CAN GASTROPODS BE FOUGHT DOWN BY INTENSIVE FISHING?  
A Case Story from Denmark 1910

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INTRODUCTION

The newspaper Bangkok Post published a story called "Sinking ships to save marine life" the 31st July, 1991. It appears from the story that the Diving Club of Krabi is very worried about conditions for survival of marine species. The Diving Club states that private tourism business operators have kept campaigning for not selling coral and sea shells in souvenir shops, as part of the education process for both villagers and tourists not to destroy nature. Following the move of not selling nature's products, the province invented a new type of souvenir to offer nature lovers, called the toy of Krabi Province. The toy is made from plaster cement in the shape of animals like turtles, fish, birds, then decorated with small pieces of broken sea shells collected from the beaches.

Recently staff from the PMBC attended a meeting in Trang south of Krabi. A fisherman explained about catching Chicoreus ramosus, the target species of the Tropical Marine Mollusc Programme (TMMP). He fished for the snails in an area with high density of these snails, but even if he fished as much as he could, he never observed the population to decline.

If we compare the worries expressed by the Diving Club of Krabi with the statement of the fisherman there seems to be quite a conflict. However, both parties may be right. The main problem is that the statement from Krabi is a generalization, and as such misleading because the biology of most gastropods and bivalves is virtually unknown. Some species, such as the triton snail, is today virtually extinct in the Thai part of the Andaman Sea. Without doubt this is due to overfishing.

Figure 1. Northern part of peninsular Jutland, Denmark, showing the location of the Limfjorden. Thisted Broad indicated by arrow.

In this case a regulation, ruling out minimum size for selling (or some other measure of conservation) would have been appropriate in order to prevent the species from disappearing.

In a number of other species, particularly smaller species with pelagic larvae, regulation will not be necessary. Overfishing of such populations will not be possible by use of conventional methods. The following story from Denmark is presented to illustrate this point. The study took place 80 years ago, but since (to my knowledge) there never has been a similar study in tropical waters, it is presented within the frame of the Tropical Marine Mollusc Programme (TMMP) at this workshop.
The Study Area

The Limfjorden is a body of sea water stretching across the northern part of peninsular Denmark from east to west, connecting the Kattegat with the North Sea (Fig.1). In consequence, the fjord is not a true fjord but rather a sound subdivided into a number of broads filled with shallow water, rarely exceeding 6-9 m in depth. The broads are connected by narrow channels characterized by strong currents and depths of about 20 m.

MATERIALS AND METHODS

Around the turn of this century, fishing was an important source of income for local people. They wanted to maximize the income from fishing, and were therefore interested in fighting down marine invertebrates known to be harmful to fisheries. They focused on two species, viz. the small whelk Hinia (Nassarius) reticulata, occurring at densities from 3-6 individuals per sq.m, and the larger Buccinum reticulata with densities from 0.5 to 1.5 individuals per sq. m. Both species of whelks are carnivorous. They feed on bivalves or as scavengers on a variety of other animals, including fish caught in traps or gill nets. The latter habit made the fishermen complain because the whelks damaged good catches of plaice which then lost their market value. The snails would use the radula to rasp holes in the skin of fish hanging in the mesh of the net, then insert the long extensible proboscis through the hole and eat quantities of muscular tissue from the trapped fish.

This problem was especially pronounced in the Thisted Broad of Limfjorden, where up to 8 Hinia and 3 Buccinum would attack a single flatfish, mainly plaice, and destroy it.

A well known fisheries biologist C.G.Johs. Petersen was contacted by the fishermen and asked for advice to solve the problem with the whelks. He decided to try to help. His plan involved intensive fishing using hive traps, a kind of eel pot with bait enclosed. The bait was either dead, or dried salted fish.

RESULTS

At the time of the study, Petersen (1911) and Petersen & Jonsen (1911) estimated the total area of Thisted Broad below the 6 m depth contour to be 65 million sq.m. This area harboured approximately 275 million Hinia reticulata and 80 million Buccinum undatum. The total live weight of these snails amounted to approximately 410 tons (Petersen, 1918 p.27).

Petersen hired a motor boat and two fishermen from April to November 1910. It became their job to fish for whelks with 240 hive traps. the fishing area was decided by transects running across the Broad. Every time the traps were harvested, they were moved 20-40 m in order to avoid overfishing of any particular transect.

When fishing was most intensive in June to August 1910, a total of 80-90 hive traps were harvested per day, each trap containing 3-5 kg live weight of snails. In total the harvest in 1910 amounted to 45.6 million snails which, however, only constituted about 10% of the estimated biomass.

Catch per effort as an Indication of oxygen deficiency

Figure 2 is based on detailed Tables in Petersen (1911). Fig.2(A) shows that the catch decreased considerably during 18-27 July 1910. Petersen mentions that the summer temperature was very high that year, but he does not give specific measurements from water in the study area. However, he informs that plaice were found dead in gill nets as indicated on the Figure.

At a nearby locality, Oddesund, measurements of water temperatures were performed daily and these measurements do not indicate especially high summer temperatures in 1910.

Spärck (1925) showed that water temperatures reached 20 degrees centigrade a few days
prior to the 18th July 1910, i.e. the time when plaice died in nets and the catch of whelks decreased dramatically. After the peak value of 20 °C, the temperature suddenly dropped to 18 °C during 18-21 July, and then continued to decrease gradually to 15 °C at the end of August.

I conclude that there is no indication of water temperatures being notably different in 1910 as compared to normal years in the Limfjorden. Extreme temperatures can not explain the low during 18-21 July (Fig.2A). An alternative explanation would be oxygen deficiency immobilizing the whelks and killing the trapped fish. Unfortunately there are no data to substantiate this theory but catches were lower than should be predicted in both August, September and October (Fig.2 B), i.e. the months known to be troubled by oxygen deficiencies in recent studies with emphasis on oxygen concentrations.
Fig. 2(B) shows the catch per effort. The dotted curve depicts the expected relationship based on the months April, May and June. The weight of whelks per hive trap is plotted against the number of traps harvested per day. Compared to the expected relationship, the catch-es in August, September and October were reduced with 27, 53, and 39%, respectively, while November falls on the line of expected catch per effort.

Petersen (1911) had noticed the decline with time (Fig. 2 C) but he interpreted the low in November as a temperature effect. He felt that the approaching winter would make the whelks inactive and uninterested in the baited traps. It is well known that many benthic invertebrates stop growing during winter in Denmark, e.g. blue mussels, cockles and hydrobiid snails. To what extent the same applies to whelks is unknown.

CONCLUSION

Petersen (1911) came to the conclusion that it would not be possible to fight down the whelks, even if the efforts were intensified. It would be an ever-lasting fight. These species would never go extinct and Petersen reminds us about efforts to exterminate rats and other pests. In spite of concentrated efforts to get rid of these species, mankind never succeeded. *Hinia reticulata* spawns egg capsules where eggs develop into planktrophic larve. These larvae are easily spread by currents and they will quickly recolonize any area cleaned by intensive fishing. The whelk *Buccinum undatum* also spawns egg capsules but the larvae are not pelagic. When they have finished their development they crawl out and become instant members of the benthos.

In theory whelks should be easier to fight down but in the study of Petersen (1911) he concluded that economic considerations would forbid this to happen. The value of whelks was far too low to bring about a viable fishery for these snails. At that time there was no market for whelks in Denmark since they were not appreciated as food (contrary to the situation in France and England!). Petersen also tried to feed whelks to chicken. He found that they produced eggs of excellent quality, without any unwanted flavour. He also tried to use whelks for bait since this was common practice among local fishermen. He pickled the whelks to find out if it would be possible to store the rather large quantities of meat obtained from the hive traps harvested every day. He found that it was possible, but again the economy prevented this kind of utilization. It was not feasible, so his main conclusion was that it would not pay to control the whelks.

REFERENCES


