NORTH SEA BALLAST WATER

Sampling of Ballast Water

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Content

- Why to sample ballast water
- How to take representative ballast water samples
- Results from three ballast water sampling studies
- Findings and recommendations
- Conclusion

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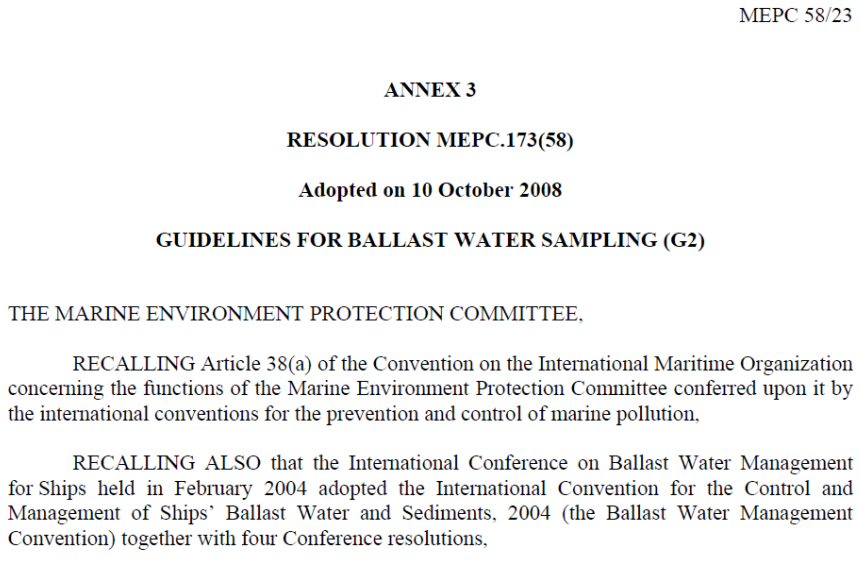
Why to sample ballast water

- To check if vessel meet IMO Ballast Water Exchange Standard (Regulation D-1) and/or Ballast Water Performance Standards (Regulation D-2)
- Description in Article 9 Inspection of Ships
- Sampling can be done by any port State anytime
- The objective is to take a representative sample (IMO Guidelines G2)



MEPC 58/23

ANNEX 3

RESOLUTION MEPC.173(58)

Adopted on 10 October 2008

GUIDELINES FOR BALLAST WATER SAMPLING (G2)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by the international conventions for the prevention and control of marine pollution,

RECALLING ALSO that the International Conference on Ballast Water Management for Ships held in February 2004 adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the Ballast Water Management Convention) together with four Conference resolutions,

Sampling Purpose

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- Compliance with D-1 (Ballast Water Exchange)
  - 200 m depth, 200 nm from nearest land
  - 200 m depth, 50 nm from nearest land
  - Designated areas
- Compliance with D-2 (Ballast Water Performance Standard)
  - <10 ind/m^3 of orgs. >50 µm
  - <10 ind/ml of orgs. <50 & > 10µm
  - Indicator microbes (Escherichia coli, Enterococci and Vibrio cholerae

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IMO Sampling Guideline

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- Guidance for compliance control sampling
- Still to be agreed:
  - Sampling access point (discharge line, in-tank sampling)
  - Sample volumes
  - Number of replicates
  - Representative sampling
  - Instantaneous vs average
  - Ongoing work

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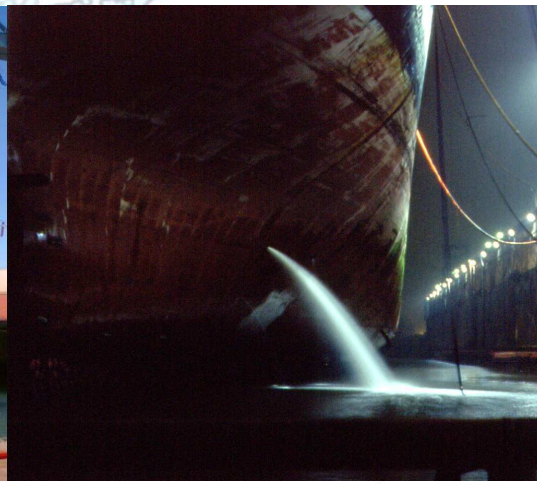
Previous Sampling Studies

- >40 biological ballast water sampling studies were undertaken in the past in various parts of the world
- No standardised sampling equipment is available

Sampling Access Points

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- Sounding, air pipes
- Fire-fighting system
- Manholes
- Ship´s ballast water pipe
- Cargo holds

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D-1 (Ballast Water Exchange)

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- Salinity
  - If salinity is below 25 psu it is unlikely that it was exchanged at sea
- Tracers of human activity
  - Presence of e.g. Nitrogen or Phosphorous may indicate nearshore BWE (river run-off in urban areas or agricultural sites)
- Coastal species
  - Harpacticoid copepods, barnacles
- Sediment
  - High sediment load may indicate near-shore BWE, but re-suspension from tank bottom occurs

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D-2 Compliance Control Sampling

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

- Voyages on commercial vessels
- Water flow split equally (untreated water)
  - split 1 sample taken over entire pumping time (OET), i.e. the whole discharge
  - split 2 sequential samples in ca. beginning, middle and end of the pumping event

EMSA

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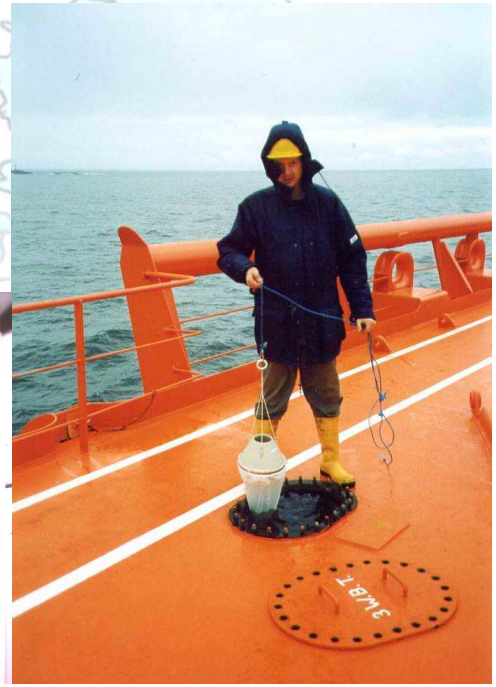
Sample representativeness is key

- What is the real organism concentration in the discharged ballast water?
- How to avoid under- and oversampling the real organism concentration?
- Comparison of different sampling scenarios
- Does it matter when and how much water is sampled?



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Test Voyage 2009 (BSH)

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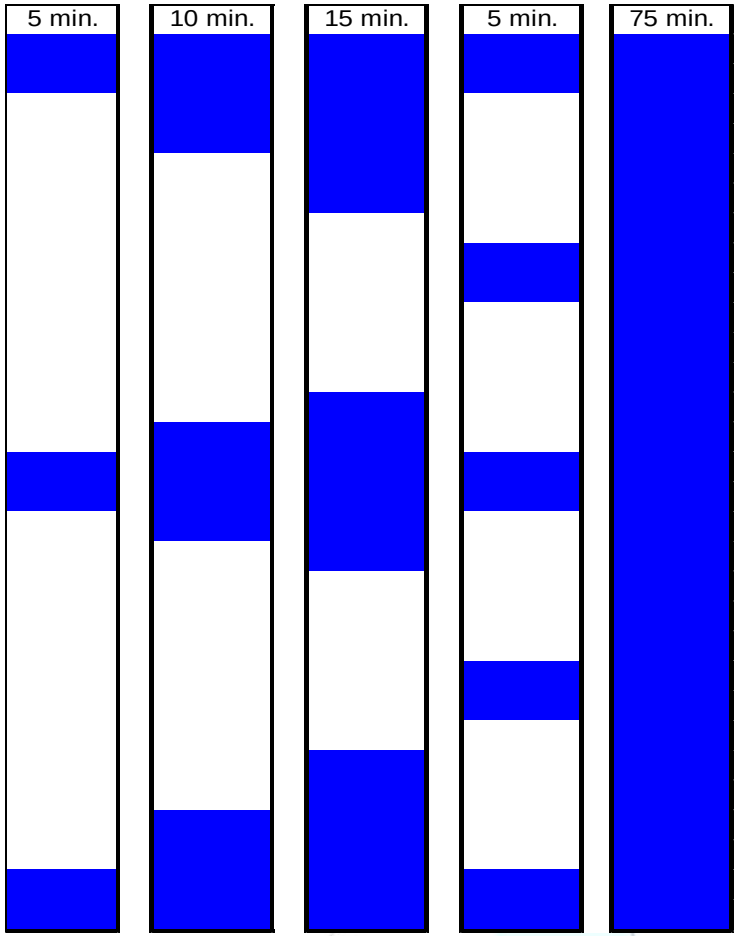
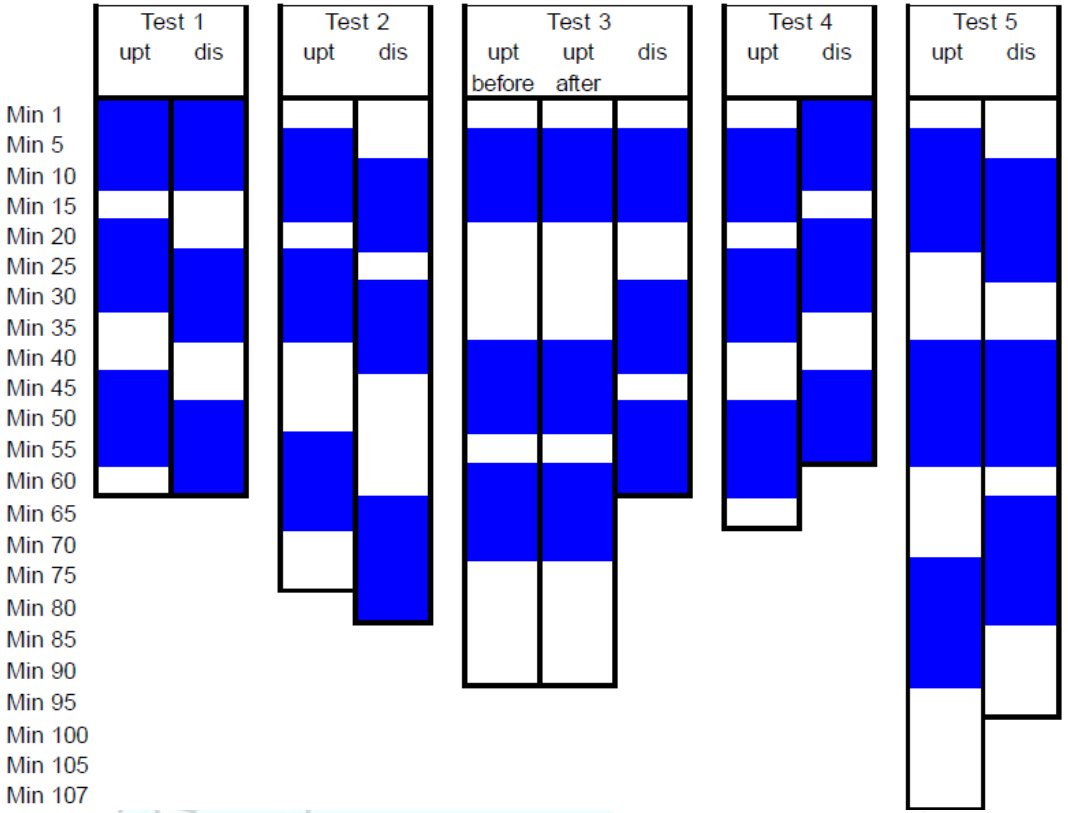


Blue = sampling time

White = no sampling



Test Voyages 2010 (EMSA)

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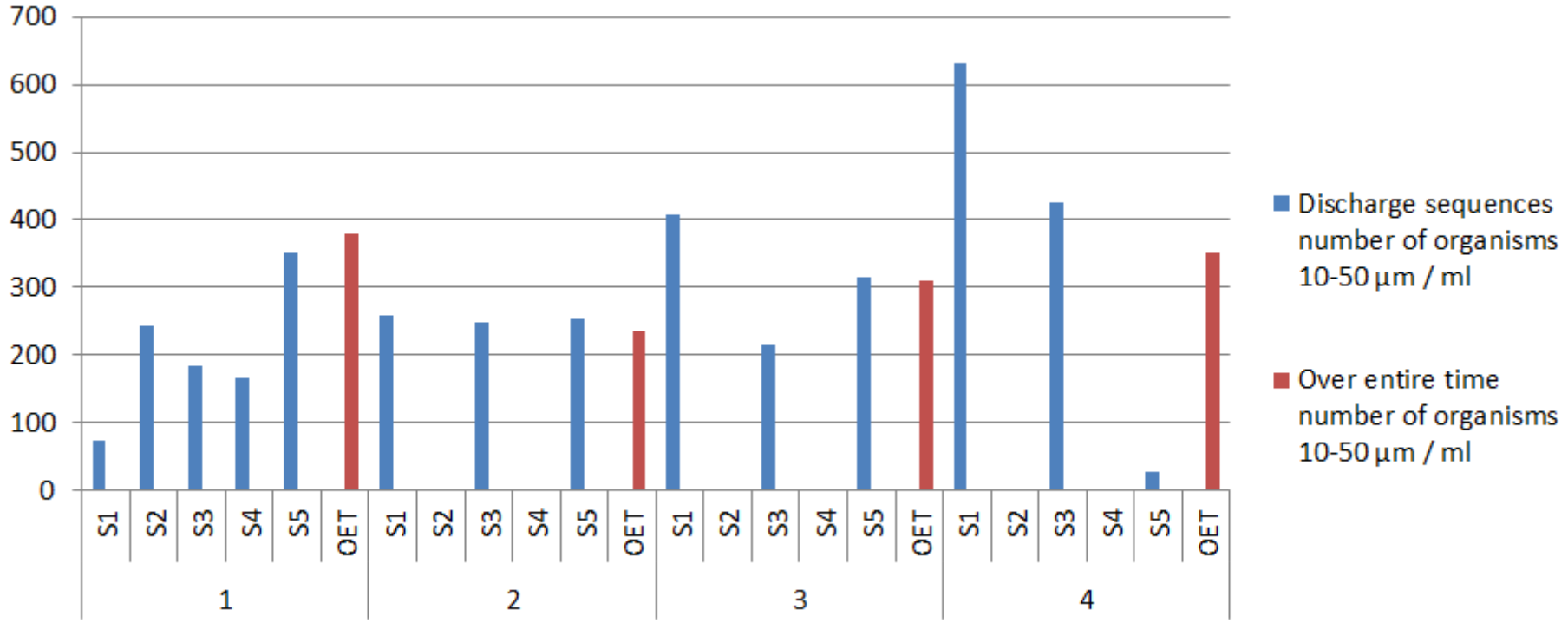
Test Voyage 2009 (BSH)

NORTH SEA BALLAST WATER



- Organisms patchiness occurs
- No trend identified
- Similar results OET and sequences

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Test Voyage 2009 (BSH)

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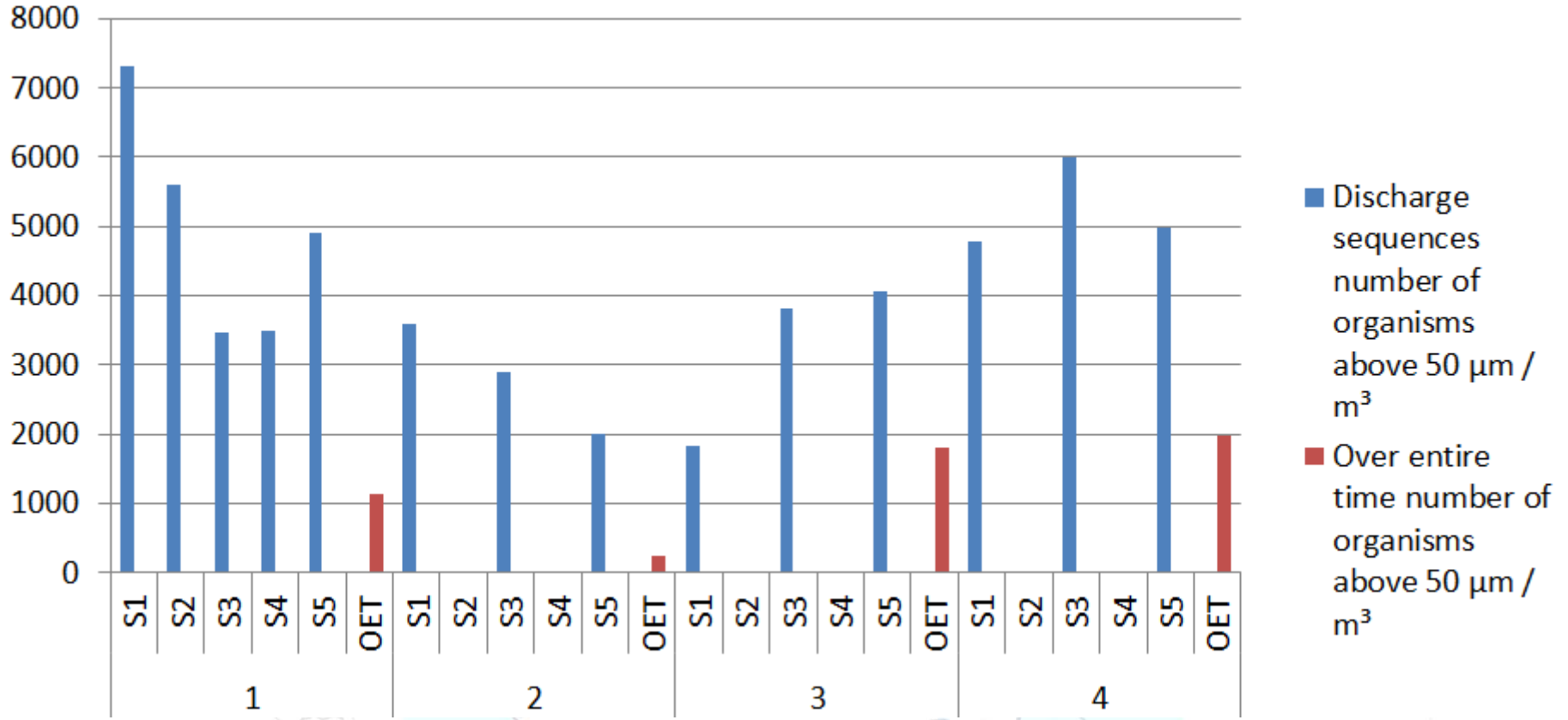

- Organisms patchiness occurs
- No trend identified
- Much higher concentrations in the sequencial samples

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Test Voyages 2010 (EMSA)

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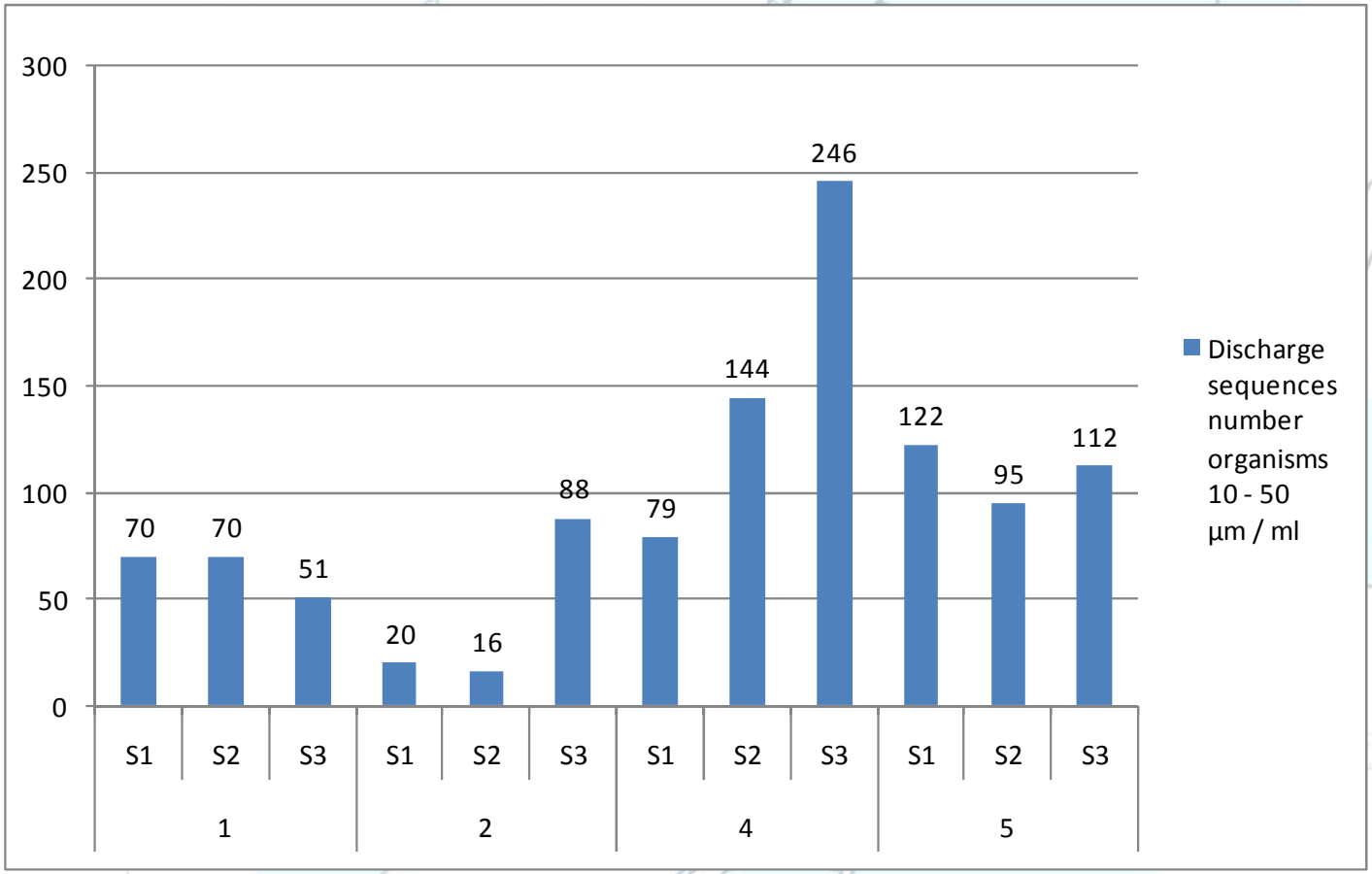

- Organisms patchiness occurs
- No trend identified

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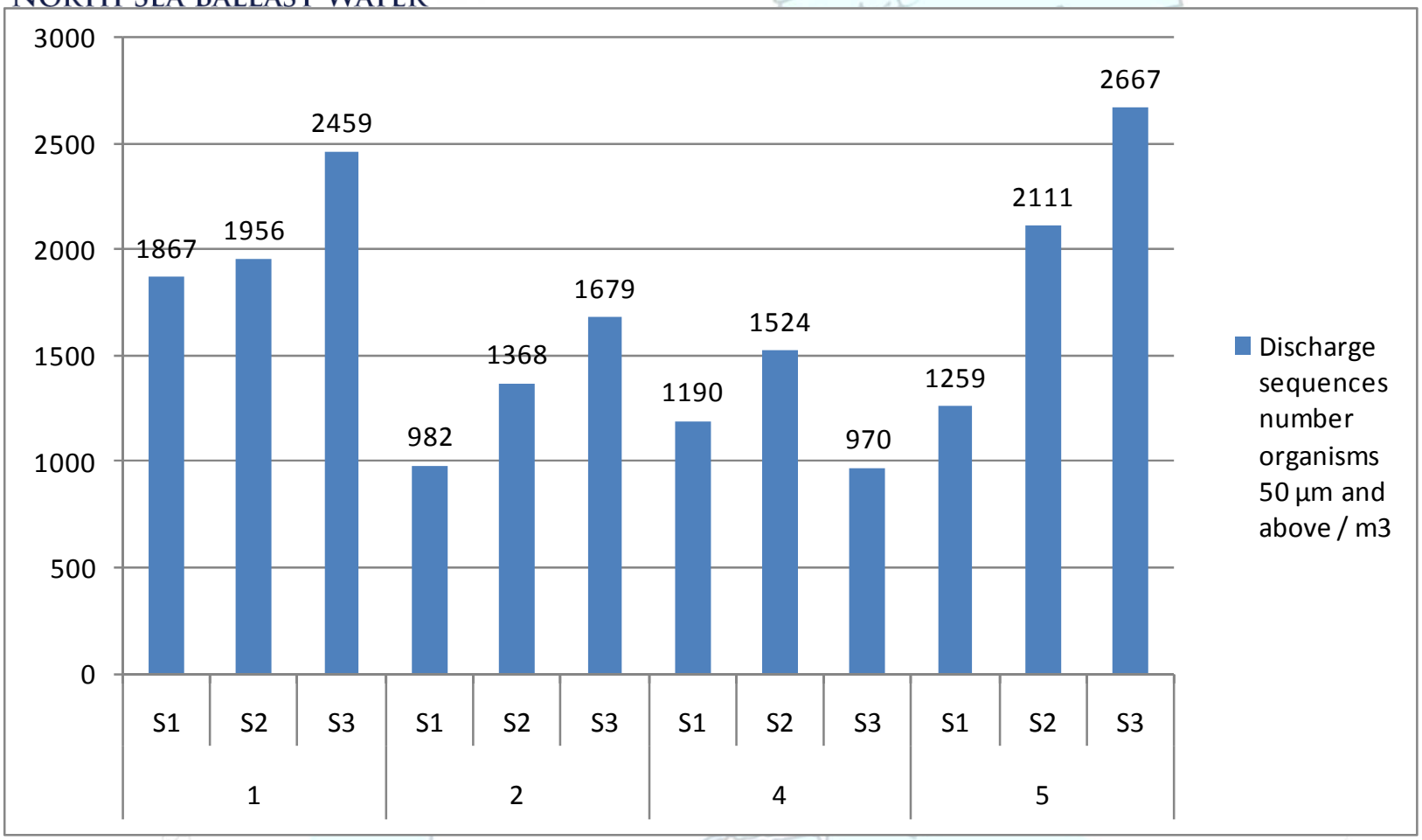
Test Voyages 2010 (EMSA)



- Organisms patchiness occurs
- Rise of organism concentration from beginning to the end

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Test Voyage 2012 (BSH)

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Duration	Test 1 Sequences	OET
Min 1	1	
Min 2		
Min 3		
Min 4		
Min 5		
Min 6		
Min 7		
Min 8		
Min 9	2	
Min 10		
Min 11		
Min 12		
Min 13		
Min 14		
Min 15		
Min 16		
Min 17	3	
Min 18		
Min 19		
Min 20		
Min 21		
Min 22		
Min 23		
Min 24		
Min 25	4	
Min 26		
Min 27		
Min 28		
Min 29		
Min 30		
Min 31		
Min 32		
Min 33	5	
Min 34		
Min 35		
Min 36		
Min 37		
Min 38		
Min 39		
Min 40		
Min 41	6	
Min 42		
Min 43		
Min 44		
Min 45		
Min 46		
Min 47		
Min 48		
Min 49	7	
Min 50		
Min 51		
Min 52		
Min 53		
Min 54		

- Continuous sequences (no time gap between sequences)
- OET
- 4 tests

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Test Voyage 2012 (BSH)

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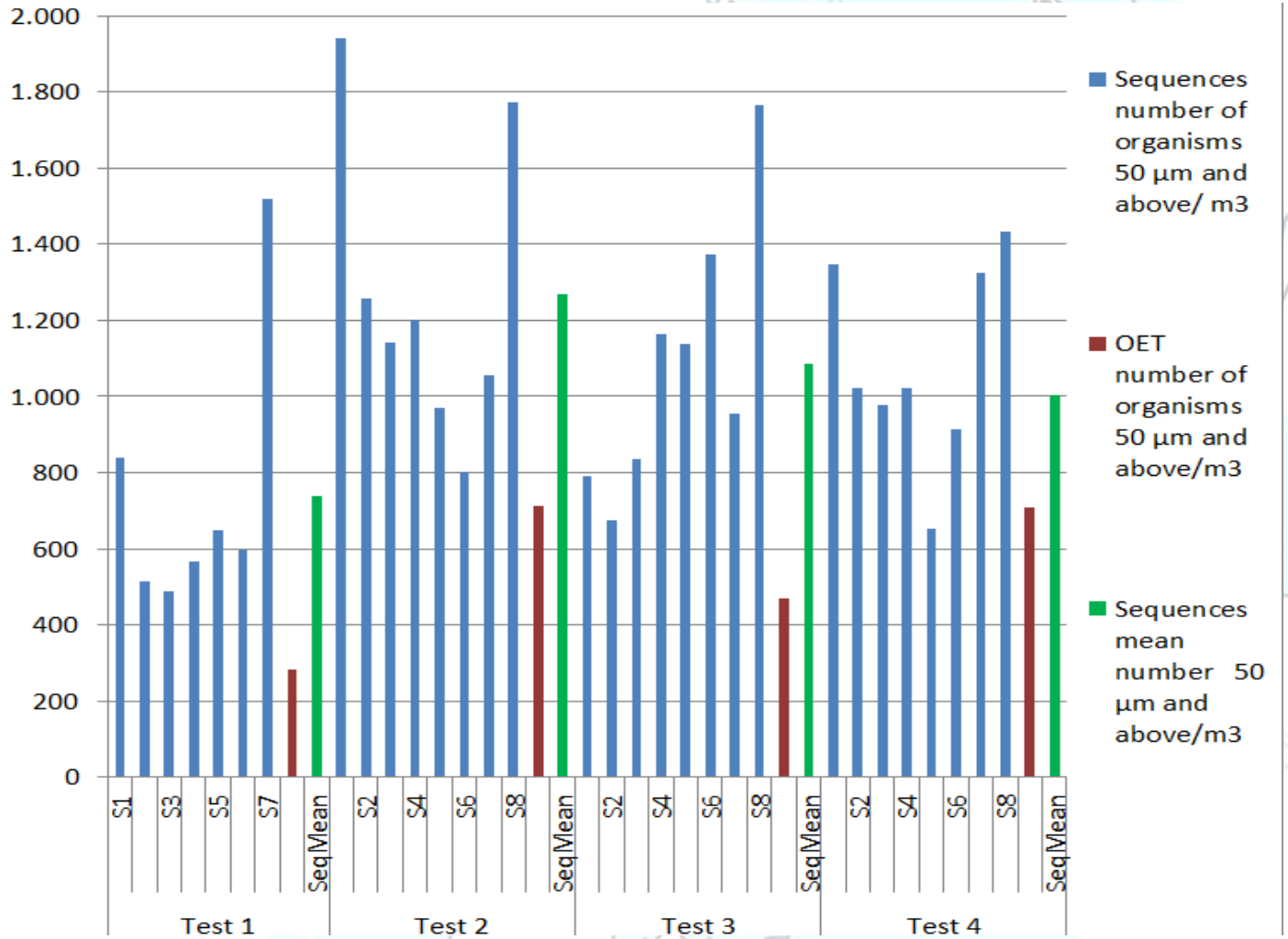

- Higher concentrations in the sequencial samples
- Highest concentration in end sequence

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Test Voyage 2012 (BSH)

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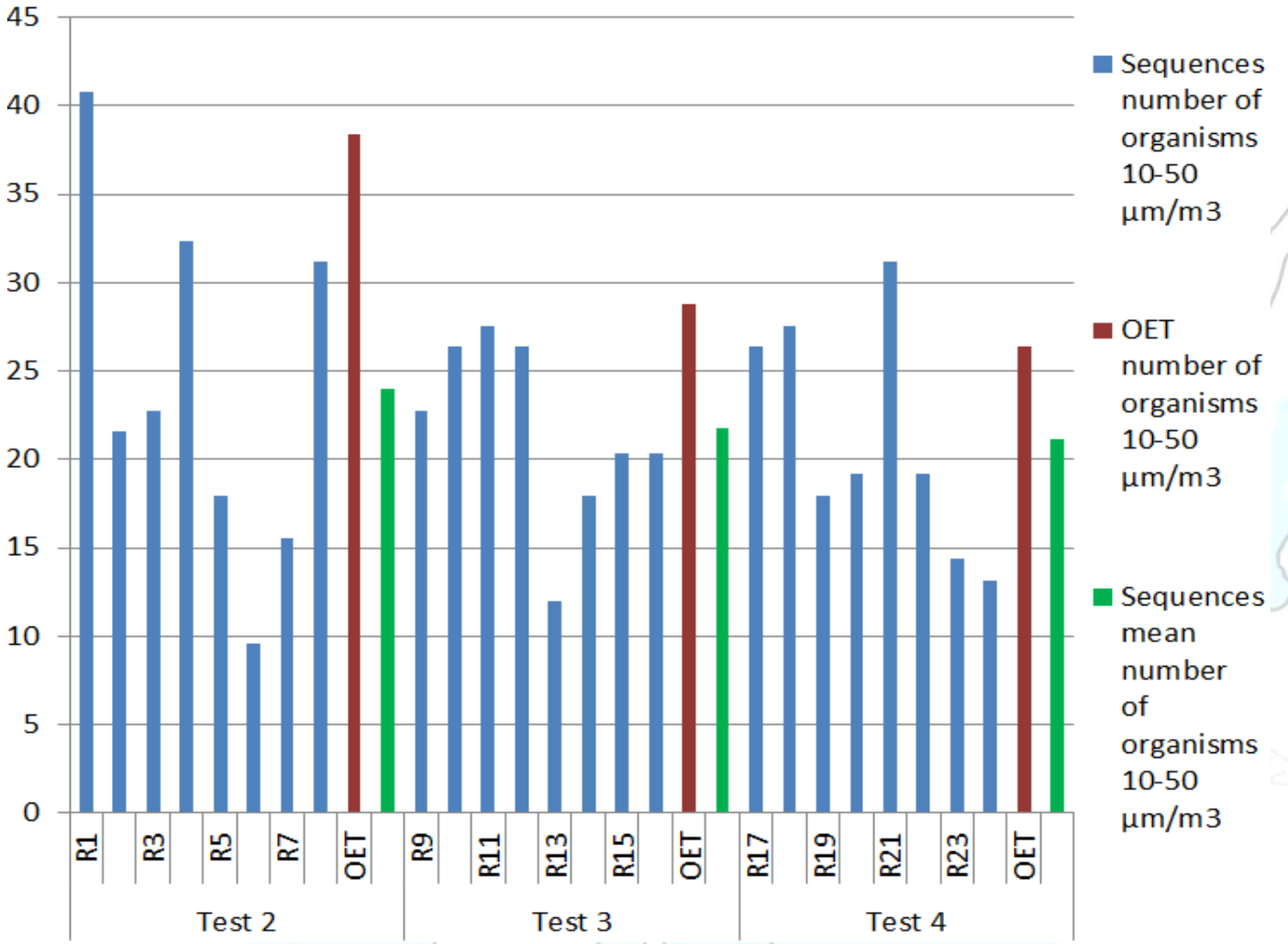

- Higher concentrations in the OET samples
- Highest concentration varied

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Study Comparison

Organisms	Study 2009	Study 2010	Study 2012
> 50 µm - Distribution - Organism numbers - Comparison sequences/OET	 Patchy No trend per sequence number In sequences much higher numbers	 Patchy Increase towards last sequence In sequences much higher numbers	 Patchy Highest concentration in last sequence In sequences much higher numbers
< 50 and > 10 µm - Distribution - Organism numbers - Comparison sequences/OET	 Patchy No trend per sequence number Similar numbers	 Patchy No trend per sequence number Similar numbers	 Patchy No trend per sequence number In OET higher numbers

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Findings

- **Larger organisms**
  With one exception, each sequence contained much higher organism numbers > 50 µm as OET
- **Smaller organisms**
  OET contained higher organism numbers < 50 and > 10 µm as most sequences
- **At least three perspecitives of representative sampling: the biological, statistical and shipping view**
- **Compromise needed to satisfy all views**

Conclusions

- As a compromise, we suggest representative sampling to be conducted by
  - taking two sequential samples, each of 400 L volume and taken over 10 minutes
  - avoid sampling in the very beginning and very end of the pumping event, due to risk of oversampling
  - for larger organisms, while sampling is ongoing concentrate to 100 ml of which 10% are analysed for an indicative analysis and 100% are analysed for an in-depth investigation
  - with 99% confidence non-compliance is indicated when the organism concentration is 50 when 10% subsample analysed and 36 organisms when 100% of the sample is analysed

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SEVENTH FRAMEWORK PROGRAMME VECTORS

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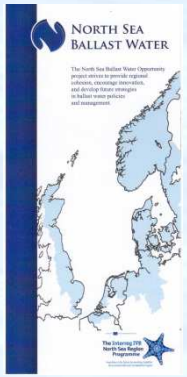
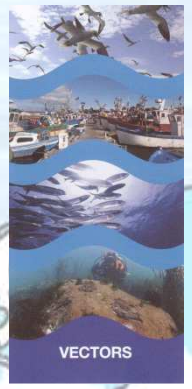
Vectors of Change in Oceans and Seas Marine Life, Impact on Economic Sectors

Ballast Water Opportunity





www.NorthSeaBallast.eu

www.marine-vectors.eu

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Acknowledgements

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- Test voyage 2009
- Test voyages 2010
- Test voyage 2012

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resource ballast technologies (pty)ltd
Wilhelmsen Ships Equipment
EMSA
MAHLE Industrial Filtration
Aquaworx clear solution
BSH BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE
ERMA FIRST ESK ENGINEERING SOLUTIONS S.A
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Thank you very much
for your attention