EFFECT OF SEA WATER DESALINATION WASTE PRODUCTS

ON FISH DEVELOPMENT

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Introduction

The aim of this study is to understand the effect of desalination waste brine on the early life stages of turbot *scophthalmus maximus* L.

Water desalination is very important in many countries where fresh water is scarce. Many desalination plants have been built and are functioning in many parts of the world. These plants separate salt from seawater using several techniques, the end product is fresh water that goes to the people and hypersaline hot brine that is poured back to the sea. This contains several substances like corrosion products, antiscaling additives (polycarbonic acids, polyphosphates), antifouling additives (chlorine and hypochlorite), halogenated organic compounds formed after chlorine addition, antifoaming additives, anticorrosion additives, oxygen scavengers (sodium sulfite) causing oxygen deficiency, acid, Heat and The concentrate which is the excess salts. (T.Hopner, et al. 1996). Del Beve (1994) states that " extremely high salinities (twice the ocean ambient) can impact ocean biota if the biota are exposed for extended time periods. For brine discharged near the ocean bottom the benthic environment could be exposed to high salinities for as long as the effluent continues." To elucidate the effect of brine discharged from a desalination plant upon coastal marine organisms, Iso et al. (1994) carried out preliminary experiments on the incipient lethal high salinity (ILHS) on some stages of the development such as fertilised egg, larva, juvenile and adult, of two species of fish and a bivalve. They found that the ILHS was about 50 ppt or even higher (ranging 50-70 ppt), the high salinities here caused delay in embryonic development.

Materials and Methods

All the fertilised and non fertilised Turbot eggs were purchased from the Manin Farms from Isle of Man

Preparation of solutions:
All the solutions were made from normal filtered seawater (the seawater was filtered with the help of absorbent cotton)
Boron Solution with 50‰ salinity:
The boron solution was made by dissolving 100 mg of (Na2B4O7.10H2O) DI-sodium tetraborate/L of filtered seawater, then artificial salt was added to the solution until it reached the wanted salinity which was 50‰, the salinity was recorded with the help of a portable salinometer. The solution was then aerated for 2 or 3 hours before being used each time.
Preparing 50‰ salinity solution:
This was prepared by adding artificial salt till arriving to the wanted amount of salinity, which was measured by a portable salinometer.
Preparing the mixed 50‰ and pH6 solution:
The 50‰ solution was prepared as above then 10% Hcl was added drop by drop till the wanted acidity which is ph6 was reached, the acidity was measured by a pH meter, then the salinity was measured again. The acidity and salinity of this solution was measured each time before using it in order to make sure it was the right one.
PH6 solution
10% Hcl was added to normal sea water drop by drop till the normal acidity ph6 was reached, and it was measured by a pH meter.
Streptomycin sulphate and penicillin were added to all the solutions, the amount was 1 mg/L
All solutions were well aerated each time before use.
Apparatus and Glassware:
All the tanks used in this experiment to rear eggs and larvae in were washed very carefully with hot water and soap, then all the inside was swept with ethanol and set to dry upside down on a bench wiped with alcohol.

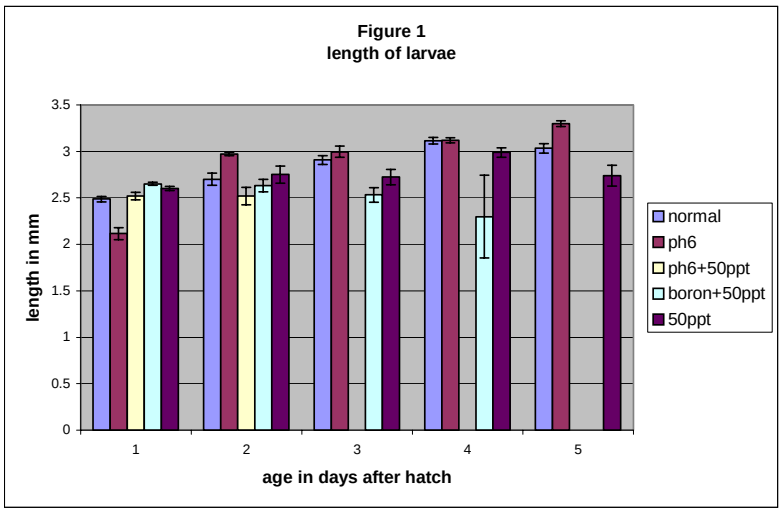
Each day specimens were taken from each tank having alive eggs or larvae, with the help of a Pasteur pipette; the samples were fixed into Bouin's fixative and 10% formalin in seawater, in order to make whole mounts and histological sections from these samples. Some samples were frozen with their solutions for physiological analysis.

Every day live specimens were video taped, which was to record the actual shape and activity of the specimens. A stereo microscope connected to a video camera was used to do the recording .

Histological wax sections were made by using Haematoxylin & Eosin method .The sections were then photographed compared for differences and measurements eg. body wall, and eye cup measurements which was done by the help of an image analysis program called Image tool .
Statistical data analysis was done by excel for all the measurements gathered.

Results:

High salinity solutions caused high death among embryos and larvae. Larvae length was affected by high salinity , but not by acidity,fig 1.
It was also clear that the larvae in hypersalinity solutions used up their yolk sac content more quickly than the control, which proves that they were under stress. The body wall was thicker in the larvae reared in hypersaline



solutions that in the control ,which proves the existence of a relation between chloride cells present in the body wall and osmosis regulation in turbot larvae.
The larvae treated in pH6 hatched prematurely ,without stain which also shows some effect of acidity on stain cells in the body wall.

The larvae, which were treated with the boron+50ppt solution, had a C shaped body, showing some malformation in the vertebral column. As shown in Fig 2

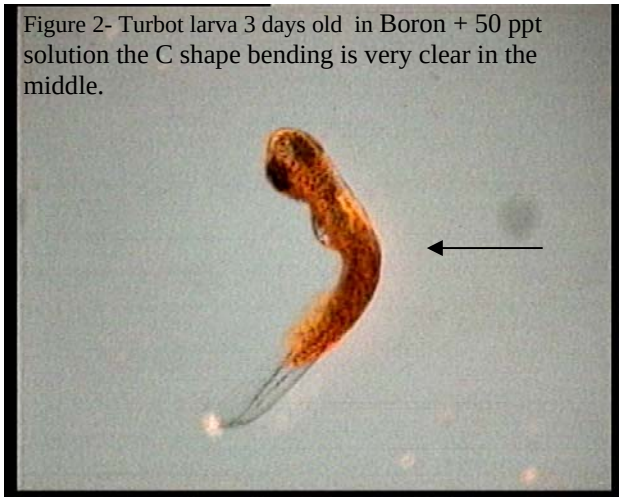


Figure 2- Turbot larva 3 days old in Boron + 50 ppt solution the C shape bending is very clear in the middle.

We conclude from this work, that the desalination waste brine has direct effects on turbot embryos and larvae, and it should have other effects on other marine organisms. Therefore, these waste products should be treated before being poured back to the sea.

References

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