Summary
for decision makers

Ecological restoration

of fish nurseries in shallow coastal areas of the Mediterranean basin

Current status of knowledge

" Biodiversity is a societal issue "

For many years, multiple efforts have been made to improve water quality and reduce pollution in shallow coastal areas of the Mediterranean. At the same time, European conservation regulations – as well as those of individual Mediterranean nations – have evolved and ecosystems are now considered in their entirety. Societal expectations have also evolved: nowadays, acceptable water quality for human seaside activities is not enough; there is a requirement for rich, healthy and waste-free ecosystems.

Despite all these conservation efforts, human coastal activities and population pressure are always increasing, with dire consequences for the coastal region and the shallow coastal areas. Therefore, action needs to be taken with the utmost urgency, especially as scientific knowledge and current conditions favor the development of ecologic restoration projects.

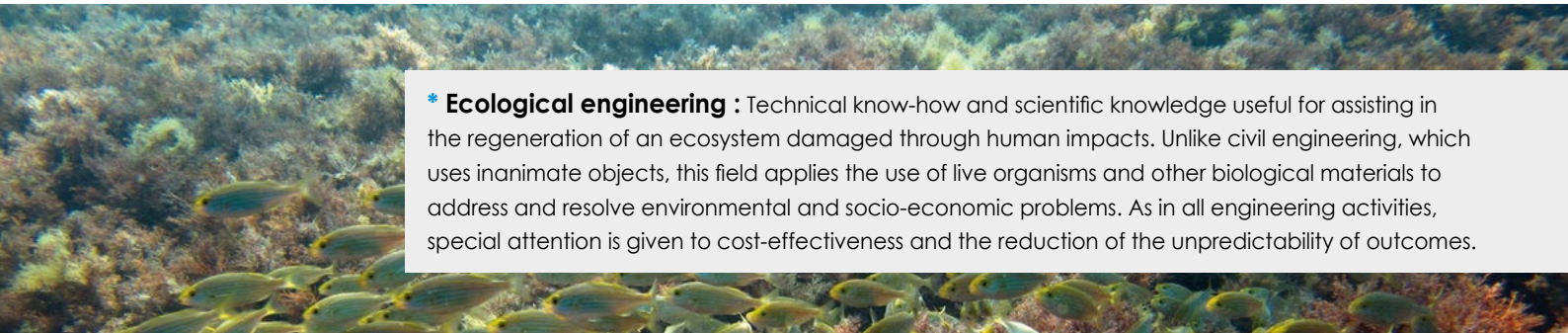
What is marine ecological restoration ?

" An action undertaken with respect to marine habitats, and their fauna and flora, which will improve their condition within coastal zones where the quality of water is good and where the pressures that are the cause of degradation have disappeared or have been controlled "

Ecological restoration is not only possible but also advisable in highly human-impacted areas. It is an additional tool to support the marine environment, to complement and reinforce protection and conservation tools.

The aim of ecological restoration has to be consistent with the ecological reality: to completely restore the original ecosystem – to its pristine state before degradation – is technically impossible in most cases. Nowadays, ecological restoration is used to improve or return to a satisfactory ecological state by enhancing or reinstating essential functions of the ecosystem, while supporting associated economic activities.

In order to do that, innovative technical solutions derived from recent advances in ecological engineering* are very useful. Depending on the ecological status obtained through restoration, a certain level of management may be necessary for a limited period to maintain the proper functioning of the ecosystem.



* **Ecological engineering :** Technical know-how and scientific knowledge useful for assisting in the regeneration of an ecosystem damaged through human impacts. Unlike civil engineering, which uses inanimate objects, this field applies the use of live organisms and other biological materials to address and resolve environmental and socio-economic problems. As in all engineering activities, special attention is given to cost-effectiveness and the reduction of the unpredictability of outcomes.

What is ecological restoration ?

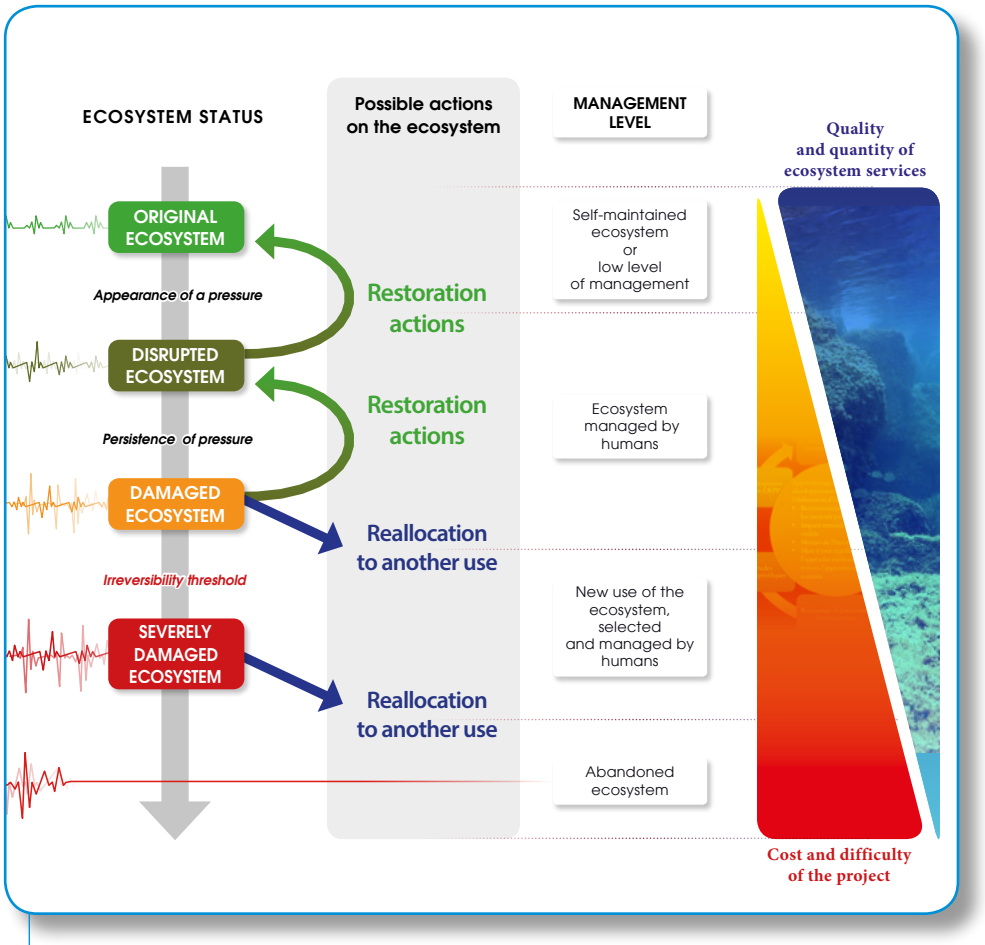
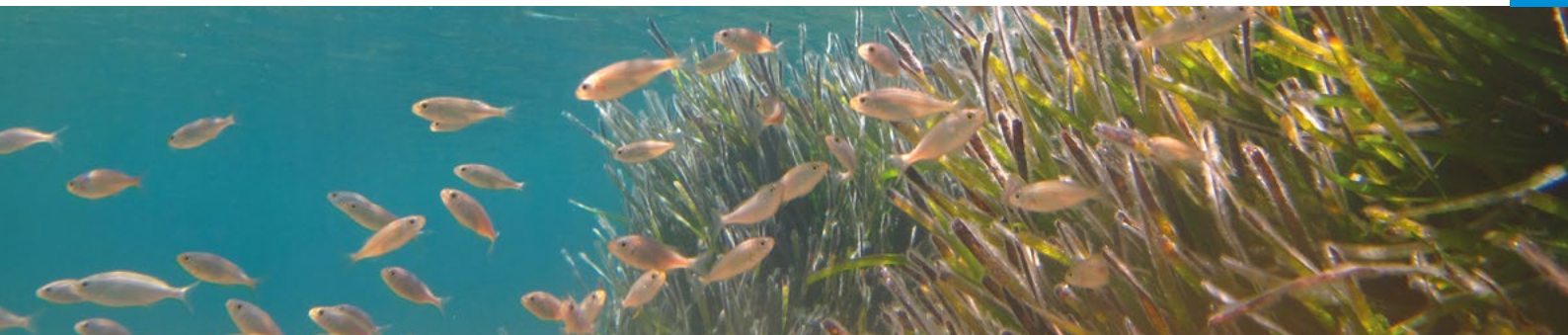


Figure 1 - the different possible human actions depending to the degradation status of the ecosystem. The need for management depends on the status of the restored ecosystem.

Please do not confuse restoration and mitigation !

These are two distinct actions: restoration is used to improve ecosystem status, by reinstating some functions once pressures are under control, at the same location where degradation occurred. Mitigation is used to offset current or future degradation through a positive action on the concerned environment or in another location. Mitigation accepts or at least implies that the environment in question is to be degraded. However, its main principle is that, whenever possible, it is better to not degrade in order to not have to restore aquatic ecosystems.



Ecological restoration project

Prerequisite

Active and operational policy roll-out has 5 key requirements:

- **Availability of proven technology** that address a particular problem
- **Monitoring** to enable comprehensive evaluation of the restoration project
- **Financial resources** to implement all aspects of the project
- **Administrative and regulatory authorizations** to apply these solutions
- And, finally and most importantly, **a commitment to restore degraded environments**

Special features

Although implementation of an ecological project is similar to any other project (thorough specifications, realistic schedule, well-organized human and technical resources etc.), there are nevertheless some particularities to take into account and to define carefully before starting the project. The final choice of actions to apply depends on a consensus between ecological, socio-economic, technical and financial parameters.

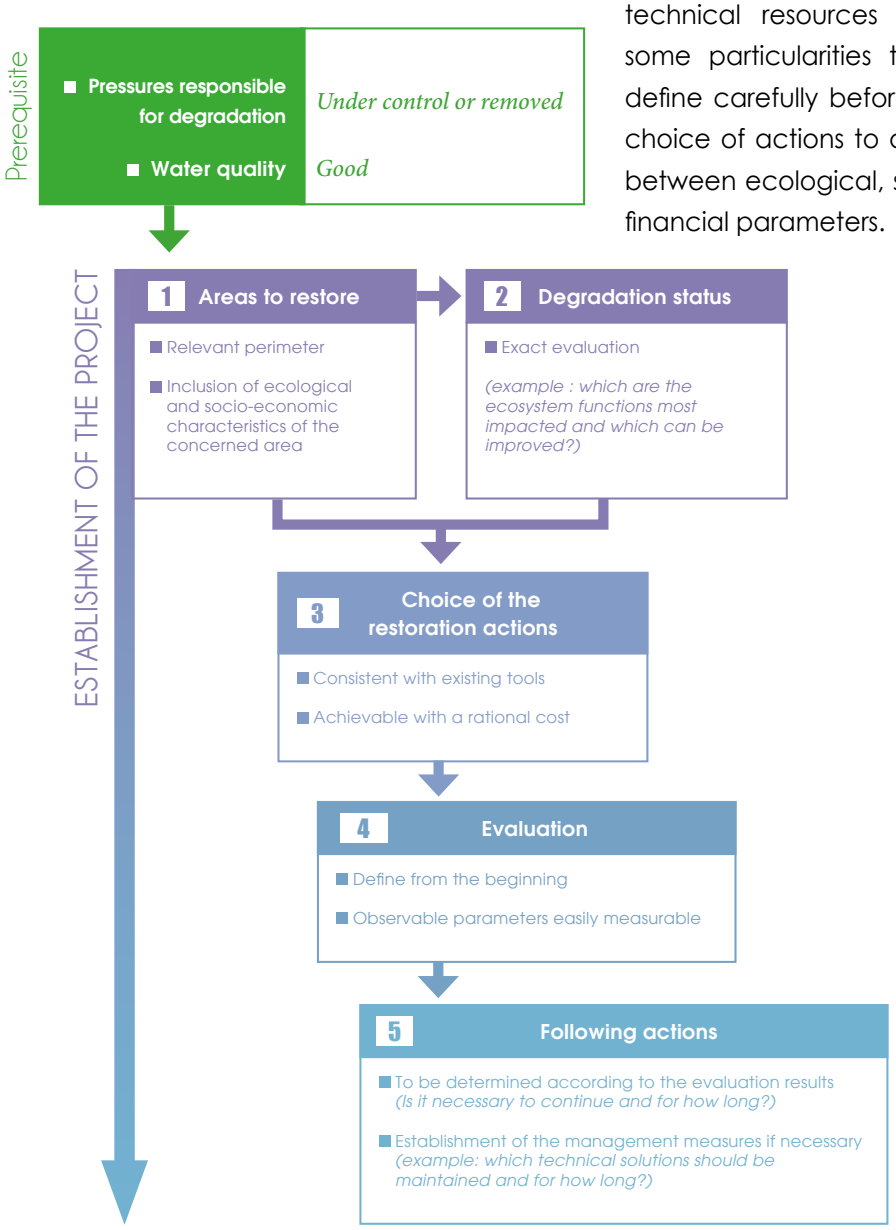


Figure 2 - the main steps for the organization of an ecological restoration project.

Understanding coastal ecosystems in order to take appropriate action.

Life-cycle of coastal fish

The life cycle of coastal fish is composed of different stages with their own characteristics. Each stage has a natural mortality rate, increased by human activities (direct or not). So, for one million eggs, only one fish will eventually become a reproductive adult. Primary life stages (a, b and c) are the most critical and the less well-known phases. Nowadays, technical limitations enable ecological restoration only from phase c – post-larval recruitment (see figure 3).

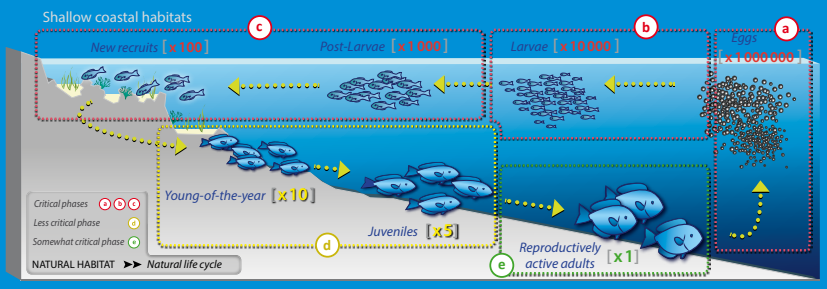
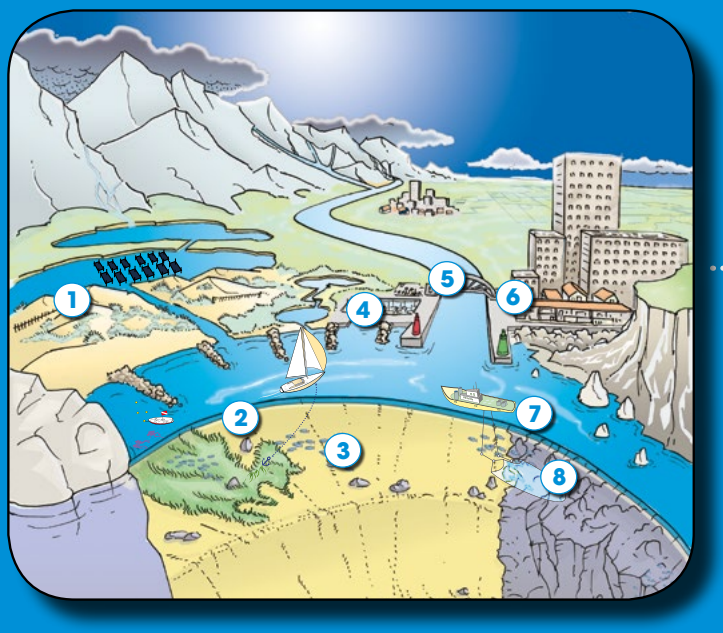


Figure 3 - the life-cycle of coastal fish

Shallow coastal areas

Shallow coastal areas extend from 0 to 20 meters in depth and have a multitude of habitats including seagrass meadows, sandy and rocky areas and artificial habitats (like seawalls or port infrastructure). Thanks to this diversity, a lot of marine species at different stages of development (from new recruits to adults) take shelter in these habitats. Some habitats have a crucial importance for the development of young fish (post-larvae and juveniles) and are call "nurseries". They present specific characteristics such as providing adapted food to the needs of fish and protecting them from predators. Coastal nurseries potentially include all coastal habitats, depending on the species and the time of year.



Ecosystem services

Ecosystems, by their different functions, provide multiple high-value goods and services to humankind. These are named ecosystem services. The quantity and quality of goods and services are in inverse proportion to the degradation status of these ecosystems (see figure 1). Examples of certain services and their potential benefits are listed below.

Ecosystem Services	Examples	Potential benefits
Provisioning services	***Food provisioning*** *(fish, shellfish)*	***Protein, preservation of economic activities***
Regulation services	***Protection*** *from erosion, storm damage…*	***Protections of people and goods***
Socio-cultural services	***Stand*** *for tourism, recreational activities and sport (diving, sailing)*	***Well-being***
	Development of knowledge *(interpretation centres, school visits)*	***Sensibilisation***

Anthropogenic pressures on shallow coastal areas

1. Non indigenous species
   Aquaculture
2. Anchorage zone
   Macro-waste
   Swimming area
3. Sound pollution
   Materials extraction
   Cleaning out/oil slick
4. Port / Marina
5. Polluted input from rivers
   Diffuse input of nutrients
   and chemical contaminants from catchment basin by flow
6. Urbanization
   Polderization
7. Disposal of waste water and industrial waste
   Dragging / port cleaning
8. Professional and recreational fishing
   Anchorage zone
   Trawler fishing

Conclusions

The shallow coastal areas are thus indispensable at a number of different levels:

Ecological
They are essential to the life-cycle of fish and to maintain aquatic biodiversity and halieutic stock.

Socio-economic *(ecosystem services)*
Human activities are very dense in shallow coastal regions, both for socio-economic and leisure needs.

These are areas of high ecological value and need protection through regulation (and enforcement), relevant conservation activities and, if necessary, ecological restoration.

This document is based on

Lenfant et al., 2015. Ecological restoration of fish nurseries in shallow coastal area of the Mediterranean basin. Guidelines and Principles. 93p.

All relevant documents are available in French and English language on our website: **www.nappex.fr**