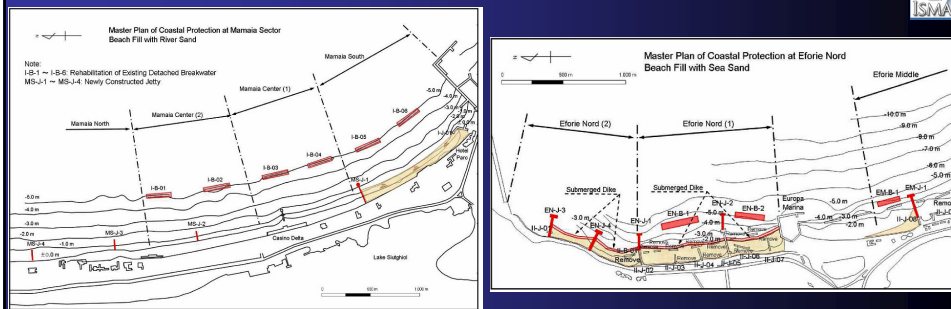


Total amount of the Plan: 249 million Euros (82% EU funding under the Operational Programme 2007-2013)

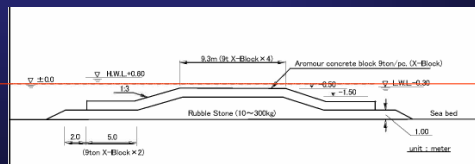
65 million Euros for ARs



## ROMANIA



Sea surface



Cross section of submerged breakwater (AR)

Installed offshore for wave attenuation but also planned to develop marine fauna and attracting fish



# CONCLUSIONS

ARs and AHs in Mediterranean have been developed over 40 years with different aims:

- ✓ nature conservation and restoration
- ✓ fish stock enhancement
- ✓ fishery management and improvement
- ✓ aquaculture
- ✓ research
- ✓ recreation

The artificial reef process is still going on



- ✓ **Research** has strongly contributed to the AR success providing a basis of information and experience useful for a better understanding of the many challenges offered by ARs for the conservation and sustainable use of the marine environment and exploitable resources.



- ✓ Several **guidelines** aimed to assist States in AR construction and avoid dumping in the European seas have been developed. Although not binding, they have been acknowledged by several States.
- ✓ These guidelines give an **unambiguous definition of AR** and provide for **common protocols** for the AR deployment and the assessment of their effectiveness and impacts.

- ✓ In spite of the recent developments, National and/or Regional programmes for AR deployment are **only** in force in most of countries overlooking the Mediterranean Sea, while **only few** of these programmes have been developed in the other European Regions (Portugal and Spain) up to now.
- ✓ The **adoption of overall regional/national programmes** would be strongly recommended in the view of overall plans based on a holistic approach to fisheries and nature conservation within the coastal zone.
- ✓ At the same time, **research and cooperation** among researchers **should continue** to fully understand how the ARs work and how they can be manipulated to get desired biological and socio-economic products.
- ✓ In fact, **the key of acceptance of AR concept** still depends on research and dissemination of knowledge among the managers of the marine environment and users.

ITALY

WEB SITE – [www.habitatartificiali.it](http://www.habitatartificiali.it)



## 10th International Conference on Artificial Reefs and Related Habitats



The 10th CARAH will take place in Izmir organized by Ege university, and will be held in Izmir's popular seaside Village Çesme.




## ARs in the framework of the GFCM

During the general discussions preceding the review of the 2010 work plan as proposed by the Sub-Committees, the SAC highlighted the need to enhance the knowledge on the artificial reefs, which are being considered by some Mediterranean countries within the framework of their management plans.




## TRANSVERSAL WORKSHOP ON ARTIFICIAL HABITATS IN THE MEDITERRANEAN SEA


- ✓ Report of the 9th Coordination Meeting of the Sub-Committees (CMSC)
- ✓ Report of the 12th Session of the Scientific Advisory Committee (SAC)




**Special thanks to**




Jaun Jesús COUTAYER GARCIA  
SPAIN




Nicola LINGARO  
ITALY



Altan LÖK  
Turkey



ARGYRIS KALLIANIOTIS  
GREECE



Denise BELLAN-SANTINI  
FRANCE