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 trial 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 were 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 µm 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!

Number of organisms per tonne

Pre-filter  Day 1  Day 2

Control  Treated

n = 9  n = 5  n = 3
(mean values)
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
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