EFFECTS OF MECHANICAL CLAM HARVESTING ON BOTTOM SEDIMENT IN THE VENICE LAGOON

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Abstract

In order to evaluate the direct effects of clam fishery in the Venice Lagoon, a research project which compare two different mechanical harvesting gears was carried out. The preliminary results showed that the gear action removes the first sediment layers (5-7 cm) of the bottom with significant immediate effects on bottom features (morphology, oxidized layer depth).

Keywords: fishery, sediment, lagoon.

Fishing activity can disrupt the entire ecosystem (1) as it exploits target species, damages/kills non-target species, alters/destroys habitats, also inducing indirect effects such as changes in trophic webs (1; 2; 3). This is more evident for mobile demersal fishing gears (mostly trawls and dredges) that can remove large amount of epi and infauna specimens, since they scrape the surface off, or dig into the seabed (3).

Venice Lagoon is a 'sensitive ecosystem' that experienced in the last decade a growth of mechanical clam (*Tapes philippinarum*) harvesting, with a fishing fleet at present estimated to reach ca. 600 boats with total annual landings of 35000-50000 MT (4).

T. philippinarum is an alloctonous species introduced in the Venice Lagoon since 1983 in order to improve aquaculture production, but, due to its morphological and physiological features (robustness and higher reproductive capacity), presented a demographic boom with a wide dispersion in all the area, becoming an important economic resource.

In order to evaluate the direct effects of clam fishery in the lagoon a research project which compare two different mechanical harvesting gears (one locally named 'rusca' (5) and a prototype gear) was carried out.

In this paper preliminary results concerning the fishing effects on sediment and resuspension are reported; results are discussed in the light of fishing gear efficiency data.

Sediment profiles images were acquired by means of a REMOTS® (Remote Ecological Monitoring of the Seafloor) sediment camera (6) that allows the upper 20 cm of the sediment to be documented by photo (7).

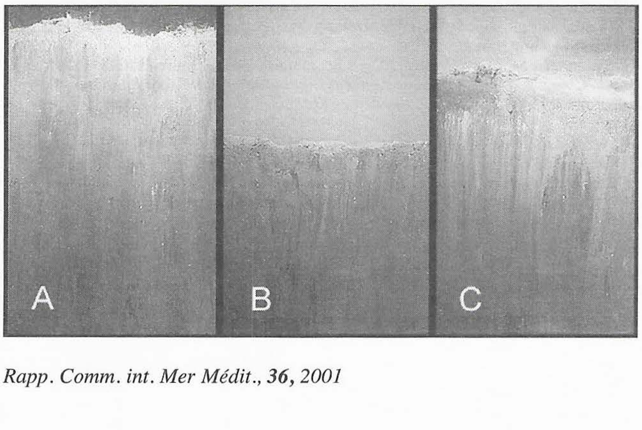
A number of 3 images in 5 stations were acquired in a previously undredged muddy bottom area (mean depth 1.0 m) in order to describe the undisturbed habitat.

Then two experimental hauls (with 'rusca' and 'prototype' dredge) were carried out and two sets of 15 images were acquired into the disturbed areas (tracks).

To characterize the dredge induced sediment plumes in terms of total Carbon, organic Carbon and Nitrogen contents, two water samples were collected respectively before and after 'rusca' dredging, and before and after 'prototype' dredging.

Fishing gears efficiency was assessed by comparing pre-dredging clam densities (investigated by means of 10 Day grab (0.1 m^2) replicates) with the catches for square meter of 7 experimental standard hauls.

In figure 1, three examples of digitally analysed sediment profile images, acquired before (1A) and after dredging (1B and 1C), are reported.



Sediment profiles images showed no significant changes in bottom grain size after dredging; whereas average redox potential discontinuity (RPD) depth indicates that the oxidized layer thickness was significantly ($p<0.05$, Mann Whitney U Test) reduced by 'rusca' dredging and only disturbed by the 'prototype'.

After 'rusca' dredging, mean penetration depth, measured by means of REMOTS, showed a significant decrease ($p<0.01$) from 23.7 to 16.8 cm, whereas no significant differences were observed after 'prototype' dredging.

Both 'rusca' and 'prototype' dredging produced a significant sediment plume, as confirmed by the significant increase ($p<0.05$) in total and organic C and N concentrations after dredging.

These preliminary results shows that the effects of mechanical clams harvesting on bottom sediments are 'gear specific', being the 'rusca' more disruptive than the 'prototype'. All this is connected with the different observed efficiencies (40% in 'rusca; 13% in 'prototype'), since the higher 'rusca' performance could be the consequence of deeper or stronger interactions of the gear with the bottom. Even if 'prototype' seems to induce lower disturbance on the bottom, it must be considered that, to gain the same 'rusca' catch level, the 'prototype' has to sweep a 3 times larger area.

The digging action produced by mechanical harvesting activity removes the first sediment layers (5-7 cm), as described also for other fishing gears (8), with significant immediate effects on bottom features (morphology, oxidize layer depth).

On long term scale, the continuos dredging could produce permanent changes, such as modifications of grain size towards coarser fractions (9) and of geochemical features. All this could be quite stressful for a sensitive ecosystem such as the Venice Lagoon.

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