"CRAB"

Towards European Best Practice in marine aquaculture biofouling

Biofouling is a complex and recurring problem in all sectors of the European fish-farming industry. The problem greatly reduces the efficiency of materials and equipment in aquaculture as it can physically damage equipment (abrasion, brittleness, increased load) and increase drag. Water flow can be significantly lessened – directly reducing food supply. Biofouling can also accelerate corrosion and bio-deterioration problems. Finally, the selling of biofouled shellfish can be affected on aesthetic grounds, or because the fouling is not compatible with product processing or packaging methods.

In summary, uncontrolled biofouling leads to significantly increased maintenance costs and production losses (low growth/poorer quality).

Surfaces immersed in the aquatic environment become biofouled when unwanted aquatic organisms such as barnacles, tubeworms and seaweed settle and grow on those surfaces. **CRAB** is a pan-European initiative that aims to develop **effective biofouling management strategies** for the aquaculture industry. It reviews current fouling control techniques and technologies and optimizes suitable strategies to combat biofouling in aquaculture. This includes biological control (using natural grazers), new materials such as non-toxic antifouling coatings, electrical methods (generating biocides or pH shifts) and new shellfish handling and immersion techniques. A key ambition of this Collective Research is to increase the knowledge base of the European aquaculture community on biofouling.

The project has been monitoring biofouling from Norway to the Canary Isles. A series of standard panels submerged at a depth of 2m on each site were assessed monthly using digital photography to monitor recruitment and succession. **Problematic biofouling species** have been identified in the first fouling season, and segmented into 6 groups: algae, barnacles, mussels, tubeworms, ascidians and hydroids. The **development of the biofouling community over the season** has also been studied and has shown the following results so far:

- At southern sites soft-tube forming amphipods and polychaetes dominate all year.
- At the intertidal site, diatoms give way to crustose, coralline red algae.
- At northern sites, *Ectocarpus sp.*, a brown algae, dominates.
- Blue mussels appear from June and are present at most western sites by September.
- Tunicates are found in Scotland from June and later in northern Norway.

The main principles that have been identified to **reduce biofouling on infrastructure and equipment** are to combat settlement, to prevent fouling from developing and/or to remove the biofouling (by cleaning or reducing the adhesion forces). **Net cleaning**, through various methods, is the most widely used strategy in many finfish producing countries. The cleaning may be done underwater, or on land, after drying the nets to kill the biofouling organisms. Another

Project acronym:
CRAB

Full title of Project:
Collective research on aquaculture biofouling

EU contract number:
500536

Web-site:
www.crabproject.com

Coordinator
Mr. Peter Willemsen
TNO (Netherlands Organisation for Applied Scientific Research)
Department of Science and Industry
Bevesierweg gebouw MML
Postbus 505
1780 AM Den Helder
The Netherlands

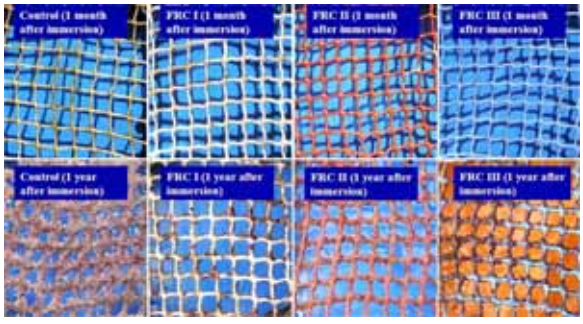
Phone: +31 223 638850
Fax: +31 223 638888
Email: Peter.willemsen@tno.nl

important strategy is **net coating**, especially non-toxic fouling release coatings, of which some are being tested in CRAB in "real-situation" farms. In both strategies, the most important factor for effective antifouling treatment is the **ability to accurately predict the occurrence of fouling episodes**.

Antifouling measures on **shellfish** are based on husbandry and cleaning methods and involve manual or mechanical cleaning, facilitated by dipping (for example in hot water) and air drying. Here again the timing of any treatment is of primary importance. CRAB is also assessing other strategies, including the **use of grazers** such as sea urchins (*Paracentrotus lividus*) and sea snails (*Monodonta lineata*) in shellfish trays. In addition, the possibility of allowing **tunicates** to foul shellfish is being explored, as these organisms would prevent other fouling organisms taking hold and as they are easy and therefore cheap to remove. Furthermore, special shellfish coatings are being looked into for their efficacy.

In the next 10 years the choice and availability of biocides for use as antifoulants will become much more restrictive within Europe with the application of the Biocides Products Directive EC 98/8/EC. Informing farmers about the importance and extent of biofouling at a local and regional level, combined with effective training in management tools, will give farmers the skills and know-how to make informed appropriate choices for their farming situation. CRAB will contribute to increasing the knowledge base of the European aquaculture community on biofouling by developing Best Practice Guidelines and a Biofouling Manual.

"BIOFOULING HAS BEEN MONITORED THROUGHOUT EUROPE"



FOULING-RELEASE COATINGS SHOW PROMISE FOR THE FUTURE.

PROFET Policy receives financial support from the Commission of the European communities under the thematic priority of integrating and strengthening the European Research Area (ERA), contract FP6-SSA-022771. Information contained in this Technical Leaflet does not reflect its views and in no way anticipates the Commission's future policy in this area.