



BERLIN OYSTER RECOMMENDATION

on the Future of Native Oyster Restoration in Europe

Part I, Preface and Recommendations

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„Native oyster restoration in Europe - current activities and future perspectives“

Bringing back an ecological key player: principles for native oyster restoration in Europe

Preface

Oyster habitats are hot spots of biodiversity and are vital to the health of the surrounding ecosystem but are among the most threatened marine habitats worldwide. Oyster reefs and beds are biogenic structures formed by oysters that occur at high densities and provide the dominant structural component and significant vertical relief on otherwise unstructured sea-floor. As an ecological keystone-species it offers substrate, spawning ground, food and shelter for many more species. Their ecological role can be compared to the function of coral reefs in tropical regions. In Europe, native oysters once formed extensive beds and reefs along North Atlantic coastlines and in the North Sea, even in offshore regions of moderate depth. However, over 90% of former oyster reefs have been lost.

Over the past two decades, substantial headway has been made in progressing restoration of oyster habitats in the USA. While restoration efforts historically sought to address declines in oyster landings, many recent efforts focus on recovering the valuable and diverse ecosystem services these oyster habitats provide. Across Europe, native oyster restoration is also starting to gain momentum. The Oslo-Paris-Commission (OSPAR) included *Ostrea edulis* on the list of threatened and declining species and habitats, for which restoration measures should be developed and the EU Habitats Directive also calls for the protection, conservation and restoration of biogenic reefs in European waters. Over the last 3-5 years, several projects have started with the aim of recovering the biodiversity and the ecosystem services provided by oysters.

High fishing pressure and poor shell management practices not only resulted in the decline of living oysters, but also in the loss of the most important natural settlement substrate for oyster larvae: oyster shells. In waters with sufficient larval abundances, the lack of suitable substrate can be the limiting factor for the recovery of oyster populations. Throughout much of Europe, a lack of broodstock (adult breeding individuals) in sufficiently high density for successful breeding may also be the reason for low larval abundances. Furthermore, in many European ecoregions the invasive protozoan parasite *Bonamia ostreae* is present today and able to increase mortality in native oysters. *Bonamia*-monitoring will be an important tool for the selection of eventually tolerant populations.

Against this background the Marine Directorate of the German Federal Agency for Nature Conservation and the Alfred-Wegener-Institute Helmholtz Centre for Polar and Marine research organised a Kick-off Workshop in Berlin „Native oyster restoration in Europe - current activities and future perspectives“ with the idea of exploring interest in the foundation of a European Network for Native Oyster Restoration.

The workshop was attended by 65 participants from 11 countries, representing experts from science, nature conservation, commercial production, bio-consulting and policy advisers. It became obvious that despite the existing momentum and will for restoring native oysters and their valuable ecosystem services, several barriers to the successful wide scale uptake of native oyster restoration still needed to be addressed. Addressing these barriers requires the combined focus of a ‘network’ of restoration practitioners as well as academics and managers who recognise the environmental benefits to be gained from restoring this once dominant habitat. Thus a European ‘Native Oyster Restoration Alliance’ was conceived as an ideal mechanism to accelerate the impact of restoring native oyster habitats in Europe.

The participants of the workshop discussed a number of pertinent issues related to native oyster restoration and protection while

considering that oysters have historically played a critical role both ecologically and economically in marine environments worldwide;

noting that globally wild and native shellfish populations- including those throughout Europe- are largely degraded, and their ecosystem service value is similarly reduced;

accepting that conditions in many areas are different now from when oysters were abundant 100 to 200 years ago;

confirming that successful oyster restoration projects have been implemented around the globe on various scales;

realising that native oyster restoration in Europe should be promoted and facilitated by defined cooperative actions;

believing that restoration should be integrated into conservation policy, marine spatial planning and marine development;

agreeing that participants and key institutions will work together towards the recovery of native oyster habitat and the associated services on an ecosystem scale.

Following these discussions workshop participants established the **Native Oyster Restoration Alliance (NORA)** for the protection and restoration of the endangered European oyster.

The undersigned workshop participants (which represented the core group of the European expertise on the subject) formulated a series of specific recommendations. These recommendations are addressed to national, international, intergovernmental agencies, as well as regulators, scientists, NGOs and potential investors of the respective countries and urges them to strongly support these recommendations with the aim to provide a healthy and resilient ecosystem in the North East Atlantic and the North Sea.



Participants and members of the Native Oyster Restoration Alliance (NORA) agreed on the following recommendations:

Berlin Oyster Recommendation

1. Produce sufficient oysters for restoration of oyster reefs

Background: Sufficient seed oyster supply is a key limiting factor for native oyster restoration projects in Europe. Translocation between sites of seed oysters or any other size classes from wild beds should be discouraged to avoid increasing the pressure on still existing wild beds and reduce the risk of spreading invasive species and disease.

Recommendation: Action should be undertaken to support existing hatcheries, spatting ponds and spat collector techniques and to establish new hatcheries and spatting ponds for the production of robust and genetically diverse *Ostrea edulis* seed. Broodstock sanctuaries should be established and used for local reinforcements.

2. Identify and create suitable sites for restoration of oyster reefs

Background: Restoration projects to recover *Ostrea edulis* habitat will only succeed in areas where environmental conditions are suitable and no bottom disturbance, e.g. bottom trawl fishery, occurs.

Recommendation: Sufficient undisturbed and suitable areas should be identified for the restoration and protection of *Ostrea edulis* in all regions of its indigenous range. This includes the restoration of suitable substrate in some areas. It will be important to identify and afford protection to several major sites in Europe, where:

- *Ostrea edulis* was recorded previously but has disappeared (“reintroduction” sites)
- *Ostrea edulis* is still present, but in very low density (“reinforcement” sites)
- *Ostrea edulis* is abundant with sufficient reproduction and settlement for the habitat to persist in the long term (“conservation” sites)

3. Provide suitable substrate for successful recruitment

Background: Sustainable success of restoration efforts depends on successful recruitment and, therefore, not only on the supply of sufficient larvae but also on the availability of suitable substrate. After their planktonic phase, oyster larvae prefer to settle on oyster shells. Suitable and abundant settlement substrate is a major limiting factor for *Ostrea edulis* recovery in areas with natural spatfall and of high importance for sustainable restoration.

Recommendation: Extraction of *Ostrea edulis* shells from the marine environment for other usages should be stopped. The addition of suitable substrate will ease recruitment of larvae.

4. Respect *Bonamia*-free areas

Background: In many European ecoregions, the invasive parasite *Bonamia* is present today. *Bonamia ostreae* is an invasive protozoan parasite infecting haemocytes of native oysters and inducing physiological disorders, potentially resulting in the eventual death of the animal. High mortality rates have been described for cultivation sites with high densities of oysters and elevated summer temperatures. Despite this, tolerant populations appear to exist in France, The Netherlands, Spain and Ireland. Genetic studies have demonstrated that tolerance to this parasite is heritable and genomic studies have identified QTLs and expressed genes associated with tolerance.

Recommendation: Research to better understand the biology of the *Bonamia* parasite and infection dynamics should be encouraged. Biosecurity protocols must be strictly followed in *Bonamia*-free areas. Any area where there is functional extinction of *Ostrea edulis* should be treated as a *Bonamia*-free area. For *Bonamia*-infected areas, techniques should be sought to take advantage of any disease tolerance that has developed in broodstock from high disease load areas, without transferring pathogens.

5. Create common monitoring protocols

Background: Native oyster restoration is in its infancy in Europe. There are numerous outstanding questions regarding best practice for restoration of the European native oyster. A shared monitoring protocol will allow lessons and outcomes to be shared between all European restoration efforts. This will reduce duplication of effort and ensure that progress towards successful restoration is as rapid as possible.

Recommendation: Monitoring protocols that will provide comparable results for projects throughout Europe and for restored sites should be developed and followed. Where possible, monitoring should include the assessment of ecosystem services on a habitat and ecosystem scale.

6. Preserve genetic diversity

Background: The preservation of the genetic diversity of European native oyster populations is of central importance for maintaining its ability to adapt to changing environmental conditions, stress factors (disease, climate change) and to facilitate the long-term survival of native oyster habitats in Europe.

Recommendation: Established hatchery and pond production protocols should be adapted to preserve the extant genetic diversity of native oysters in Europe.

The Native Oyster Restoration Alliance (NORA)

The participants of the European Native Oyster Restoration Workshop in Berlin, Germany, recognise the need for sharing experience and lessons learned from restoration projects as well as the value in coordinating policy and regulatory changes that promote or enable native oyster restoration.

The Native Oyster Restoration Alliance (NORA) will facilitate this process and will therefore establish topic-related subgroups. Results and further needs for action will follow in Part II.

Note: Contributions to the *Berlin Oyster Recommendation* on the future of Native Oyster Restoration in Europe were received from members of the Native Oyster Restoration Alliance (NORA), session chairs and speakers as well as from workshop participants who presented their views during the break-out groups and during the panel discussion of the workshop. These views were accommodated as much as possible by the Editorial Committee.



The participants of the European Native Oyster Restoration Workshop in Berlin.



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