

**Tests of a ballast water treatment
system onboard an ocean-going vessel
and
hints on a new sampling device for
larger volumes of water**

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Characteristics of the OceanSaver® Ballast Water Treatment System

- The system is a modular three-step treatment system
- It consists of a
 - 50 μm filtration unit
 - Nitrogen injection
 - cavitation unit (C-3)
- The required footprint is small, i.e. existing ships may be retrofitted



Vessel details

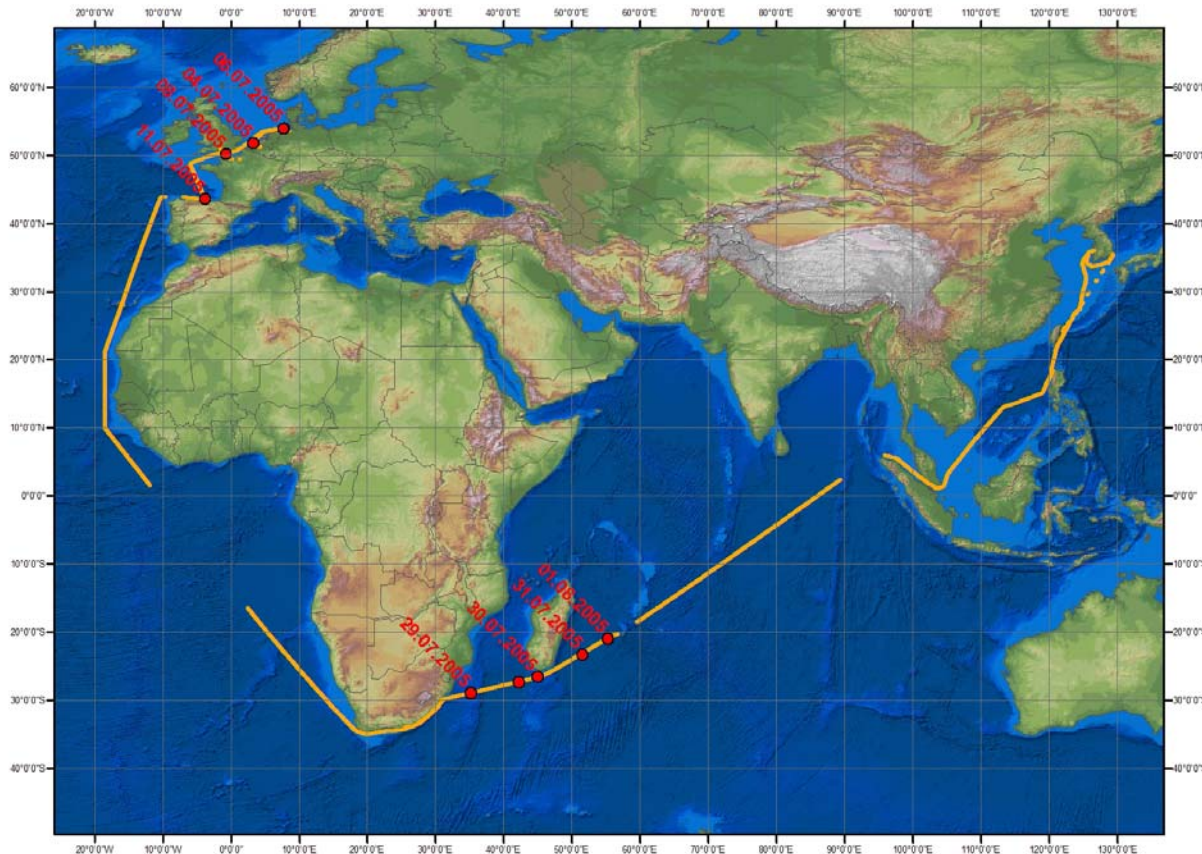
Roll-on roll-off Car Carrier Höegh Trooper

- built in Ulsan, Korea, in 1995
- gt 56,164 (ITC 69), 21,414 dwt (summer)
- Length 199.99 m, breath 32.26 m, draft appr. 10 m
- car capacity: 5,689 standard car units
- 15 ballast water tanks
- total ballast water capacity 7,158 m³ or 7,337 mt
- test tank No 4 portside 910 m³ or 933 mt
- control tank No 4 starboard 932 m³ or 956 mt



Voyage details

- The two first voyages were undertaken from:
 - July 4th to 11th and (NW Europe)
 - July 28th to August 2nd (South Africa - Mauritius)



Test set-up onboard

- In total 11 sampling trials were undertaken
- Prior each trail the ballast tanks (treated & control) were emptied completely
- During tests both tanks are filled simultaneously
- Both tanks are (nearly) identical in construction and size (portside and starboard tanks)



Sampling Water Characteristics

- In addition to biota (zooplankton and phytoplankton), the following parameters measured
 - Temperature, pH & salinity
 - Barometric pressure, oxygen & total gas content
 - Chlorophyll & Phaeopigment
 - Total Suspended Solids
 - Particular Organic Matter
 - Particular Inorganic Matter



Sampling points

- Various sampling points of identical design were installed in the ballast water pipes (in-line sampling)
 - after the ballast pump prior the filtration unit
 - after the filtration unit prior nitrogen unit
 - in the discharge line
- Additional sampling points were installed to sample the organism density in both tanks (in-tank sampling, two levels in each tank)



Sampling device

- A new sampling device for the concentration of organisms $>50\ \mu\text{m}$ was designed
- The device collects and concentrates water simultaneously
- A flow-meter indicates the volume of water sampled
- In 30 minutes up to 2.5 cubic meters of water were sampled

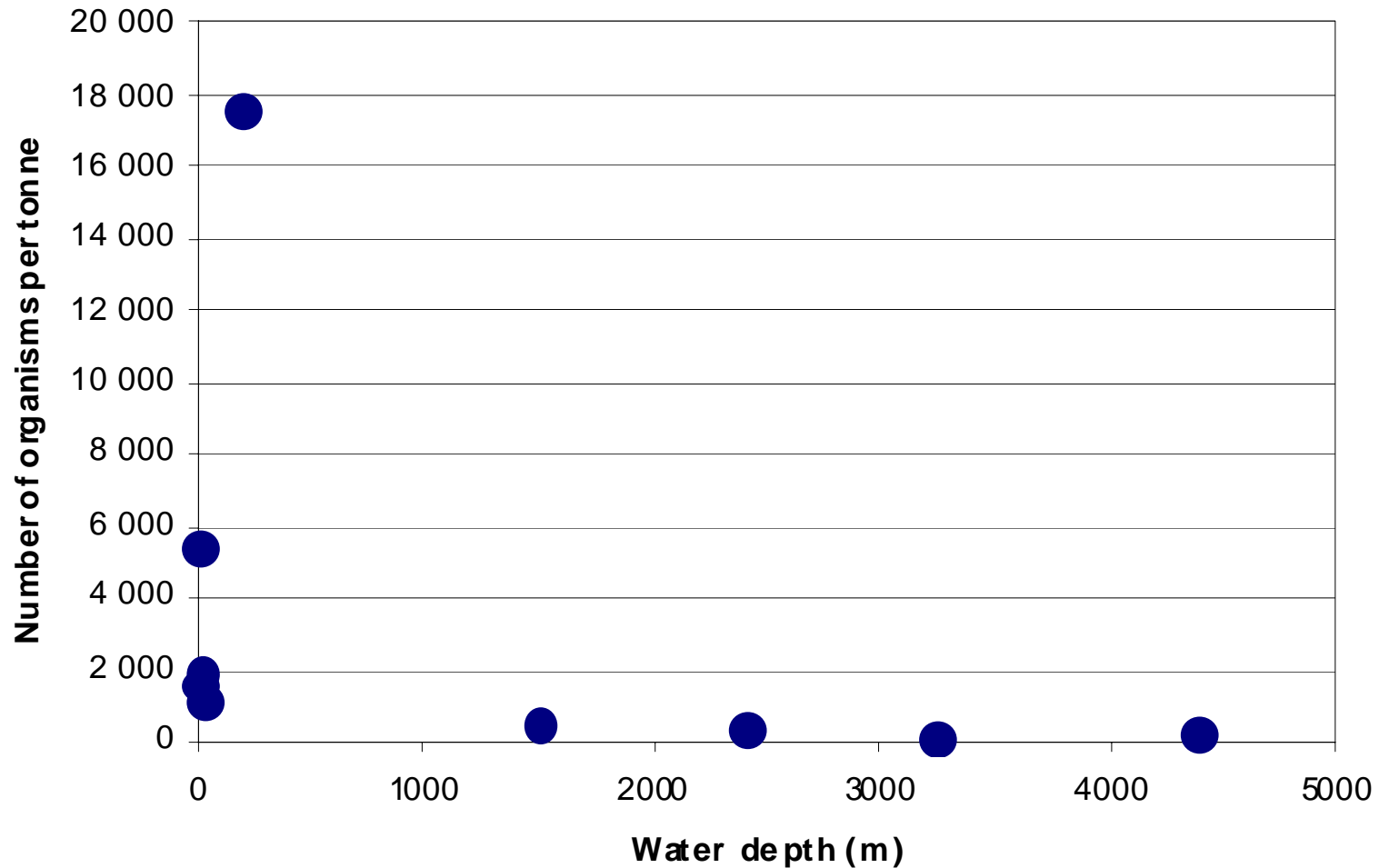


Sample analysis onboard

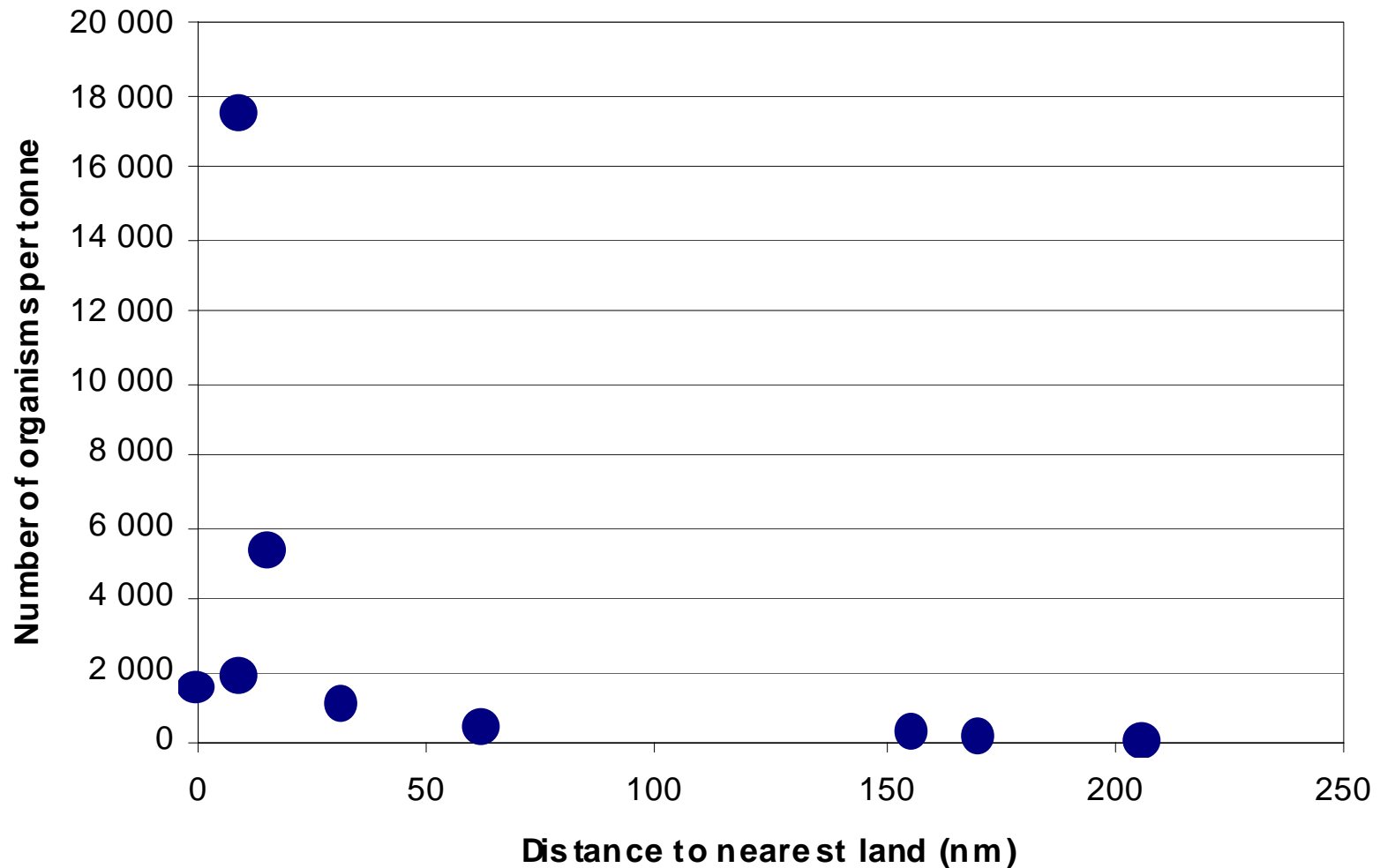
- Zooplankton samples were analysed onboard immediately after sampling
- Living and dead organisms were counted by using a stereo-microscope
- The living/dead judgment was made according to organism movement
- Organisms were poked to initiate movements
- Phytoplankton samples were analysed in a land-based laboratory



Organism concentration in uptake water (pre-filter samples)

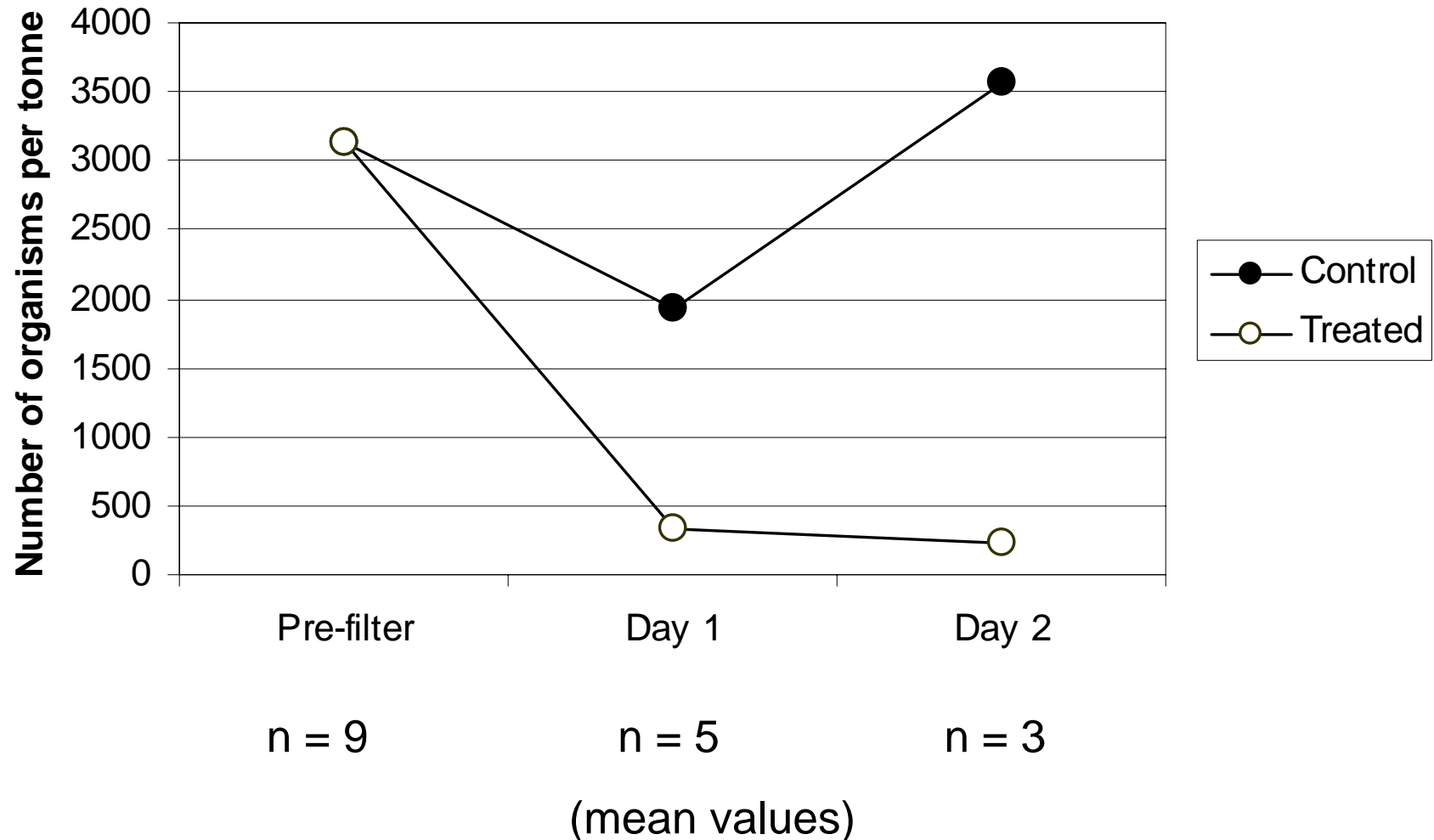


Organism concentration in uptake water (pre-filter samples)



First treatment results

Filtration & Nitrogen unit only !



Summary

- The modular OceanSaver[®] treatment system can easily be installed onboard with a small footprint (also on existing vessels)
- The filtration and nitrogen system were tested
- The new sampling device proved to be a very useful tool (up to 2.5 m³ sampled in 30 minutes)
- During the 11 initial trials the number of living organisms dropped significantly after treatment - and to a lesser degree in the control tank (impact of ballast pump?)
- Organism numbers increased in control tank

Future plans

- Longer term experiments are planned to better assess organism survival after treatment (recovery test)
- After installation of the cavitation unit the system will be tested in great detail
- A second vessel will be equipped with the OceanSaver® system later in 2005
- Corrosion tests will be carried out
- Tests of improved onboard analysis tool for larger organisms

Acknowledgments

- Ship owner Leif Höegh & Co. Limited
- OceanSaver[©]
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**Thank you very much
for your attention !**

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