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Are young sea bass, *Dicentrarchus labrax* L., (Teleostei: Pisces) adapted to mussel cultures?

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In Mont Saint-Michel Bay, one of the most abundant food items in young sea bass diets was *Mytilus edulis*. This invertebrate is an abundant cultured bivalve in many coastal systems and it is known to be in direct trophic competition with the natural food items of sea bass. This study shows that mussel culture can play the role of a nursery area, providing food for young opportunistic fish. Quantification of these interactions appears to be of a major importance in order to enable sustainable management of coastal areas.

European mudflats of marine coastal waters such as estuaries and bays are an important nursery for many fish species (Elie et al., 1990). The Mont Saint-Michel Bay (France) represents one of the main nurseries of the English Channel coast for commercial fish such as *Dicentrarchus labrax* (Laffaille et al., 2000). However, human activities exert enormous pressures on these coastal areas and create strong disturbances and functional changes (Costa & Cabral, 1999). In the Mont Saint-Michel Bay, one of the most important pressures on the intertidal areas is mussel culture. Shellfish culture production may be very important in some systems but it does not improve trophic levels since humans remove it. Furthermore, dense populations of bivalves are shown to assimilate a great part of the primary production (Butman et al., 1994), that is less available for other filter feeders. Cultured bivalves, such as mussels, are thus direct trophic competitors together with natural invertebrate filter feeders, all depending on the same resources, especially benthic diatoms and detritus (Savouré & Radureau, 1996). Moreover, natural invertebrate filter feeders constitute the main food items for young sea bass (see review by Pickett & Pawson, 1994). Consequently, cultured bivalves are indirect trophic competitors with young sea bass. In this short note, a preliminary study of the impacts of mussel culture on young sea bass is made by analysing fish diets.

The Mont Saint-Michel Bay (France) is a wide littoral zone situated in the Normano-Breton Gulf (48°40'N 01°40'W) and extends over 500 km². The intertidal mud flats cover 180 km². Extending shellfish cultures (10,000 t y⁻¹ on a total surface of 1,000 hectares) largely occupy the lower levels of the intertidal flat in the western sector of the Mont Saint-Michel Bay (Lefeuvre et al., 2000). Young sea bass were caught monthly in adjacent areas of mussel cultures between January and December 1998 by professional fishermen using traditional fishing gears (10-mm mesh size, 2-m high, 250-m long). In each month, 20 young sea bass stomach contents were analysed.

The number of empty stomachs was counted. Preys were identified and weighed. For each sample the frequency of occurrence (%FO), the numeric structure (%N), the biomass structure (%B) and the Main Food Index (MFI) modified by Laffaille et al. (1999) were calculated, for each food item:

$$MFI_i = [([B_i \times (\%N_i + \%FO_i)/2]^{\frac{1}{2}}) / (\sum_i [MFI_i])] \times 100$$

with i=food item i.

Among the 240 young sea bass analysed (mean LF=108 mm, min LF=70 mm, max LF=190 mm), 59 stomachs were empty (between 0 and 10 per month, in average 4.9). Fourteen food items were identified (Figure 1). Four were dominants: *Nephtys hombergii* (mean MFI=28.5%), *Mytilus edulis* (mean MFI=22.5%), *Hediste diversicolor* (mean MFI=19.5%) and *Crangon crangon* (mean MFI=13.5%). Other items were of minor importance (individual MFI < 4%). Even if these four dominant items were present every month, their importance varied. In February, May and August, *M. edulis* was the most important item (monthly MFI > 34%). In October, November and December, *H. diversicolor* and shrimps were dominant food items (monthly MFI > 33%). In other months, *N. hombergii* were the most dominant food items (monthly MFI > 45%).

This study confirms that, in their young stage, invertebrates and especially crustaceans and polychaetes constitute an important food item for juvenile sea bass (see review by Pickett & Pawson, 1994), but one of the main food items in this study was the cultured bivalve *M. edulis*. This bivalve was the most abundant cultured invertebrate in the intertidal mudflats of Mont Saint-Michel Bay, but it was absent in the natural benthic community (Thorin, 2000). This study confirms that young sea bass are opportunistic feeders which was already known in a number of areas (Pickett & Pawson 1994; Laffaille et al., 2000). It can be noticed that the period when *M. edulis* became of a lesser importance for the sea bass diets (especially from October to December) coincided with the period during which adult mussels were removed from cultures for commercialization. Therefore, during this period, only small size class mussels, corresponding to a new cohort remained, and it is possible that this size of individuals is not attractive for sea bass. In fact, only bigger mussels were caught by the young sea bass. It is certainly easier for fish to extirpate the soft parts from the shellfish of a bigger mussel. Moreover, this period is also the season when *C. crangon* and *H. diversicolor* are more numerous, with dominant small size individuals (Thorin, 2000).

Human activities in coastal areas create strong disturbances and have negative major consequences on fisheries. For example,

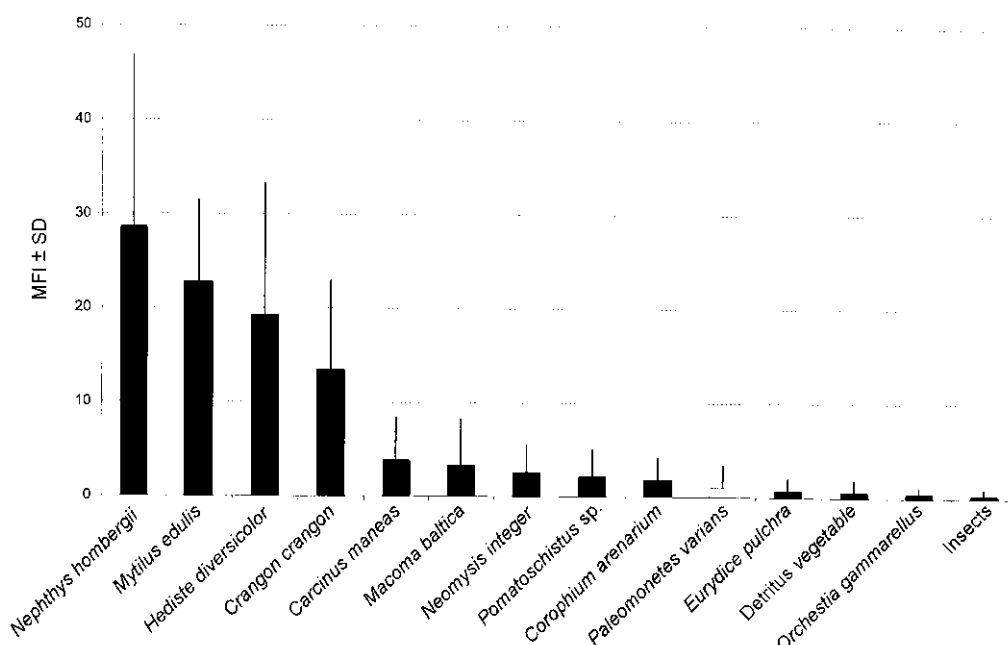


Figure 1. Mean Food Item (MFI $\pm$ SD) from preys identified in young sea bass stomach contents in the intertidal areas of the Mont Saint-Michel Bay.

Author:
Figure 1,
'Item'
or
'Index'?

in Mont Saint-Michel Bay, sheep grazing in intertidal salt marshes reduced habitat, food resources and density of the amphipod *Orchestia gammarellus*, which is the main food item of young of the year sea bass in these wetlands, and therefore sheep grazing reduced feeding activity on this fish species (Laffaille et al., 2000). Due to the fact that *M. edulis* was a trophic competitor with the natural prey of young sea bass (see introduction), it can be hypothesized that mussel cultures pose a problem and consequently disturb sea bass fisheries. This study showed that shellfish culture might contribute to the production of superior trophic levels and that this culture can play the role of a nursery area, providing food for young opportunistic fish. Other examples show that mussel culture is beneficial to aquatic fauna such as the birds *Melanitta nigra*; the mussel culture is the most important moulting site for the common scoter due to the abundance and availability of food (in particular mussels) and the lack of disturbance from human activities (Schricke, 1993). These findings suggest that strong interactions exist between use and resources. In order to improve our knowledge on the relations between aquatic biocenose (such as sea bass) and the coastal habitat, it is important to develop future research on interactions between organisms, whatever their origin (natural or alien, aquatic or terrestrial). Quantification of these interactions at several scales is of major importance to enable sustainable management of ecosystems and especially coastal areas.

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