Corso di Dottorato di Ricerca in Scienze della Vita e dell'Ambiente - Ciclo XXXVIII
Biologia ed Ecologia Marina
Dipartimento di Scienze della Vita e dell'Ambiente

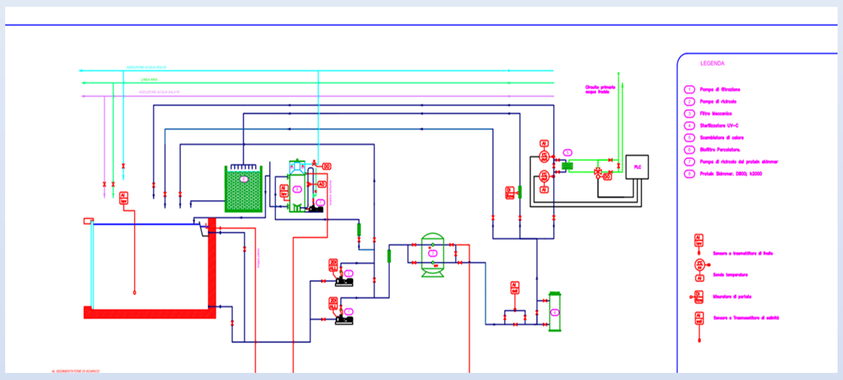
Technological development for studies in the field of experimental marine ecology

Domenico Sacco


Cymodocea nodosa


Acesta excavata


Gongolaria barbata



Typical example of P&I of a *Life Support System*

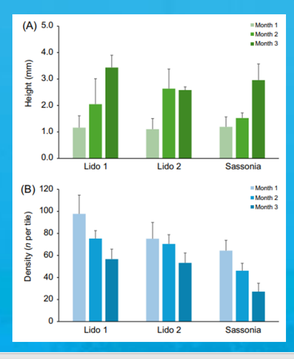
All experiments are carried out in the experimental aquaria.

To guarantee the highest standards in the maintenance of marine organisms in a controlled environment, we used LSS (*Life Support System*).


Aquarium systems used for the experiments

1 Stranded seaweeds (*Gongolaria barbata*): an opportunity for macroalgal forest restoration

Is it possible to use beached fragments of *Gongolaria barbata* to create new recruits?



Mean heights (A) and density (B) of Gongolaria barbata recruits on tiles placed below the fertile adults, across the 3 months in mesocosms. Data are reported as mean ± SE.

Stranded individuals of *Gongolaria barbata* offer an opportunity to promote habitat restoration.

RESTORATION ECOLOGY
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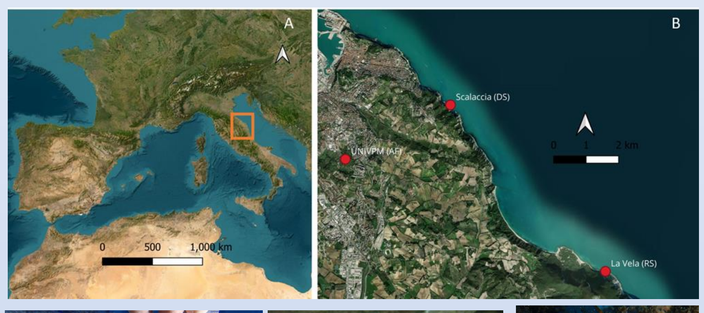
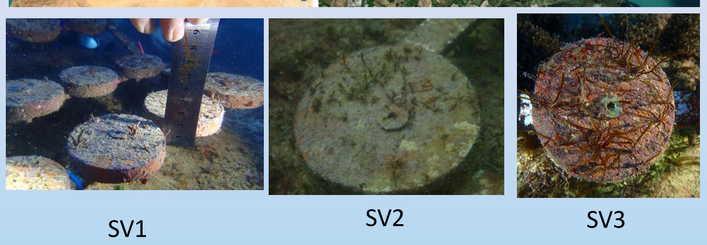
PRACTICE AND TECHNICAL ARTICLE

Stranded seaweeds (*Gongolaria barbata*): an opportunity for macroalgal forest restoration

Giuliana Marletta[1,2], Domenico Sacco[1], Roberto Danovaro[1,2], Silvia Bianchelli[1,2,3]

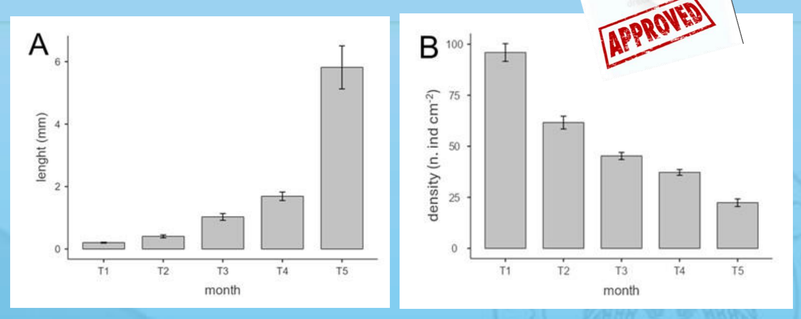
2 The effect of transplantation depth on the restoration success of *Gongolaria barbata* (Fucales) in the Mediterranean Sea



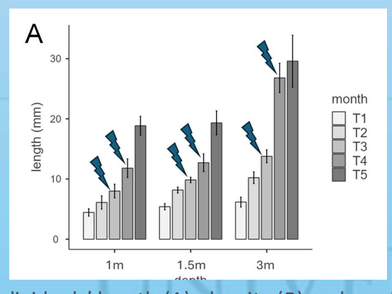

SV1 SV2 SV3

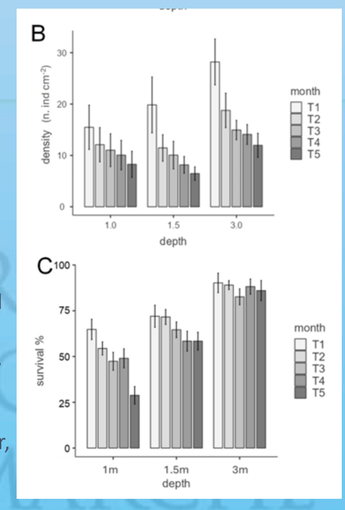
Objective: to test different outplanting depths to evaluate which one promote an effective and longterm recovery of *Gongolaria barbata* in a exposed site along the Conero Riviera (Adriatic Sea).
In the ***aquaria***, some small nets were put on the surface with the fertile apices inside and on the bottom were put clay tiles on which the zygotes will fall resulting in new recruits. The temperature (about 20°C), photoperiod (15L:9D) and light intensity (125 µmol photons m^{-2} s^{-1}) were set to reflect the environmental conditions at sea during the reproductive period of the species.
In the ***field***, in July, the tiles were outplanted to the restoration site (La Vela). The tiles were screwed to three 65-cm-long steel structures and fixed to the sea bottom.

The three structures were anchored at three different depths: 1 m (SV1), 1.5 m (SV2) and 2.5 m (SV3).



Individuals' length (A) and density (B) from the beginning (T1) to the end (T5) of the cultivation in mesocosms. Data are expressed as mean ± standard error. (T1 = march, T2 = april, T3 = may, T4 = june, T5 = july 2023).

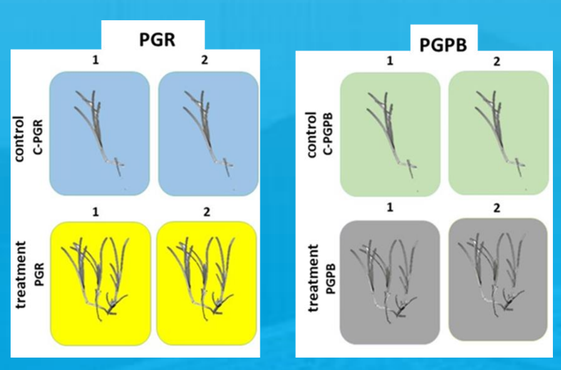




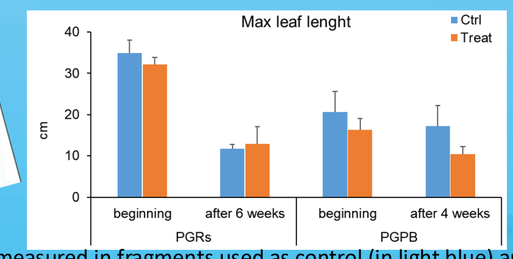
Individuals' length (A), density (B) and survival (C) from the beginning (T1) to the end (T5) of the experiment, after the transplanting at sea. Data are expressed as mean ± standard error. The lightning indicates the storms occurred during the study. (T1 = august, T2 = september, T3 = october, T4 = november, T5 = december 2023).

3 Effectiveness of growth promoters for the seagrass (*Cymodocea nodosa*) restoration

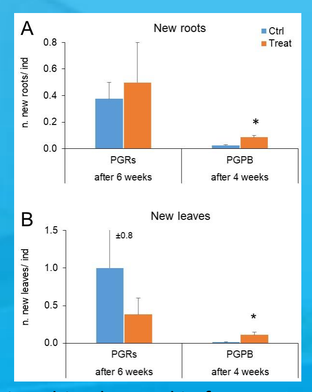
Objective: to test the effects of PGRs and PGPB on the survival and growth of different types of fragments of *C. nodosa*, namely stranded or fragmented and maintained in aquaria, to explore their potential to produce new shoots and roots and thus representing a potential source of cuttings for restoration interventions



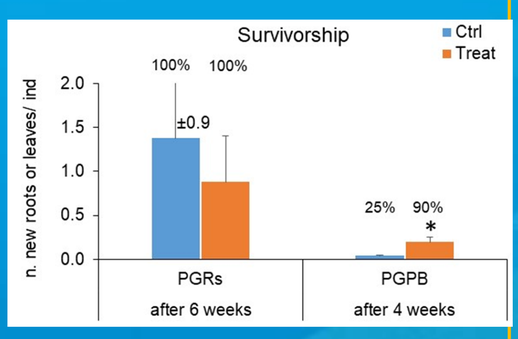
Experimental design for the PGRs and PGPB experiments. In each experiment, *C. nodosa* fragments were exposed to PGR (left panel) or PGPB (right panel) and compared to fragments not exposed. Treatment = treated fragments (with PGR or PGPB, depending on the experiment); Control = fragment not exposed during each experiment (C-PGR and C-PGPB, respectively); 1 and 2 = code of the tank used.



Max leaf length measured in fragments used as control (in light blue) and those exposed to PGRs or PGPB (in orange), at the beginning and after 6 and 4 weeks, respectively. Data (in cm) are reported as average of values measured in the tanks ± standard error. Ctrl = control, Treat = treatment.



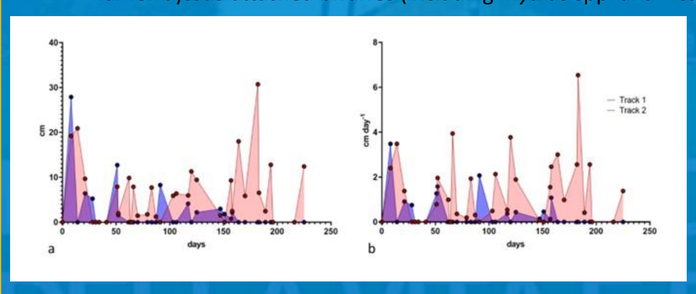
New roots (A) and new leaves (B) observed in fragments used as control (in light blue) and those exposed to PGRs or PGPB (in orange), after 6 and 4 weeks, respectively. Data (as number of new roots and leaves per fragment) are reported as average of values measured in the tanks ± standard error. Ctrl = control, Treat = treatment; ind. = individual (= fragment); * = $p < 0.05$.



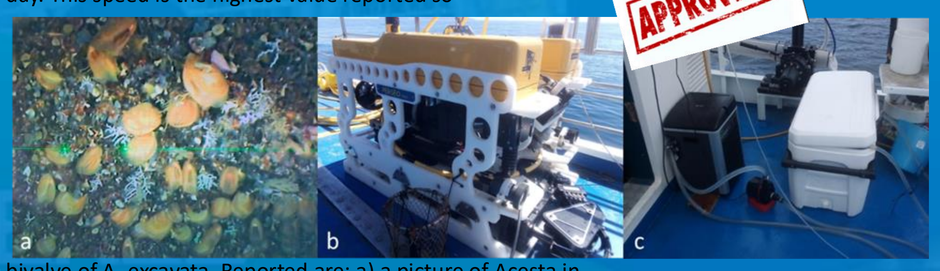
Survivorship observed in fragments used as control (in light blue) and those exposed to PGRs or PGPB (in orange), after 6 and 4 weeks, respectively. Data (as number of new roots or leaves per fragment) are reported as average of values measured in the tanks ± standard error. Reported are also the % of individuals developing new roots or leaves. Ctrl = control, Treat = treatment; ind. = individual (= fragment); * = $p < 0.05$.

4 Can the movement of the deep-sea bivalve *Acesta excavata* lead to a dynamic habitat?

Here we investigated, in **mesocosm conditions**, the ability of this deep-sea species to move/displace and compared its mobility with that of other shallow-water species. We report here for the first time that *A. excavata* moves almost continuously, with a maximum speed of 6.5 cm day^{-1} (maximum weekly displacement of ca 28 cm), with average speeds of approximately 0.3-1.3 cm per day. This speed is the highest value reported so far for byssus-attached bivalves (including *Mytilus* spp. and *Pictada imbricata radiata*).



Range of observed displacement (a), and speed (b) of *A. excavata* specimens during the monitoring period.



Phases of the collection of the bivalve of A. excavata. Reported are: a) a picture of Acesta in situ (Dohrn Canyon, Tyrrhenian Sea, Mediterranean); b) ROV equipped with the collection basket; c) refrigerated box for the transport of the specimens.

5 Abyss Deep Tank