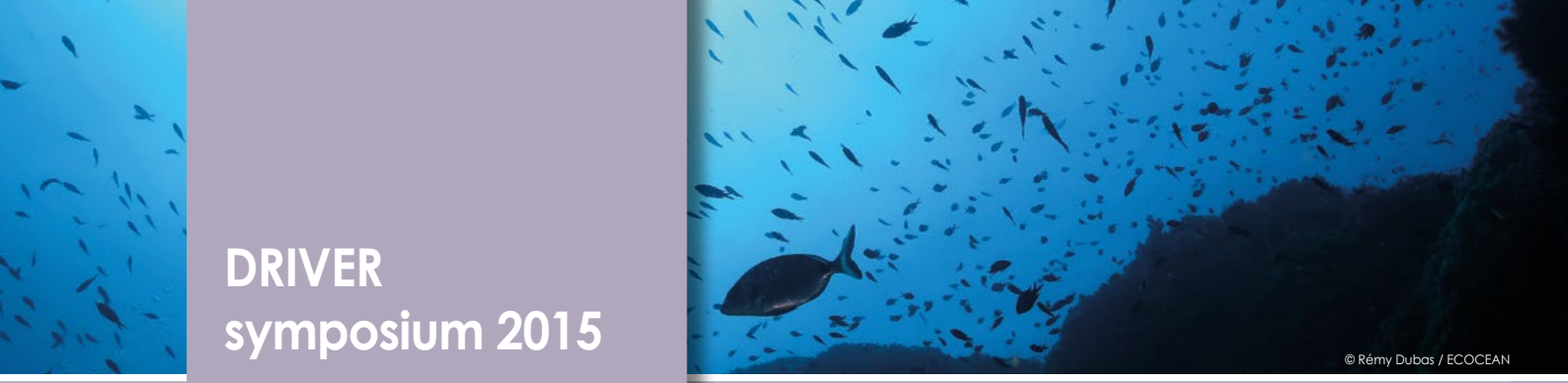
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DRIVER symposium 2015

Ecological restoration of Mediterranean shallow coastal waters

Written by :
Anaïs GUDEFIN / Ecocean
Philippe LENFANT / CREM-CEFREM
Pierre BOISSERY / AERMC

This conference took place from April 27th to 29th, 2015, on Embiez Island (French Mediterranean coast). Organized by the Centre of Research on Marine Ecosystems of the University of Perpignan and its partners, it brought together some 130 people from different backgrounds (scientists, companies, managers, state services, financers...) with the common goal of improving the state of the Mediterranean shallow coastal waters.

Highlights

Sessions 1 & 2 : Nurseries, post-larvae and juvenile fish

- Shallow coastal waters (0 to 20m) play a **key role in the survival of post-larval and juvenile fish.**
- Current management measures do not sufficiently take into account nursery areas: many **coastal marine nurseries are located outside MPAs.**
- Studies of post-larvae and juveniles should no longer focus on a single habitat but **must include all habitats of a zone**, including the interface areas.

Session 3 : From ecology to ecosystem services

- It is still difficult to link the environment and the economy, especially as many fear potential drifts in turning the protection of biodiversity into a business. However, ecosystem services can help make that connection by developing multidisciplinary approaches.
- Faced with biodiversity erosion and increasing pressures, **many actors**, whether scientists, mangers or funders, **commit themselves** to develop restoration actions.

Session 4 : Example of restoration and ecological engineering

- Technical solutions exist in ecological restoration with **encouraging efficiency**;
- **R&D efforts must be maintained** to develop and validate other tools, as well as standardize protocols, etc.;
- **To not degrade remains the priority**. Indeed, the later action is taken, the harder and the more expensive it is to implement ecological restoration.


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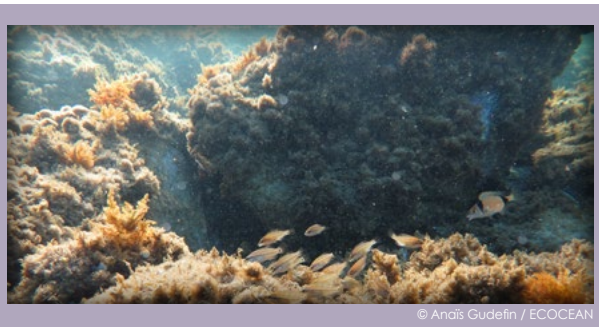
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Conclusions and perspectives

Although shallow coastal waters are not assigned as much importance as other marine areas, they are however **essential to young life stages** and consequently, to the **renewal of natural marine populations.** Considering the many pressures and human impacts taking place along our shores, a question arises: should we restore the impacted areas?

Today solutions exist, but it is **essential to support their development** by **strengthening the commitment of scientists** validating them, helping funding innovative projects, incorporating eco-design and developing the coastal ecological engineering sector. Port managers, community councilors, etc., also have a role to play. **Good communication between the different stakeholders is essential so that the solutions get known by those needing them**, whether they are scientifically validated or still under development. However, to be able to take action, it is also necessary that regulations evolve to better support initiatives (from whatever sources) and make restoration actions possible. **We all have a responsibility and a role to play**, but for this, we must change attitudes and modalities for cooperation. We must also keep the dialogue running through annual meetings. The next one is scheduled for **12.05.2016 in Le Barcarès** (Pyrénées-Orientales department, south of France).


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PROGRAM SUBLIMO LIFE+

Analyze, monitor and restore marine biodiversity

This European program has revealed new areas and aspects of knowledge on post-larvae in the Mediterranean (especially distribution and other influential parameters). It has also enabled the optimization of a technique of post-larvae breeding, rearing and juvenile release. All the scientific and technical knowledge gained will enable the improvement of ecological restoration methodologies and the development of new tools.

DRIVER program partners

More information at the following address:

***www.life-sublimo.fr** , category: organization of a workshop on post-larvae*

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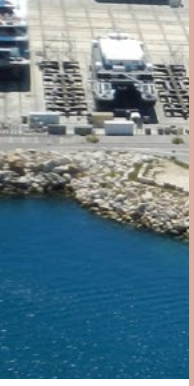

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Ecological restoration in questions:

" Does improving the survival rate of early life stages of fish in ports lead to the production of contaminated food fish? "

Written by
Marc BOUCHOUCHA / Ifremer

Though this question is very often asked, two problems arise:

- What are the consequences for fish to spend their early life stages in a port environment?
- What is the risk of contaminating the food chain, knowing that these fish are likely to leave the port and get eaten by others who will then accumulate large amounts of pollutants?

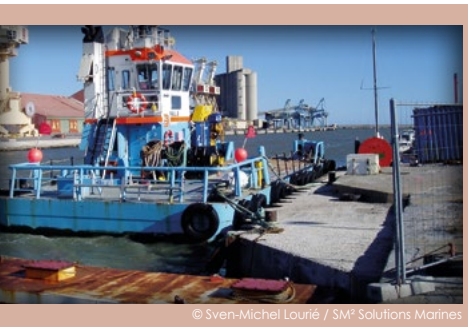
Work is currently being carried out at Ifremer to try to answer these questions.

Mode of contamination and potential risk

Exposure to chemicals has a number of consequences for fish, especially young stages; for example, decrease in growth rate, changes in behavior or even death at high concentrations. Contamination levels in organisms obviously depend on toxicology parameters such as pollutant concentrations in the environment and/or exposure time, but also on benign environmental parameters (salinity, pH or temperature) and the ability of fish to naturally regulate certain contaminants. All these factors mean that **the concentrations of contaminants in the environment are not directly correlated with the concentrations found in the fish.**

So, contaminated or not ?

A little, but... contrary to what might have been assumed, analysis of heavy metal concentrations shows that **fish are not more contaminated by pollutants in port areas than in the natural environment**. There is indeed a difference in water quality inside or outside of the port, but this difference is generally not reflected in the studied juveniles. So there is an insignificant risk a priori of contamination from the external environment, but the question deserves more research efforts (further analysis is ongoing).



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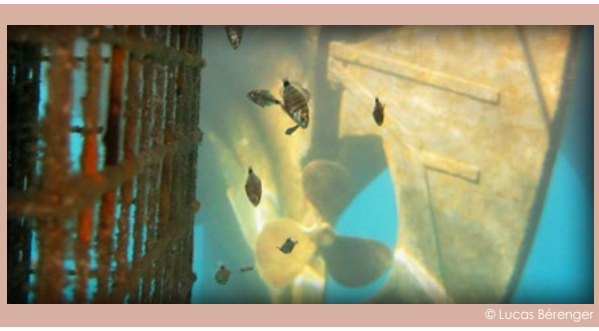

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Sampling areas

The study was conducted in the harbor of Toulon, whose port areas are known to be highly contaminated, particularly with heavy metals.

Figure 1: Sampling areas selected for the study; three areas are in the port, one is located in the intermediate zone along the open-sea dike, and one is in a natural environment.

Conducted analyses

All analyses were performed on juvenile common seabream (Diplodus sargus) and focused on the concentrations of metal contaminants in the muscles of these fish. The concentrations of these same metals were also measured in water from 5 sampling areas.

Studied elements are: mercury, aluminum, copper, lead, cobalt, manganese, chromium and nickel.

Other ongoing analyses : The study continues with the analysis of other contaminants (including hydrocarbons, whose presence is strong in ports). In addition, the consequences on fish of this exposure are also investigated. For this, a comparison between natural environment and harbor is based on biological parameters such as growth rate.

Ifremer

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Find all the information on the website: ***www.nappex.fr***

This information come from a thesis in progress:
«Ecological restoration of nursery functions in ports. Marc BOUCHOUCHA»
Thesis co-directed by: Ifremer, La Seyne-sur-Mer and the CREM-CEFREM, Perpignan.
For more information, contact Marc Bouchoucha: Marc.Bouchoucha@ifremer.fr


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Ecological restoration and European directives

WFD and MSFD

Written by
Pierre BOISSERY
Agence de l'Eau Rhône Méditerranée Corse

Public and EU policies for the protection of the Mediterranean were initially focused on **reducing sources of pollution** reaching the sea. This meant, for instance, stricter legal requirements in the implementation of treatment plants and improvement of the sanitation system. It can be acknowledged that significant efforts have been made in recent years, and that the fight against pollution remains a strong political goal which still offers great scope for improvement, especially with the inclusion of rainwater in the factors to be taken into account. However, policies now need to emphasize two recently-emerging priority areas of work, namely: non-degradation and ecological restoration.

Non-degradation is the first priority

It is generally **easier and cheaper** to not degrade the natural environment than to repair it. Two categories of pressures are particularly targeted concerning our Mediterranean coast: **land reclamation** from the sea, for example when building new port areas, and the **impact of various uses of the sea**, such as moorings linked to pleasure-boating.

Non-degradation is at the heart of the new European guidelines that are the **Water Framework Directive**[1] and the **Marine Strategy Framework Directive**[2]. These two Directives aim to achieve good environmental status of the marine environment, from the coastal zone to the open sea. For this, a special focus is put on strengthening goals and targets for **reducing pollutant flow to the sea**, while **restoration of the marine environment and its functions** will be required in relevant sectors.


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Ecological restoration

of shallow waters is fully compatible with the logic of non-degradation and strengthening the fight against pollution. It is an innovative third axis of additional work, for which **efforts to improve methodology, effectiveness and evaluation must continue**, although **operational solutions** already exist today to restore lost nursery functions in port areas.

Ecological restoration is now defined as (Lenfant *et al.*, 2016 [3]):

" 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. "

❶ WFD

The Directive 2000/60/EC of October 23rd, 2000, establishes a firm framework for European water policies. The objectives are "good ecological status" and good chemical status for coastal waters of the Mediterranean, and good chemical status for territorial waters.

❷ MSFD

The Marine Strategy Framework Directive 2008/56/CE of June 17th, 2008, establishes a European action framework for marine policies. This directive sets an objective for a good ecological status of coastal waters and offshore waters.

❸ Lenfant *et al.* 2016. Ecological Restoration of Fish Nurseries in Shallow Coastal Areas of the Mediterranean Basin. Guidelines and Principles.

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www.eaurmc.fr

All the information are available on the website: **www.nappex.fr**

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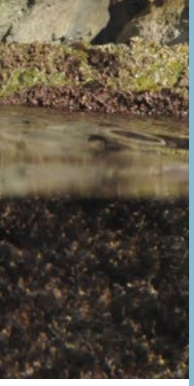

Ports, harbors and marinas' role in coastal fish populations' preservation

Contribution of ecological restoration

Written by
Manon MERCADER / CEFREM-UMR5110
Philippe LENFANT / CEFREM-UMR5110

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This PhD project lies in the frame of the coastal shallow waters restoration thematic and more precisely in the fish nursery function rehabilitation axe (following the GIREL and NAPPEX programs). The main goal is to estimate the ecological gain resulting from harbors' rehabilitation. The project is led on two harbors of the Catalan coast *(Pyrénnées-Orientales)* which are benefiting form large scale rehabilitation programs and is based on restoration ecology's evaluation methods.

Expected Information

- **Characterization of juveniles' assemblages** in harbor and distribution patterns
- **Determination of juveniles' relative abundance** inside harbors compared to natural nurseries
- **Quantification of the effect of restoration** on juveniles' density and diversity
- **Development of indicators and monitoring tools** for coastal zones restoration
- **Survival rate estimation** on artificial habitat and effect of complexity
- **Development of an effective method** for ecological gain estimation
- **Help for the incorporation** of ecological restoration in ongoing and future management strategies

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COMPOSITION OF THE VARIOUS STEPS :

Baseline and Reference

Evaluation of juvenile fish's density and diversity inside harbors before restoration (4 harbors) and in natural nurseries (for Reference).

- Visual census along transects on different habitat types form April to October, which permits to cover the installation of a large number of species.

Monitoring and evaluation

Assemblages

A restoration project's efficiency needs to be evaluated on the base of a change toward a functional stage (Reference) and not only on a move away from a degraded state. Also, evaluation needs to be performed by comparison with a Reference in addition to comparison with a control (a degraded site not undergoing restoration).

- Here, the developed method is based on a BACI (Before-After-Control-Impact) type protocol by comparison of juveniles' density and diversity level of variation (pre- Vs. post- restoration).
  - 2 harbors under restoration program
  - 2 control harbors
  - 2 natural sites (Reference)

Survival rate

Observation of high abundances of juveniles might be the result of attraction alone, and not of a better survival. Also, the above evaluation needs to be completed by an evaluation of the mortality rate on the structures used for restoration. Disappearance of juveniles from a given habitat is linked to two factors: mortality and emigration. However, those two factors are hard to distinguish in an open environment.

- Survival rate estimation using mesocosm experiments: juveniles are exposed to a predator in different potential nursery habitat, including artificial nurseries.

Ecological gain and implication for coastal zones management

While more conceptual this last part aim at giving concrete tools for ecological restoration's development in marine environments.

- Proposing a model for the estimation of ecological gain linked to nursery function's rehabilitation based on results from the precedent parts (effect of artificial habitats on juveniles' diversity, density and survival).
- Defining a conceptual framework for the good integration of ecological restoration in the strategies developed to maintain or restore a good environmental status of marine waters (cf. Marine Strategy Framework Directive).

For more information on artificial nurseries please visit : ***www.nappex.fr***

This these is in progress at the University of Perpignan and it supervised by Pr. Philippe LENFANT, CREM-CEFREM.
For more information, contact Manon Mercader : manon.mercader@univ-perp.fr