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Physiological and Immunological Responses of Sea Urchins Exposed to Low Salinity and Handling Stress

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Introduction

Sea urchins and other marine invertebrates are becoming increasingly important both in aquaculture and the development of biomedicines. However, in an aquaculture environment, animals encounter stress due to handling, salinity change, and crowding, which can cause loss of animals and loss of profit due to lowered disease resistance, lack of treatment for disease, and lowered growth rate.

Objectives

To examine the immunological and physiological effects on sea urchins in conditions that might be encountered in an aquaculture environment.

Materials and Methods

Purple sea urchins (Stronglyocentrotus purpurtus) were obtained from Bodega Marine Laboratory, CA. Three treatment groups were established:

- Handling
  - Three times daily for 5 minutes; kept at optimal salinity (34 ppt)
- Low Salinity
  - Kept at 28 ppt
- Controls
  - Optimal salinity (34 ppt) and never handled

After 72 hours in treatment conditions, hemal fluid was collected for analyses of cells (coelomocytes).

Results

- **Phagocytic Cell Count**
  - Fig. 2: Packed coelomocyte volume as determined by hematocrit.
- **Vibratile Cell Count**
  - Fig. 3: Hemal fluid protein as determined via protein refractometer.
- **Phagocytic Capacity**
  - Fig. 4: Phagocytic capacity of phagocytic cells.
- **Lytic Activity**
  - Fig. 5: Lytic activity as determined by lysozyme turbidity assay.

Conclusions

Handling and low salinity produce stress responses in sea urchins, as can be seen from the increased cell counts, packed coelomocyte volume, and hemal fluid protein. This stress is also reflected in the reduced phagocytic capacity and lytic activity of the cells. It also would seem that care must be taken to maintain the proper salinity levels and keep handling to a minimum as these can produce stress that could lead to loss of production.

Impact

Our study of the physiological and immunological parameters in invertebrate aquaculture can be used for increased production and to make better pharmaceuticals in the future.

Further Research

Areas for further research include molecular analyses to validate the findings, and similar studies on other echinoderms of interest such as sea cucumbers.

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