

Setting the stage for mussel research in the north Atlantic region

Notes from the first NAEMO workshop, Oban 2019-10-30, Corran Halls, 54 Corran Esplanade, McCaig suite.

Introduction by Nick Lake

Introduction by Åsa Strand

Mussels are keystone species, contributing to biodiversity, cultural and social services. Reports of blue mussel regression are of concern. During discussions a year ago it became apparent that there were a lot of knowledge gaps and a need for a consolidated view on the status and development of wild populations.

Thanks to Nick and the ASSG for hosting this back to back workshop.

Introduced the agenda and stated that to encourage open discussions, the 'Chatham House Rules' will be applied i.e. you can refer to the discussions in the workshop, but you cannot refer specifically to individual views.

Workshop objectives were:

1. network formation
2. identifying network ambitions
3. initiated formation of joint agenda and a joint knowledge platform

Network outputs could include joint publications, joint grant applications, wide ranging understanding etc

After the initial welcome and information, the workshop session "**Develop a joint knowledge platform for existing information about mussel status and population trends**" was initiated and 9 presentations were given (see Agenda and presentation PDFs).

Topics that were addressed in comments and discussions after the presentations were:

1) The issue of hybridisation with *Mytilus trossulus* and *M. galloprovincialis* was raised. Can we even confidently state that the species we are dealing with is *M. edulis*? In Scotland packaging states 'Mytilus edulis' is this accurate? Does species matter? Will hybrids be more resilient and fitter to cope with various anthropogenic threats (climate change etc)

2) There are measurements of existing seed beds/index beds in Maine and the observed reduction in these. A massive drop/absence in spat fall has been noticed by the industry. In parallel is the loss of eelgrass beds. It was stated that when talking about seed mussels it's important to think about the longevity of the resource and consider ephemeral beds as opposed to biogenic reefs. The problem of definitions was also raised– mussel reefs are features in conservation zones and so a poorly thought out definition can reduce interaction with seed beds as a resource. A definition therefore should include a temporal dimension and function of the mussel bed, e.g. if it is a permanent biogenic mussel reef or an ephemeral seed bed. From a management perspective, a permanent biogenic mussel reef is considered a conservation feature and may be protected and unfishable,

whereas an ephemeral seed bed is a non- permanent feature and therefore a resource that can be fished.

3) How important is the wild blue mussel fishery to the industry?

5) We must consider the interrelationship between aquaculture and wild populations to achieve a sustainable management of the mussel populations.

8) Is there differences in threats between areas? In some areas there is very little commercial exploitation of wild beds and no (or limited *Martelia*) yet a similar trend is observed as in the rest of Europe.

9) How does biofouling affect byssus production? Intensive biofouling can increase drag and thereby indirectly affect byssus production. From an aquaculture perspective we can time production to optimise mussel settlement and reduce biofouling or alternatively find ways to utilise a biofouling species. In Sweden the tunicates (*Ciona*) are being used to produce an umami sauce and for biofuel etc. Tunicates are a major issue in Canada and in Ireland.

10) Can *M. galloprovincialis* provide ecosystem services at a similar level/rate to *M. edulis*? And if the answer is yes, does the shift in range expansion matter?

11) Disease outbreaks are heavily impacting all bivalve production sectors and increasing host-pathogen interactions together with climate change could be a driver for development of a mussel hatchery.

12) We need to increase our understanding of the interaction between aquaculture and nature – how do sea ranching and fisheries impact biodiversity? Much information is lacking related to the biological carrying capacity of an area. Can high densities of farmed mussels outcompete wild populations?

13) The understanding of circular food production systems including N reduction and carbon capture must be improved and the benefits of mussel production as a climate robust production should be promoted.

The first session after lunch was devoted to a group exercise aiming to **identify knowledge gaps related to management of blue mussels and identify potential areas of collaboration** (opportunities, constraints, collaboration/research ideas). The outcome of the discussions were presented by each group and resulted in the following key points:

- How do we best evidence and monitor decline?

The main knowledge gaps related to management of mussels were identified as population trends and threat analysis (Figure 1). More specifically, it was agreed that the first step towards establishing more efficient management strategies of mussels is to establish evidence of decline. As a first activity, long-term trends based on existing datasets subdivided into different habitats will be compiled and analysed. However, in many areas long-term monitoring programs of both wild and farmed mussel populations is lacking. Standardized monitoring across the north Atlantic region with a management focus was therefore identified as an area in need of development. It was commented upon that it is difficult to monitor wild stocks, but much easier to monitor farmed stocks, so perhaps farmers could aid monitoring in a standardised way?

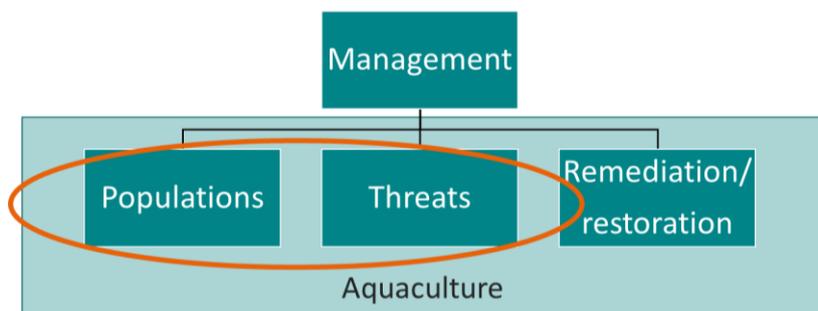


Figure 1. A conceptual model describing the aspects required for successful management of mussel populations. The circle highlights the topics of highest priority based on the workshop discussions.

- What are the causes of decline?

The second step towards improving management was identified as a lack of knowledge related to causes of decline, including evaluation of recruitment processes (i.e. quantification of larval abundances in different areas and differences in recruitment between habitats), with the objective to connect this to a risk assessment and gap analysis based on a literature review to identify existing threats. Mass mortalities have been observed and this must be monitored, quantified and causes defined. It was acknowledged that the effects of abiotic conditions on mussel recruitment is an area where more research is needed, and that the effects of the most pronounced threats (substrate destruction, commercial exploitation) can easily mask underlying causes of decline. These may potentially be disentangled by comparison of “high pressure areas” with reference areas where the major threats are less pronounced.

- There is a need to improve the communication between policymakers, academia and industry.

The third step towards improved management of mussels was identified as a need to improve general knowledge of mussels and their value to society by communicating to user groups the ecosystem services provided by mussels. Special emphasis was put on providing a holistic perspective where services from wild populations to aquaculture, and from aquaculture to wild populations, was highlighted in order to enhance sustainability of all mussel-related activities (Figure 2).

After the workshop the results from the session was summarised. All words entered was classified into one of ten categories (Table 1). Not surprisingly, Collaboration emerged as a top priority, followed by threats to the mussel populations. After this, most categories were equally frequently mentioned by the workshop participants.

Topic	Number of words associated
Collaboration	47
Threats	37
Management	27
Ecosystem services	26
Policy and governance	25
Recruitment	23
Aquaculture	22
Population development	22
Communication	20
Economics	10

It was clear from the discussions that there was a strong request for intensified knowledge exchange and increased collaborations, and that the value of mussels (both biological and economic) should be in focus for the network. Issues raised during the previous sessions such as effects of climate change and recruitment failure were also highlighted as important topics for the network.

The final session at the workshop was aimed **at determining the specific objectives for NAEMO.**

- The need for a formal mussel network was recognized and as a first step and to achieve greater momentum, a structure for co-ordination was to be suggested by the workshop leaders.
- It was decided that the scope of the network should be broadened to *Mytilus* spp. and that the North Atlantic region will persist as the main geographical focus area.
- The network should strive to be inclusive – all stakeholders (research, industry, governance, NGO) that see a value with the network activities are welcome.
- Clustering with other ongoing activities, e.g. workshops, conferences, and projects, was identified as a key component for the success of the network.
- There was also an expressed ambition to develop NAEMO as a networking and data-sharing platform and to develop a service directory for connecting players within the field.
- Other specific tasks identified as suitable for the network were to use the network for developing expert consensus opinions, and to use this as a basis for communication to facilitate governance and knowledge transfer to society.

A roadmap was created to achieve this ambition with the following key points:

1. formalize the organisation of the network, the workshop leaders will propose a structure to the network.
2. apply for funding to formalize the network (ICES, EAS, COST action and more) (responsible: members in the network, lead by workshop leaders until a formal structure for the network has been established).
3. attract nature conservation/NGOs to the network (responsible: all members)

4. establish a web page and a logo (responsible: workshop leaders and all members)
5. form a network participant list (responsible: workshop leaders)
6. maintain the network by providing regular updates (responsible: workshop leaders until structure has been decided)
7. host thematic meetings to 1) establish standardised monitoring methods 2) to compile data sets (longer term goal, depends on funding)
8. write an opinion piece and press release- try and get published in MEPS, EAS newsletter, Marine Policy
9. establish a secretariat and create a platform where data and information can be shared and where different actors can connect to each other and identify key people with specific competences (longer term goal, depends on funding).