



SODIM

Société de développement de l'industrie maricole inc.

*Production mytilicole en milieu ouvert aux
Îles-de-la-Madeleine : une avenue prometteuse*

Rapport final

Dossier n° 710.26

Rapport commandité par la SODIM

2005

Open-sea Culture of Mussels (*Mytilus edulis*) in Îles-de-la-Madeleine: A Promising Avenue



François Bourque*, Bruno Myrand, and Guglielmo Tita

*Station technologique maricole des Îles-de-la-Madeleine, MAPAQ, 184 ch. Principal, Cap-aux-Meules, QC G4T 1C6 (*Corresponding author Tel.: 418-986-4795 #222, Fax: 418-986-6573, E-mail: francois.bourque@mapaq.gouv.qc.ca)*

Mussel culture in Îles-de-la-Madeleine is concentrated in lagoons, but the available space is limited. Future development depends on farming in open-sea areas where the conditions are different from those in lagoons – barely sheltered sites situated far from the coasts and subjected to drifting ice. A project has been ongoing since 2002 to determine the parameters of production in this new environment. The site is 20 minutes by boat from the nearest harbour, at a depth of 19 meters. Usually free of ice, it is accessible by boat nearly year-round, allowing a winter harvest. The longlines with their buried anchors have remained stable since their installation. The growth of the mussels in the sea is comparable to those in the lagoon. The use of spat from Bassin in Havre-Aubert helps the mussels reach commercial size only one year after sleeving. Spat can also be collected onsite throughout the entire water column. The yield in cooked meat remains very high (~50%) during a good part of the summer. This site thereby provides mussels of superior quality at a time when lagoon mussels have spawned and thus have a low meat yield. The results are promising.

La production mytilicole des Îles-de-la-Madeleine est concentrée dans les lagunes mais l'espace disponible est limité. Le développement futur devra passer par l'élevage en milieu ouvert, où les conditions sont bien différentes des lagunes: sites peu abrités situés à distance des côtes et soumis aux glaces dérivantes. Un projet est en cours depuis 2002 pour déterminer les paramètres de production de ce nouvel environnement. Le site est à 20 minutes de bateau du port le plus proche, à une profondeur de 19 m. Habituellement libre de glace, il est accessible par bateau presque en tout temps permettant ainsi la récolte hivernale. Les lignes avec leurs ancrages enfouis sont demeurées stables depuis leur installation. La croissance des moules en mer est comparable à celle en lagune. L'utilisation du naissain du Bassin de Havre-Aubert permet d'obtenir des moules commerciales un an seulement après leur mise en boudin. On peut aussi s'approvisionner en naissain directement sur le site, sur toute la colonne d'eau. Le rendement en chair cuite demeure très élevé (~ 50%) durant une bonne partie de l'été. Ce site fournit donc des moules de qualité supérieure au moment où les moules en lagune ont pondu et sont presque vides. Les résultats sont prometteurs.

Introduction

Mussel culture in Îles-de-la-Madeleine has been going on in lagoons for close to 20 years. These sheltered and favourable areas for mussel culture are restricted however, and there is no available space for new leases. Certain indicators lead us to believe that an interesting potential lies off the coasts in open-sea areas. First, this avenue could fulfill or resolve in part the problem of access to the commercial mussels on a regular basis with which the industry is faced. The important losses (fall-offs) associated with the summer lagoon harvest could possibly be reduced. Moreover, the meat yield observed in the sea during the summer could eventually be higher to that observed in lagoons, due to the different environmental conditions. It was with the goal of examining these premises that the Station technologique maricole undertook this exploratory project in 2002. Since then, other partners have joined the project: Société de développement de l'industrie maricole du Québec (SODIM) and Canada Economic Development.

Methodology

Choice of site

Several elements came into play when choosing the site. First, it was desirable to avoid any user conflicts. In this way, the chosen site does not conflict with commercial fishing and is considered an adequate distance from any maritime navigation (Fig. 1).

The site, which covers an area of 25 hectares (500 m × 500 m) at a depth of 19 meters, is deep enough to install longlines at a sufficient depth to avoid the drifting ice. The site is situated at the limit of the Baie de Plaisance, therefore not far from a fishing harbour.

Deployment of longlines

In June 2002, three submerged longlines were installed, anchored with buried Japanese anchors. The longlines are 100-m long and are installed in parallel at 75 m from one another.

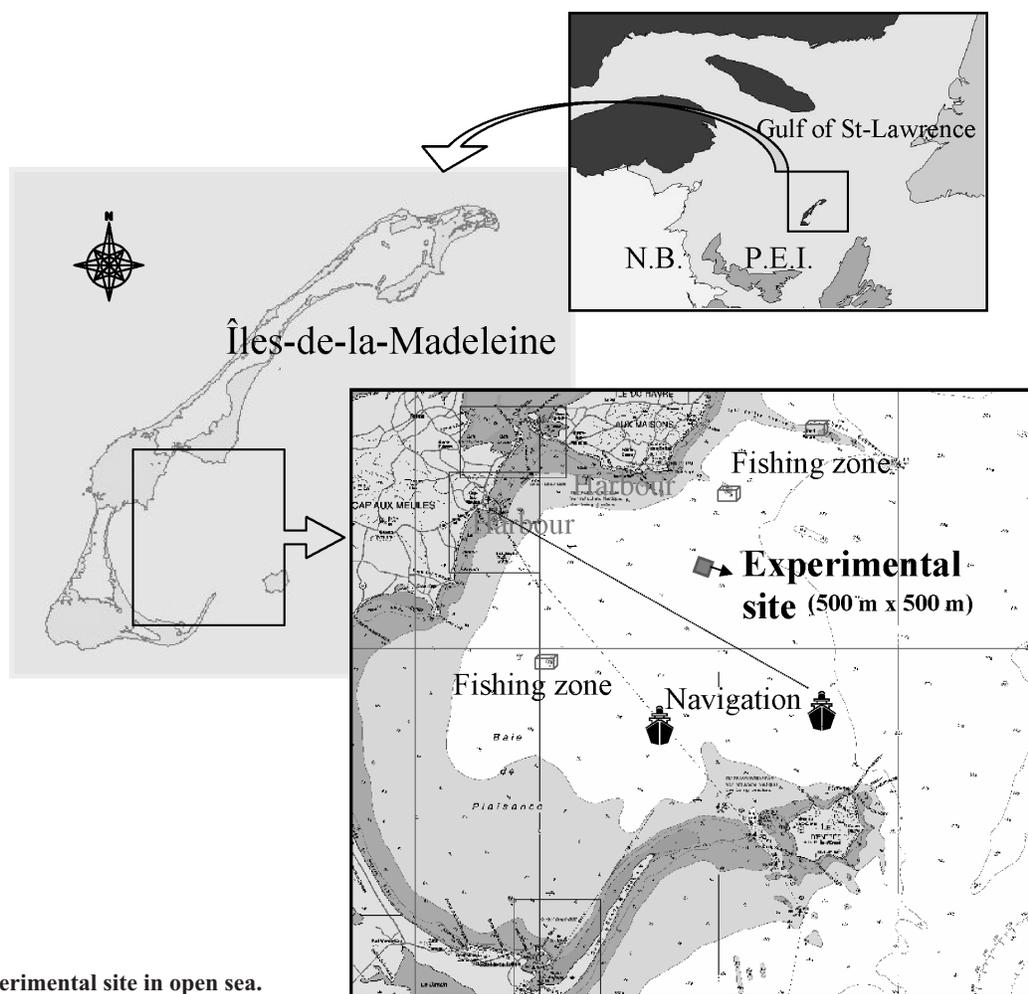


Figure 1.
Localisation of experimental site in open sea.

Environmental assessment

Prior to the deployment of the experimental longlines, Tita et al.⁽¹⁾ carried out an environmental assessment of the study site. Sediment characteristics and benthic communities were sampled between May and July 2002. Water currents were also monitored from June through October 2002.

Evaluation of the performance of different stocks

In order to evaluate the possibility to use one or the other of the different stocks of mussel spat available in Îles-de-la-Madeleine, growth from spring until autumn 2003 was compared. Four stocks were followed: those from the Bassin of Havre-Aubert, the lagoon in Havre-aux-Maisons, the lagoon in Grande-Entrée, and the Baie de Plaisance. Mussel spat from the four groups which had been collected in 2002 were placed in Vexar[®] cages (five cages per stock) in May 2003. Measurements (to the closest mm) were taken in May and then in November.

Spat collection

In 2002, the potential for spat collection and whether second set could be a problem on commercial sleeves throughout the water column were evaluated. In June, 15-m long polyrope col-

lectors were installed on a longline left at 3 m from the surface for three months. Additional collectors were set up on an entire line in June 2003 and taken out a year later to get an idea of the potential of a “commercial” spat collection.

Growth and production

In anticipation of obtaining the lease, and in order to quickly get first growth results, mussel spat taken from the Bassin of Havre-Aubert was sleeved in November 2001. These sleeves were overwintered on a longline in the lagoon of Havre-aux-Maisons. In June 2002, the sleeves were transferred to the open-sea site and followed until summer 2003.

To evaluate a complete production cycle in open sea, mussels were sleeved in October 2002 and installed on the site and in the Havre-aux-Maisons lagoon in order to draw comparisons. The experiment was repeated in November 2003.

Evolution of the meat yield

The evolution of the summer meat yield of 1⁺ mussels was observed in 2003 and 2004. In the beginning of May, Vexar[®] cages containing medium-sized mussels (~60 mm) were placed in the open sea and in the lagoon. Three cages were retrieved bi-monthly in 2003 and weekly in 2004 from each of which 10 mus-

sels were used to evaluate the cooked meat yield ($n = 30$). The cooked meat yield was assessed as: $(\text{weight of meat} / (\text{weight of meat} + \text{weight of shell})) \times 100$.

Results

Site access

The site is easily and rapidly accessible. At a speed of 10 knots, it is about 30 minutes from the harbour of Cap-aux-Meules and 20 minutes from the harbour of Pointe-Basse. In the winters of 2002-2003 and 2003-2004, the presence of ice was limited in the Baie de Plaisance and that would have allowed to access the site at almost any time.

Behaviour of longlines

In the autumn of 2004, the three longlines were still in place. The anchorage resisted well and the chosen depth for the longlines – about 10 m from the surface – allowed for avoiding the drifting ice.

Environmental assessment

The fine, well-sorted sediment (median = $96 \pm 4.5 \mu\text{m}$) had 0.38% of organic carbon and 0.17% total nitrogen. Polychaetes were the dominant macrofaunal group (84%), while nematodes dominated meiofauna (87%). As commonly observed in this type of sediment habitat, polychaetes displayed low species diversity ($n = 13$; Shannon-Wiener index = 1.17 ± 0.30 ; equitability = 0.43 ± 0.08), compared to nematodes ($n = 62$; Shannon-Wiener index = 4.33 ± 0.38 ; equitability = 0.88 ± 0.04)

Water currents had an average velocity of $6.9 \pm 3.72 \text{ cm/s}$ and predominantly flowed in an East-North-East direction. Tita et al.⁽¹⁾ suggested that such a current system might mitigate the

sediment organic enrichment associated to farming activities. Dispersion of organic matter conveyed by mussels in the form feces and pseudofeces may indeed result from local water currents. Reduced local effects on benthic communities may then be expected.

Performance of stocks

All stocks showed similar growth. Starting at a mean length of 22-26 mm, the mussels reached a mean size of 46-51 mm six months later. There does not seem to be an important stock effect on this experimental site in open sea.

Spat collection

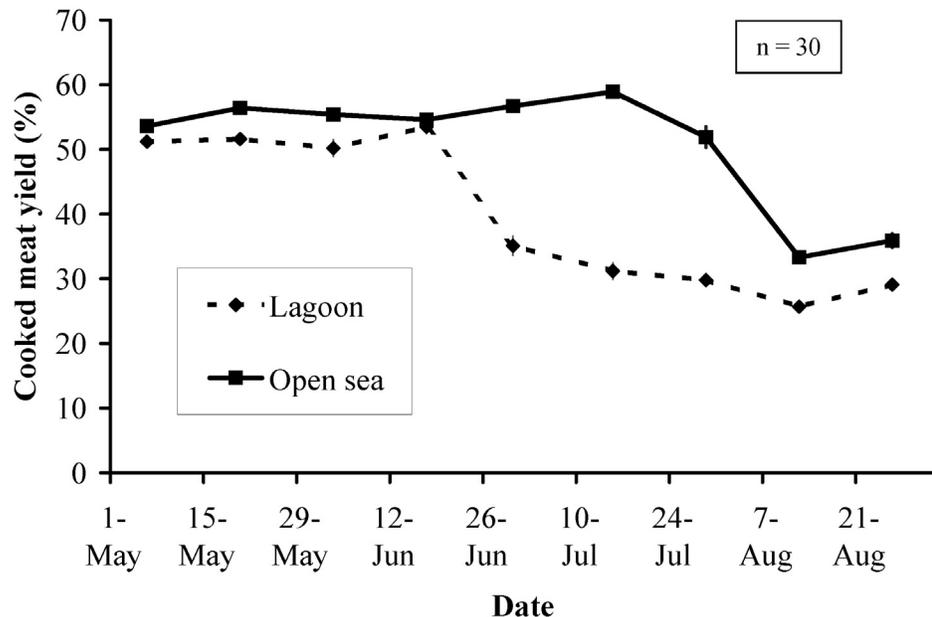
The maximum density of spat (~15 000 mussels/m) collected in September 2002 was observed between 13 and 15 meters from the surface. At the depth targeted for mussel culture (10 m from the surface), the collection was still relatively important with ~5000 ind./m. That could possibly lead to problems with second set on sleeves in the future.

Spat collection occurred later in open sea than in a lagoon and consequently, the mussel spat reached a smaller size in the autumn. As a result, the 2003 spat was sleeved in early summer 2004. Several cohorts of mussels were observed on the collectors as well as some associate species which were present in great abundance: hydroids and *Caprella*. Moreover, a heavy presence of small starfishes (*Asterias vulgaris*) was noticed on the collectors.

Growth and production

The young mussels sleeved in November 2001 and transferred in June 2002 responded well to the culture conditions in open sea. Their modal size reached 60 mm less than a year later (May 2003) whether in open sea or in the lagoon (control group). Con-

Figure 2.
Evolution of commercial mussel meat yield (mean \pm SE) in 2003.



sequently the sleeves in open sea provided up to 11 kg/m of commercial mussels (>50 mm).

The sleeves placed in open sea in October 2002 experienced heavy losses due to fall-offs in September 2003 when flotation on the longlines was adjusted. At this time a heavy second set of young mussels had added weight to the sleeves. However, the remaining 1⁺ mussels had reached commercial size in November 2003, one year after sleeving.

Another sleeving operation was undertaken in November 2003. The modal size of the sleeved mussels was 23 mm and they reached a modal size of 53 mm in less than a year (end of September 2004).

Evolution of the meat yield

In 2003, the spawning period differed greatly at the two sites (open sea vs lagoon). From the early May until mid-June, the cooked meat yield remained >50% in both the lagoon (Havre-aux-Maisons) and the open-sea site. On June 30, a sharp drop (from 53% to 35%) was observed in the lagoon, thus indicating a massive spawning. (Fig. 2). As for the yield in the open-sea, it remained high for 6 additional weeks, the drop having been noted August 12.

In 2004, the meat yield pattern differed from the previous year as no synchronized massive spawning was observed at neither sites. Nevertheless, the mussels in open sea always had higher meat yield values than those kept in the lagoon. The open-sea mussels went progressively from a cooked meat yield of 59% in May to 35% at the end of August. During the same period, the mussels in the lagoon went from 46% to 25%.

It should be noted that, though of equal size, the weight of the mussels' shell in 2004 was always much higher in the lagoon than in open sea. From the beginning of May to the end of August, the mean weight of shells (\pm SE) in the lagoon went from 7.5 \pm 0.1 g to 10.0 \pm 0.2 g, compared to 4.7 \pm 0.2 g to 6.3 \pm 0.2 g in open sea.

Discussion and Conclusion

The first findings regarding the accessibility to the site are positive. No conflict of use has been noted since setting up the longlines in the sea. Technologically speaking, the methods used have so far responded well to our expectations.

Abundant spat collection seems to be possible at the open-sea site. Doing so will require appropriate management which will take into account competitors and predators on the collectors. Also, sleeving this spat will have to wait the following spring to get mussels of required size. However, spat from Havre-Aubert have repeatedly reached commercial size in only about one year after sleeving at this site.

Second set could be abundant even if longlines are submerged as low as 10 m below the surface. In 2002, the setting of the sleeves took place on October 10 when mussel larvae were still present in the water column. That probably explains the intense second set observed on the sleeves during the following year and the subsequent fall-offs. Losses due to fall-offs were less important in 2004 on mussels sleeved in November 2003. There were probably very few or no larvae at this time, limiting the problem. The problem of fall-offs caused by excess weight due to the second set will certainly have to be taken into consideration.

The high meat yield of mussels in culture in open sea is very advantageous when targeting summer and fresh markets. The consumers would certainly come out a winner. Thus, the high summer meat yields observed in 2003 and 2004 provide great marketing potential for mussels cultured in open sea in Îles-de-la-Madeleine. However, the low weight of the shells could lead to a higher fragility and thus could possibly undermine the mussel processing because of higher proportions of broken shells. That should be examined closely.

Acknowledgements

The authors would like to thank the Société de développement de l'industrie maricole du Québec as well as Canada Economic Development for their financial support as well as Pétoncles 2000, Le Repère du plongeur, Moules de culture des Îles, and the technical staff at the Station technologique maricole des Îles-de-la-Madeleine.

Reference

1. Tita G, Crémer J-F, Long B, Desrosiers G. 2004. Caractérisation environnementale d'un site mytilicole expérimental dans la baie de Plaisance, Îles-de-la-Madeleine (Québec). *Rapp. tech. can. sci. halieut. aquat.* 2559: v + 17 p.