



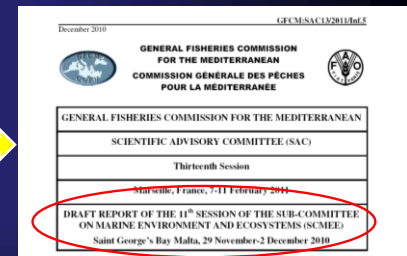
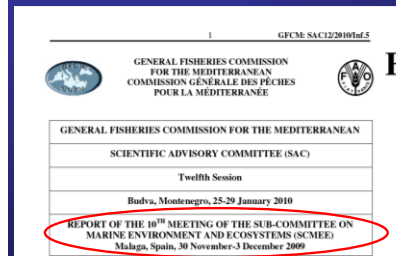
GENERAL FISHERIES COMMISSION
FOR THE MEDITERRANEAN
COMMISSION GÉNÉRALE DES PÊCHES
POUR LA MÉDITERRANÉE



PRACTICAL GUIDELINES FOR ARTIFICIAL REEFS IN THE MEDITERRANEAN AND BLACK SEA



ARTIFICIAL REEFS IN THE FRAMEWORK OF FAO - GFCM



- To carry out a review of the literature on ARs to assess their effects on fisheries and ecosystems
- to identify the possible technical and economical conditions to improve their effectiveness
- to ask the SAC to give guidance on the follow-up to be given to this activity

Recommendations on status of ARs




Organization of a transversal workshop on ARs in the Mediterranean and Black Sea in 2012




ARTIFICIAL REEFS IN THE FRAMEWORK OF FAO - GFCM

Workshop on Artificial Reefs in the Mediterranean and the Black Sea
Rome, 24-01-2012


 GFCM - General Fisheries Commission for the Mediterranean
 SAC - Scientific Advisory Committee
 SCHEE

ToRs

- ✓ General information on Artificial Reefs (ARs) in the GFCM area
- ✓ Evidences of increased productivity and/or gathering of biomass in ARs of the Mediterranean and Black Sea
- ✓ Monitoring strategies and statistical approaches to study ARs in the Mediterranean and Black Sea


Recommendations

- ✓ To encourage the exchange of information and cooperation among scientists through the development of a common database for ARs in the Mediterranean Sea and Black Sea.
- ✓ To standardize and update monitoring procedures and statistical approach to assess effectiveness of ARs. Monitoring should also be addressed to better identify/evaluate the dimensions and scale of ARs which would be necessary in order to get appreciable benefits.
- ✓ **To draft updated guidelines for ARs monitoring in the Mediterranean and Black Sea.**
- ✓ To promote application of new methodologies (otolith readings, studies on food chains, microchemistry, stable isotope analysis, etc.) to get evidences of positive effects of ARs and to assess import/export of energy to/from ARs, as well as to encourage studies aimed at collecting proofs of positive/adverse effects on fisheries activities (e.g. CPUE, conflicts, spatial effect on effort, etc.).

ARTIFICIAL REEFS IN THE FRAMEWORK OF FAO - GFCM


IOPARAH
 The 10th International Conference on
 Artificial Reefs and Related Aquatic Habitats
 23-27th
 SEPTEMBER 2013
 Izmir







GFCM Workshop on Artificial Reefs in the Mediterranean and the Black Sea
(in collaboration with FAO EASTMED Project)

Izmir, 27-09-2013

ARTIFICIAL REEFS IN THE FRAMEWORK OF FAO - GFCM

GFCM Workshop on Artificial Reefs in the Mediterranean and the Black Sea

27 participants from 8 Mediterranean and from 3 extra-Mediterranean countries

GENERAL FISHERIES COMMISSION
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Scientific Advisory Committee (SAC)

Subcommittee on Marine Environment and Ecosystems (SMEE)

Draft report of the GFCM Workshop on Artificial Reefs in the Mediterranean and Black Sea

Istanbul, Turkey, 27 September 2013

- ✓ Session 1
Posters/presentations dealing with scientific/practical experiences of Artificial Reefs within Mediterranean and Black seas with the objectives of conservation and sustainable use of the marine environment and living resources.
- ✓ Session 2
Roundtable discussion on the draft guidelines for Artificial Reefs applications in the context of an integrated maritime approach in the Mediterranean and Black sea



Draft guidelines for Artificial Reefs

Objectives

- to update the information reported in the previously prepared guidelines;
- to assist the countries in the planning and deployment of artificial reefs on the basis of scientific criteria;
- to avoid pollution or degradation of the aquatic ecosystem due to the deployment of unsuitable materials as well as dumping of waste;
- to prevent negative impacts due to the deployment of artificial reefs;
- to provide information on the different scopes and types of artificial reefs, as well as on their potential effects;
- to provide technical information on the deployment, monitoring, on-going management and socio-economic effects of artificial reefs.

GENERAL FISHERIES COMMISSION
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POUR LA MÉDITERRANÉE

Scientific Advisory Committee (SAC)

1st Session of the Sub-Committee on Marine Environment and Ecosystems

Ros, Montenegro, 4-5 February 2014

PRACTICAL GUIDELINES FOR ARTIFICIAL REEFS IN THE MEDITERRANEAN AND BLACK SEA

Final Draft



Draft guidelines for Artificial Reefs









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Draft guidelines for Artificial Reefs





DEFINITION OF ARTIFICIAL REEFS

An artificial reef is a submerged (or partly exposed to tides) 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. This includes the protection and regeneration of habitats. It will serve as habitat that functions as part of the natural ecosystem while doing "no harm".

The term excludes artificial islands, cables, pipelines, platforms, mooring, and structures for coastal defence (e.g. breakwaters, dikes, etc.) which are primarily constructed for other purposes, as well as the Fish Aggregation Devices (FADs) employed to merely attract fish in certain fishing areas.



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

London Convention and Protocol / UNEP Guidelines for the placement of Artificial Reefs (2009)

OSPAR Commission - Assessment of construction or placement of artificial reefs (2009)

Guidelines and management practices for artificial reef siting, use, construction, and anchoring in Southeast Florida (Lindberg and Seaman, 2011)





Draft guidelines for Artificial Reefs



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GFCM Glossary: Man made structure intentionally immersed in an aquatic environment to increase or gather biomass or enhance protection of natural habitats.

FAO Glossary: Materials placed on the sea floor that serve as habitat for marine organisms



Draft guidelines for Artificial Reefs



OBJECTIVES OF ARTIFICIAL REEFS

- *protecting sensitive habitats from fishing activities;*
- *restoring depleted habitats;*
- *mitigating habitat loss;*
- *enhancing biodiversity;*
- *improving populations of aquatic organisms by providing shelter for juvenile and mature individuals as well as for adults during delicate life stages (e.g., moulting season for crustaceans);*
- *providing new substrates for algae and mollusc culture;*
- *enhancing professional and recreational fisheries;*
- *creating suitable areas for diving;*
- *providing a mean to manage coastal activities and reduce conflicts;*
- *research and educational activities;*
- *creating potential networks of Marine Protected Areas to manage the life cycles of fish and connectivity.*





Draft guidelines for Artificial Reefs

TERMINOLOGY

Use of a standard terminology regarding the different components of an artificial reef helps artificial reef developers to avoid confusion.

A hierarchy, based on that used for Japanese reefs (Grove et al., 1991), has been adopted :

- ✓ *Reef unit or module*: the smallest element constituting an artificial reef; the modules can be placed singly on the seabed or assembled.
- ✓ *Reef set*: structure formed by the assemblage of reef units.
- ✓ *Reef group*: area constituted by more modules and/or reef sets.
- ✓ *Reef complex*: formed by more than one reef group.

The diagram illustrates the hierarchy of artificial reef components. It shows a 'COMPLEX' containing several 'GROUP's. Each 'GROUP' is composed of multiple 'SET's. Each 'SET' is composed of multiple 'UNIT's. The diagram uses dashed lines to group these elements into their respective levels of hierarchy.


Draft guidelines for Artificial Reefs

INTERNATIONAL LEGISLATION FOR ARTIFICIAL REEF DEPLOYMENT

- London Convention
- Mediterranean Action Plan and Barcelona Convention
- Bucharest Convention

The map shows the Mediterranean Sea region, including parts of Europe, North Africa, and the Middle East. A large, semi-transparent blue circle is overlaid on the map, centered on the Mediterranean Sea, indicating the geographical focus of the international legislation listed.



Draft guidelines for Artificial Reefs

PLANNING OF ARTIFICIAL REEFS

<p>PRE-CONSTRUCTION PHASE</p>	<ul style="list-style-type: none"> ➤ Identification of broader goal/s for the AR construction ➤ Is the concept of the AR realistic? ➤ How will the new reef and natural ecosystem interact? ➤ Evaluation of the local social and economic situation ➤ Involvement of the potential users of the AR to consider their opinions on the project ➤ Identification of specific objectives ➡ to calculate the investments and the expected ecological and socio-economic returns ➤ Identification of the AR site and design ➤ Submission of the AR plan for permission to the responsible national and/or local authorities
<p>CONSTRUCTION PHASE</p>	<p>All activities concerning the construction of the AR structures and their deployment at sea (e.g., identification of the construction area)</p>
<p>POST-CONSTRUCTION PHASE</p>	<ul style="list-style-type: none"> ➤ To identify management options to optimize the AR benefits ➤ To determine the effectiveness of the AR through a scientifically valid monitoring program



Draft guidelines for Artificial Reefs

SITING, DESIGN AND CONSTRUCTION OF ARTIFICIAL REEFS

General information on:

<p>Selection of the site for AR deployment</p>	<p>Environmental and socio-economic aspects to be taken into consideration in selecting a site for artificial reef construction</p>
<p>Materials</p>	<p>Inert to avoid pollution and bioaccumulation Resistant to the chemical and physical forces in the marine waters Durable on time Suitable for colonization by benthic communities</p>
<p>Types of AR structures</p>	<p>To take into account both the engineering aspects and the scope of the AR when planning the reef units and/or the reef sets</p>
<p>AR dimensions</p>	<p>Surface area, total volume of material, and bottom coverage depending on AR purposes</p>
<p>Placement of ARs</p>	<p>The disposal of reef units and/or reef sets inside an AR needs to be planned on the basis of a range of criteria depending on the purposes of the AR</p>
<p>Time of deployment</p>	<p>Time of development and structure of the benthic community favouring the settlement of some organisms rather than others</p>



Draft guidelines for Artificial Reefs

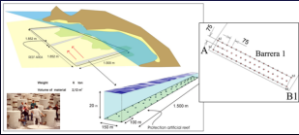
FUNCTION-SPECIFIC CRITERIA

Detailed information on the criteria to be used in the construction of artificial reefs relative to their purpose

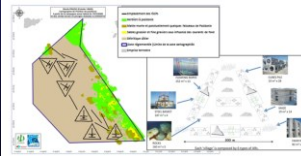
Five AR categories

- protection artificial reefs
- production artificial reefs
- recreational artificial reefs
- restoration artificial reefs
- multi-purpose artificial reefs

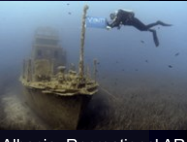
Objectives, design and material, siting and some examples of practical applications are given for each category



Spain: Protection AR



France: Production AR



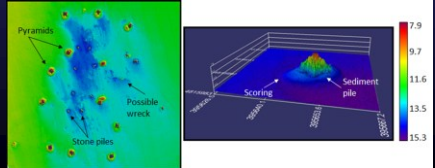
Albania: Recreational AR

Draft guidelines for Artificial Reefs

POSSIBLE NEGATIVE IMPACTS

A list of possible environmental and socio-economic impacts at short, medium and long term is provided with possible mitigation actions

Impact	Source	Effect	Duration of the effect	How to limit and possible impact
Increase of contaminants into the sediments	Work vessels and equipment during the reef installation	Degradation of the marine environment; Possible accumulation of contaminants into the food chains	Short-medium	Shortening as much as possible the duration of deployment operations
Increase of contaminants in the marine environment	Reef materials	Degradation of the marine environment; Possible accumulation of contaminants into the food chains	Long	Adequate choice of reef materials; adequate cleaning up of structures of opportunity (vessels, aircrafts, etc.)
Increase of turbidity	Sediment movement during the reef installation	Alteration of photosynthesis of algae, seagrasses and corals	Short	Adopting deployment techniques that limit sediment movement
Modification of bottom currents	Presence of the reef	Modification of sediment distribution; scouring and subsidence of the reef structures; modification of sensitive habitats in the reef surroundings	Long	Accurate study on currents and sediments at the proposed reef site
Increase of organic content into the sediments	Presence of the reef	Modification of sensitive habitats in the reef surroundings	Long	Accurate studies on water circulation at the proposed reef site



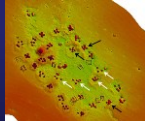


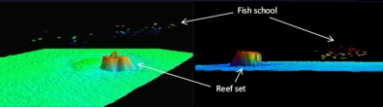


Draft guidelines for Artificial Reefs

METHODOLOGIES TO ASSESS EFFECTIVENESS AND IMPACTS OF ARs AND STANDARDIZED MONITORING PROCEDURES

A performance monitoring plan should be developed since the first steps of the planning process of an AR. This plan should focus on parameters that define the success of the AR, basing on the reef objectives, and must forecast collection of data before and after the reef deployment, both at the reef site and on adjacent natural habitats

- ✓ Monitoring the physical performance of ARs
- ✓ Benthic communities settled on AR substrates and in the surrounding soft-bottoms
- ✓ Fish assemblage

Draft guidelines for Artificial Reefs

METHODOLOGIES TO ASSESS EFFECTIVENESS AND IMPACTS OF ARs AND STANDARDIZED MONITORING PROCEDURES

- ✓ Statistical framework
 - ✓ BACI/ACI and Beyond BACI designs;
 - ✓ ANOVA, MANOVA (PERMANOVA) with uni- or multifactorial designs;
 - ✓ non parametric methods (e.g., Kolmogorov-Smirnov test, Mann-Whitney U test, Kruskal-Wallis test, Wilcoxon matched pairs test, etc.);
 - ✓ time series analyses





Draft guidelines for Artificial Reefs

SOCIO-ECONOMIC EFFECTS OF ARTIFICIAL REEFS

Independently from the purpose of an AR, its performance and efficacy is judged on the basis of the public satisfaction

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STAKEHOLDER ANALYSIS	To either identify the most relevant stakeholder groups and to understand their position towards the reef project. It also helps to identify incompatible uses of the ARs and potential sources of conflicts
SOCIO-ECONOMIC ASSESSMENT	It is useful to quantify the usage and public benefits of an AR helping to justify costs for the construction, maintenance and providing information for a successful management of the reef

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To support managers to evaluate the importance of each group in the development of the AR project and, once the reef has been constructed, to plan adequate management measures to avoid or reduce conflicts.

Draft guidelines for Artificial Reefs

ARTIFICIAL REEF MANAGEMENT: CONTROL, SURVEILLANCE AND MANTAINANCE

ARs may require some degree of management either to assure that they provide the desired outcomes for both the biological resources and users

This chapter proposes possible management strategies for the five different types of ARs considered

<ul style="list-style-type: none"> ✓ PROTECTION ARs ✓ RESTORATION ARs ✓ PRODUCTION, RECREATIONAL, and MULTIPURPOSE ARs 	<ul style="list-style-type: none"> ✓ No need of any control or management measures ✓ Need of regular monitoring to verify their structural performance ✓ Access should be totally forbidden to any kind of activity except for research ✓ Need of site-specific management plans which regulate their exploitation ✓ To avoid overexploitation and the AR resources and conflicts within and between user groups
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THANK YOU FOR YOUR
ATTENTION

