HISTORY OF MAMPEC

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Content

- MAMPEC – short history
- Processes addressed
- New features version 3.0
- Ballast water scenario
- Status and future work

Use of MAMPEC by Regulatory Authorities

- US- EPA
- EU
- Japan
- China
- New Zealand
- IMO – Ballast water substances

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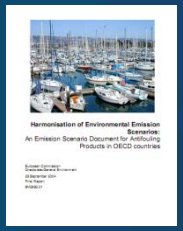
Brief History of MAMPEC

- 1996-1999 commissioned by CEPE Antifouling Working Group as part of EU project “Utilisation of more environmental friendly antifouling products” (96/559/3040/DEB/E2)
- Steering committee: EC, MS, Industry, IMO

- Model upgrades commissioned by CEPE: 2002 (v 1.4) and 2005 (v 1.6), 2006 (v.1.6.03), 2008 (v2.0/2.5), *2010 (v3.0)*

- Model referenced in the EU-OECD Emission Scenario Document for A/F paints PT-21 (2004)
- Reviewed in EU for the BPD 2004 – to date



- MAMPEC-BW (2010) for ballast water exp. assessment

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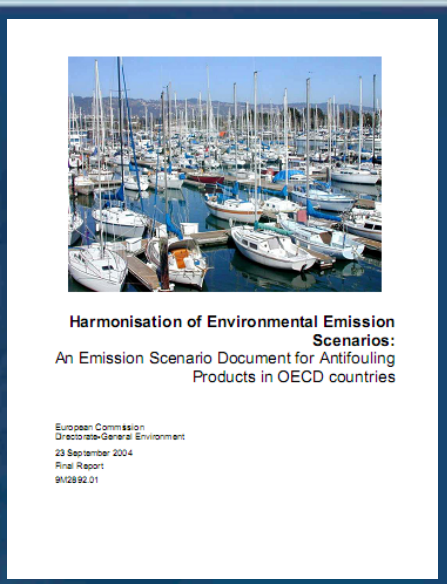
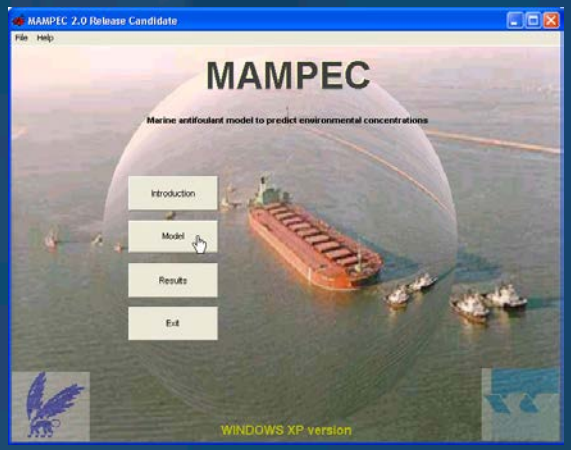
OECD Exposure assessment

- Emissions: ESD Document
- Service life
  - Application, maint. & repair, removal
- Estimation of leaching rate
  - ASTM / ISO
  - *In-situ* Dome method
  - ISO mass balance
  - ...
- Exposure modelling (PEC):
  - MAMPEC
  - REMA (HSE UK)





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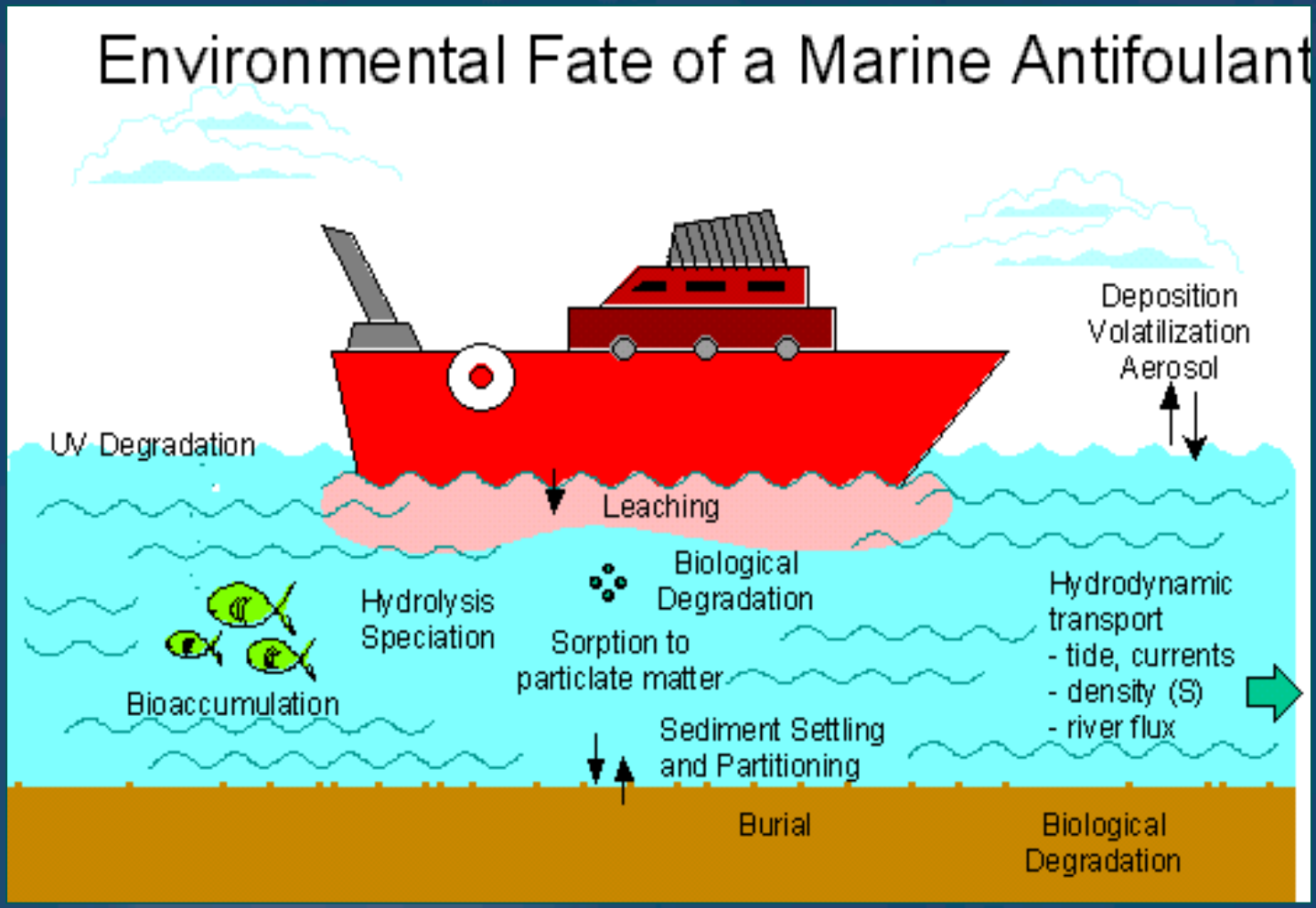
MAMPEC - fate and exposure / main factors



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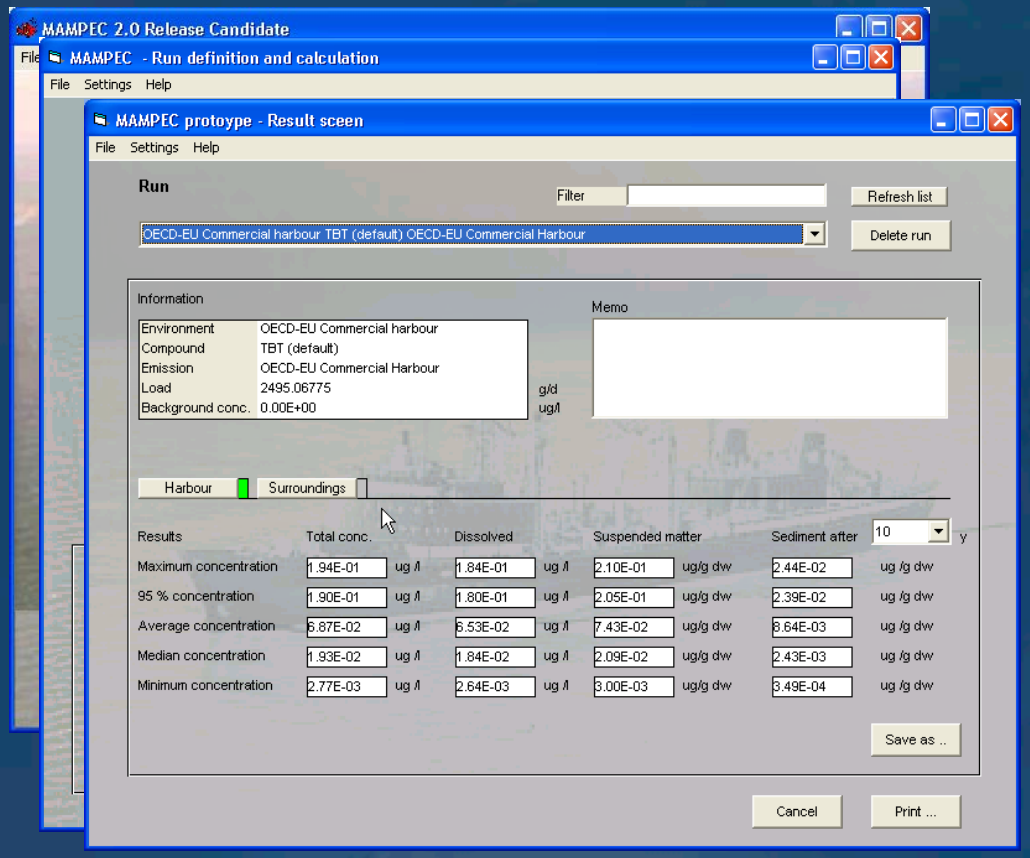
General structure of MAMPEC – workflow v1.0-2.5



Main input:

- Environmental settings
- Biocide properties
- Emission estimation module

Output:

- PECs water and sediment

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Main Input Data

- **Main input data**:
- Environmental settings
  - Marinas
  - Harbours
  - Shipping lanes
- Biocide properties
  - Phys-chem data
  - Environmental fate
- Emission estimation module
  - Number of boats – size, submerged surface area
  - Leaching rate

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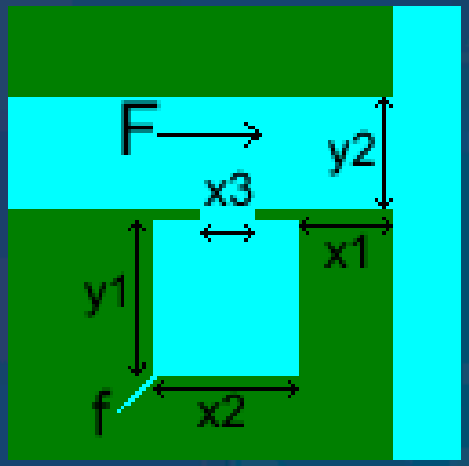
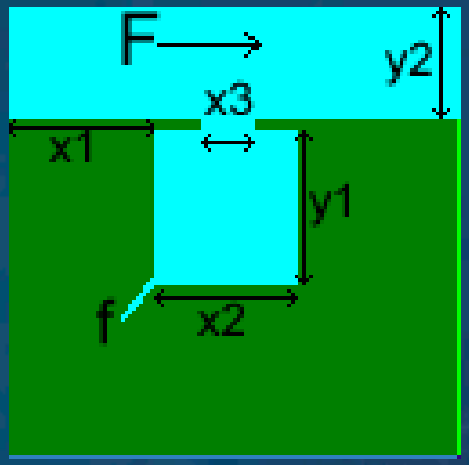
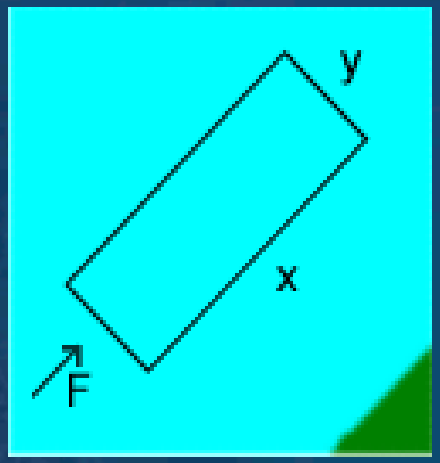
Examples of prototype environmental scenarios



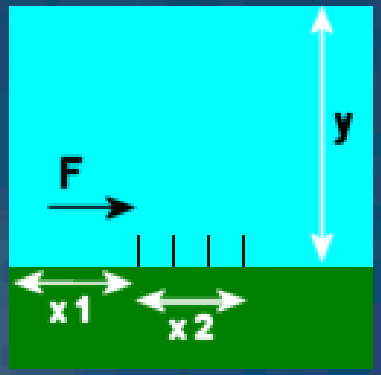
1 Commercial harbour
Estuarine harbour



3 Marina



4 Shipping lane
Open sea



5 Open harbour

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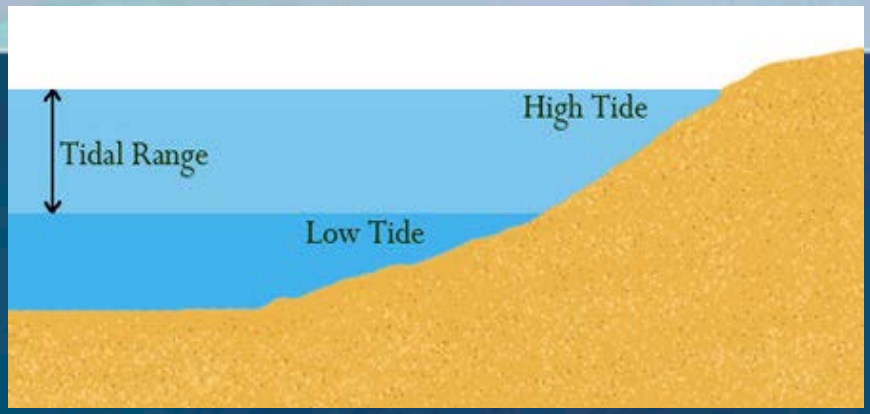
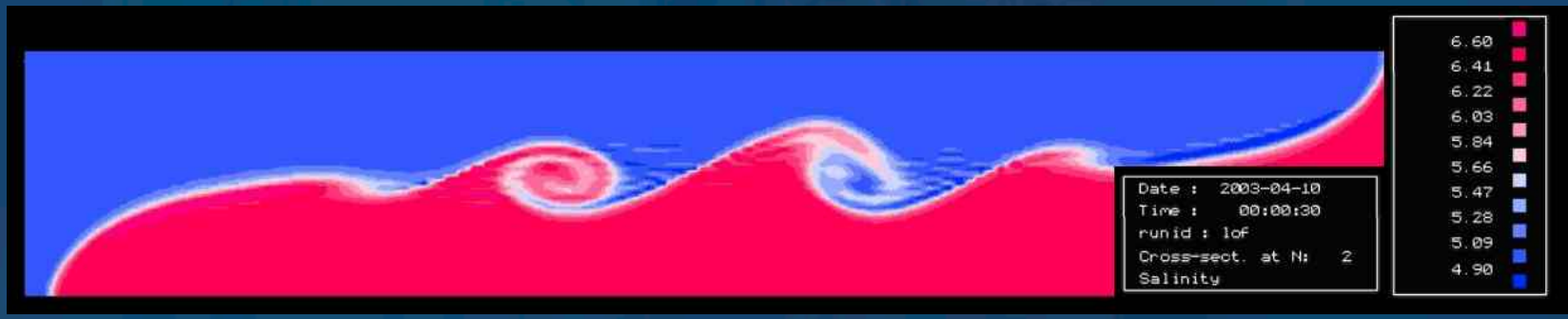
Hydrodynamic exchange in MAMPEC

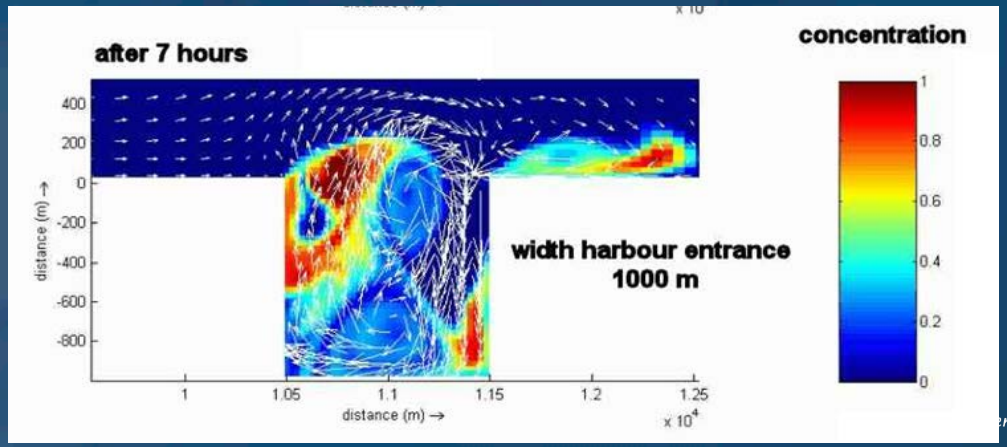
1. Tide



2. Salinity difference



3. Horizondal flow in relation to dimensions (harbour layout)



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Hydrodynamic exchange

4. additional exchange due to wind driven currents

5. other non tidal water level changes (important in absence of previous exchange mechanisms)

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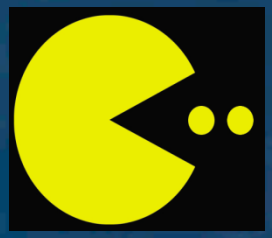
MAMPEC degradation processes



- Degradation
  - Water
  - Sediment
- Abiotic
  - hydrolysis
  - photolysis (2 options)
  - Speciation (e.g. copper)
- Biotic
  - Biodegradation (aerobic+anaerobic)

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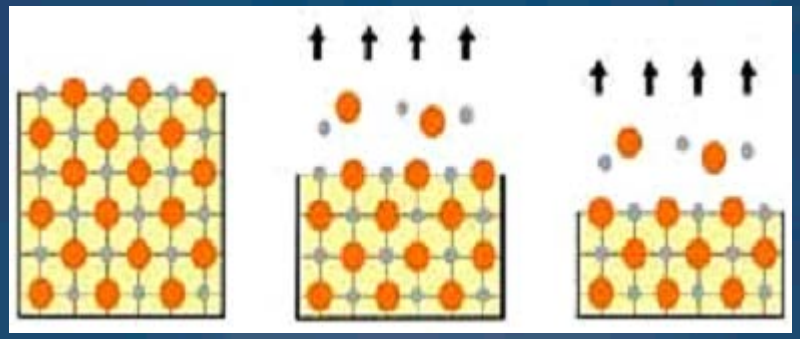
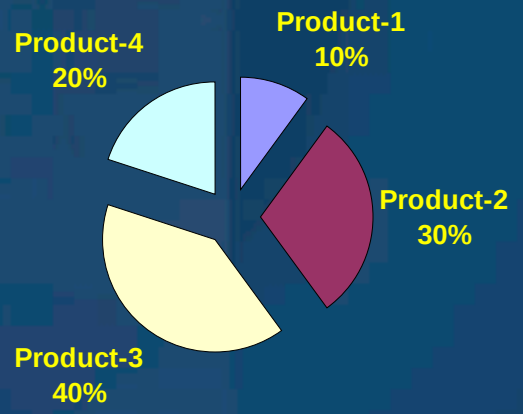
Emissions

- number of boats
- size, wet surface area of boats
- residence time

- leaching rate (paint matrix, Temp, velocity,..)
- application factor (market share)





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Objectives Version 3.0

- Compatability with Windows Vista / 7

- New emission scenarios for new-build and docking activities - full assessment according to ESD
- Multi-lingual support (Japanese in v2.5, Chinese)
- Analysis of fate and most important fluxes
- Plot of PEC-profile downstream harbour
- Copper speciation according to WHAM and BLM
- In response to comments: extension of sediment module (org-C handling and degradation; concentration basis already in v2.5)

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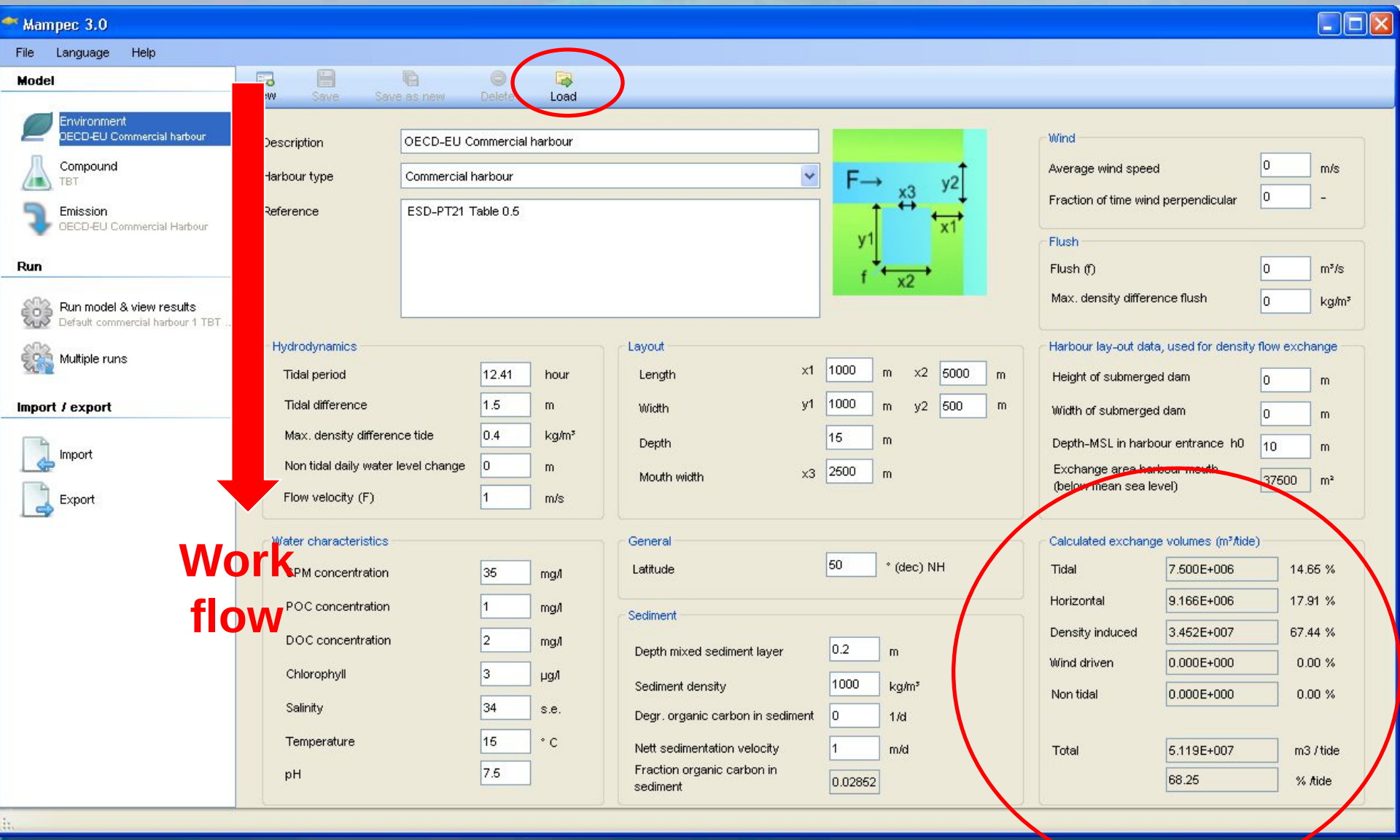
Environment in v3.0 – Example: OECD Comm. Harbour



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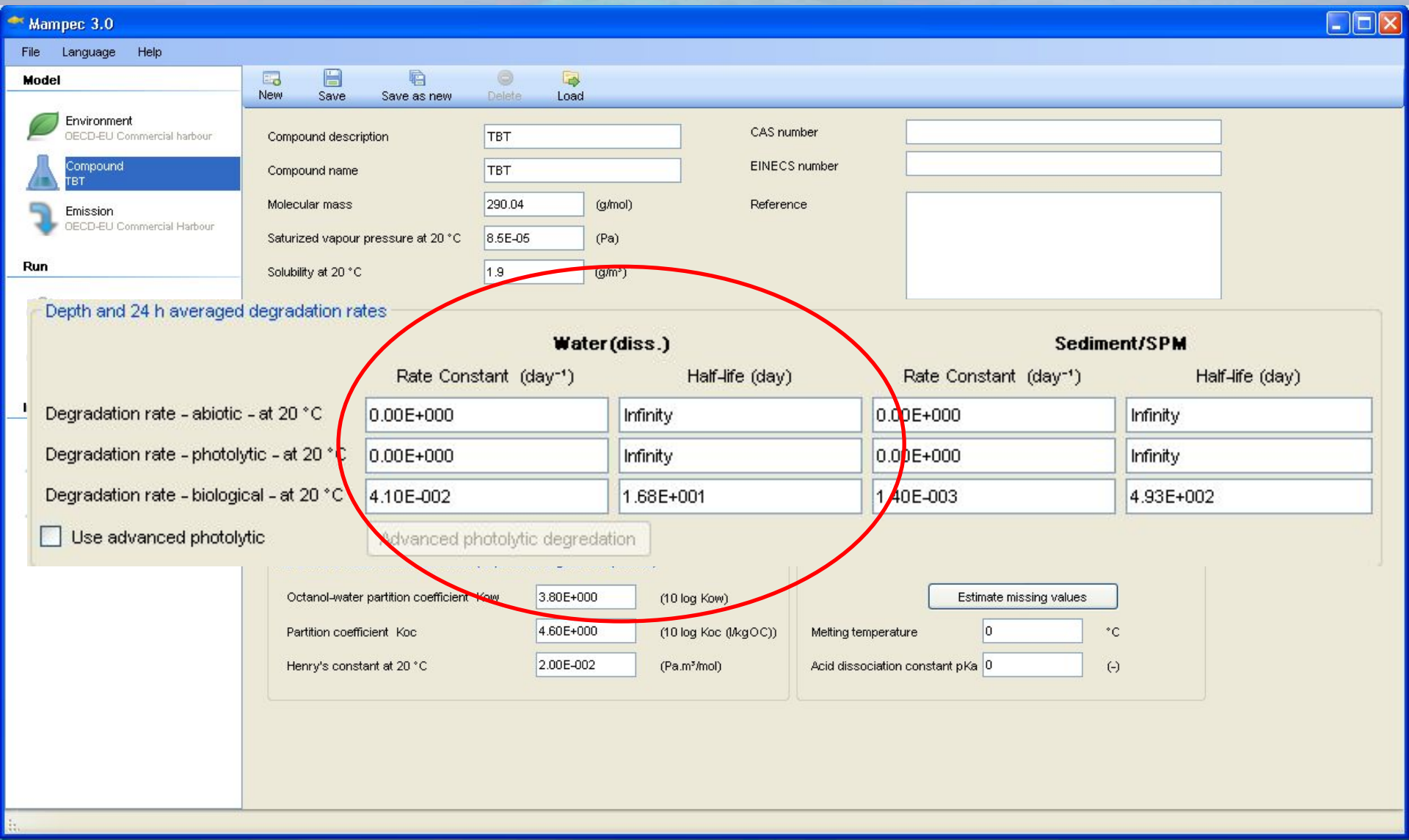
Compounds in v3.0



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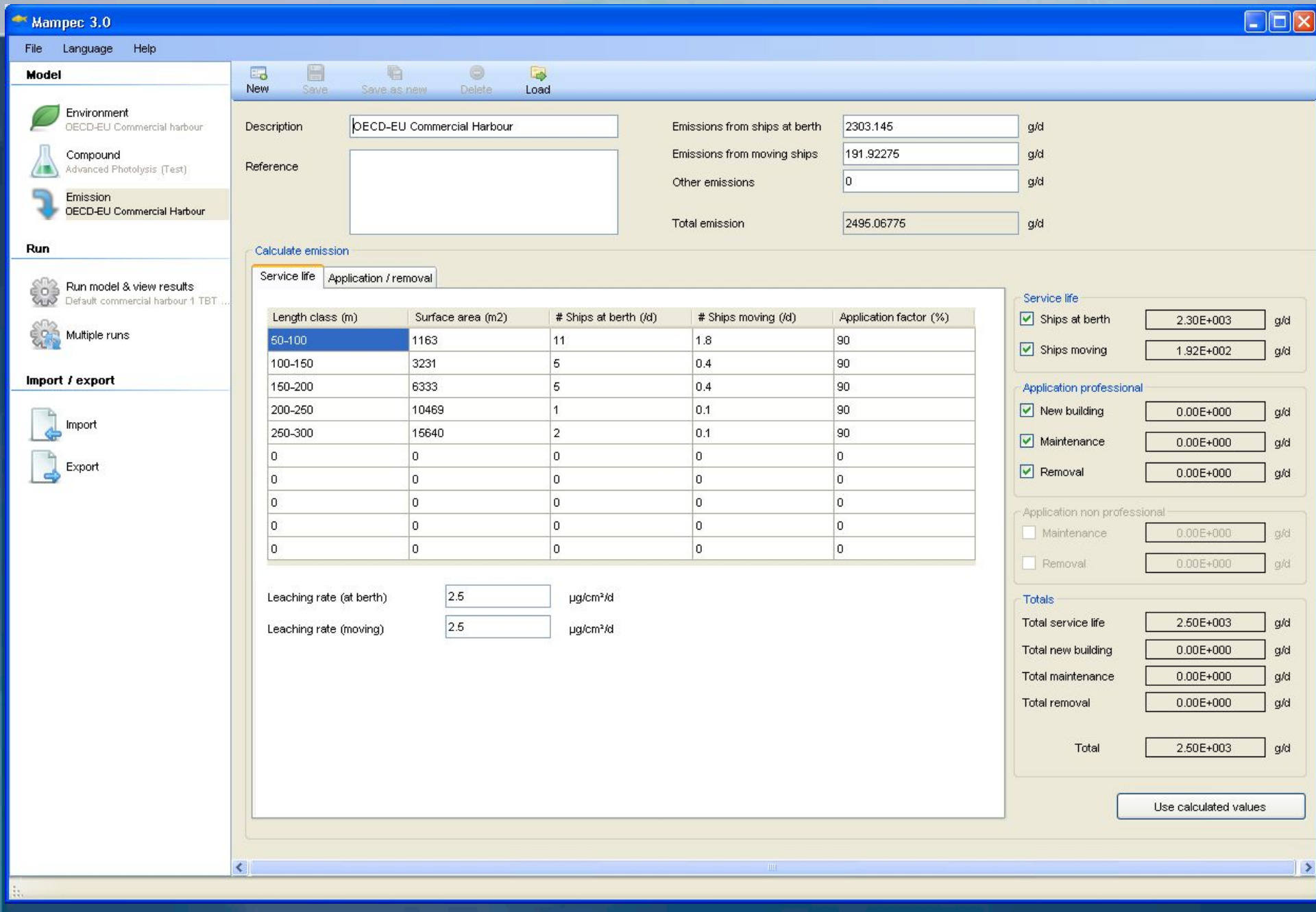
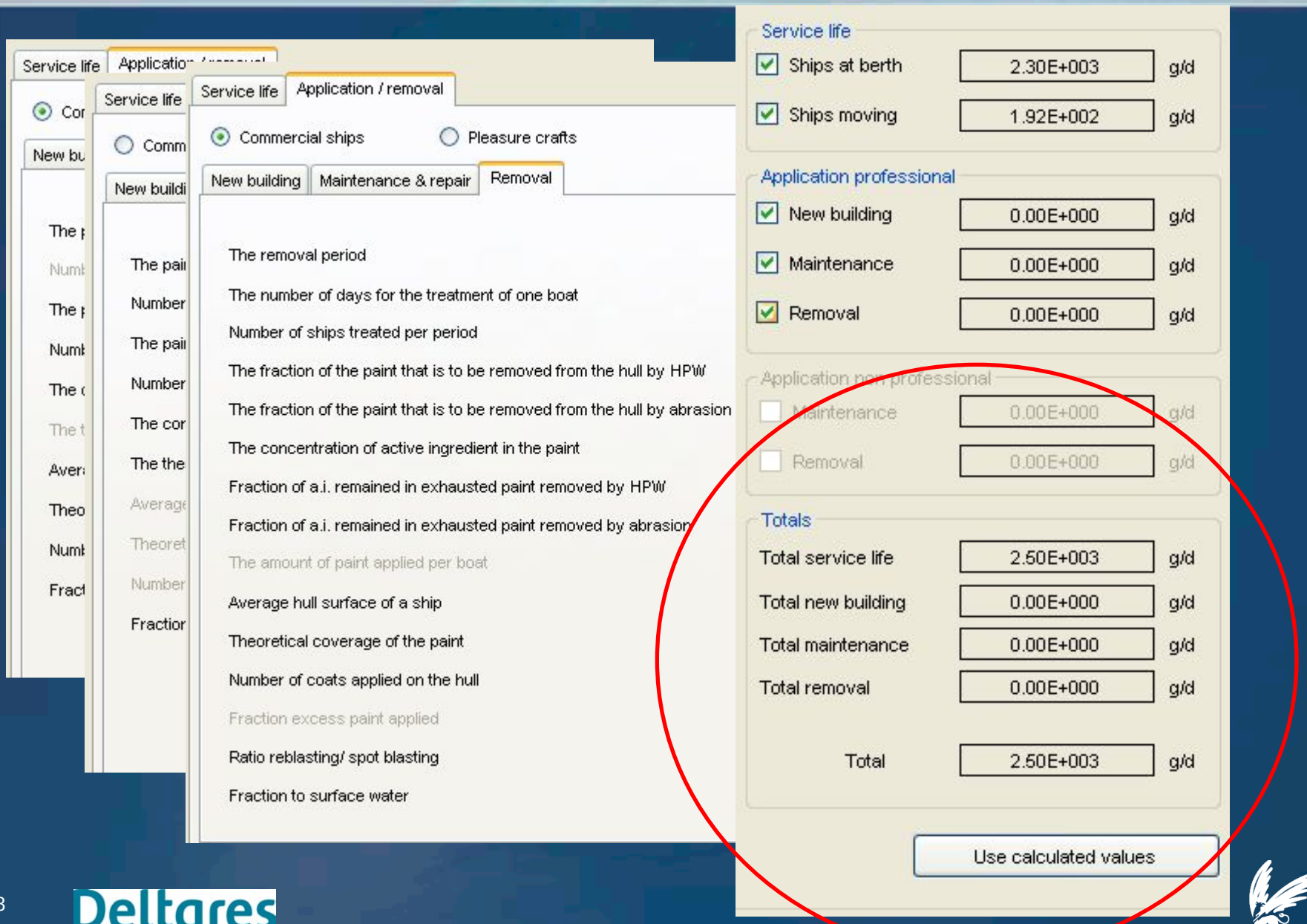
V3.0 Emission



Emission – non service life



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V3.0 View results

Mampec 3.0

File Language Help

Model

Environment
OECD-EU Commercial harbour

Compound
TBT

Emission
OECD-EU Commercial Harbour

Run

Run model & view results
OECD-EU Commercial harbour TB...

Multiple runs

Import / export

Import

Export

New Save

Run name

Environment

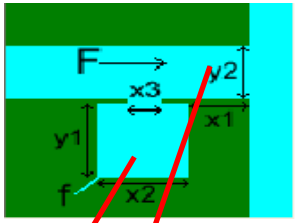
Compound

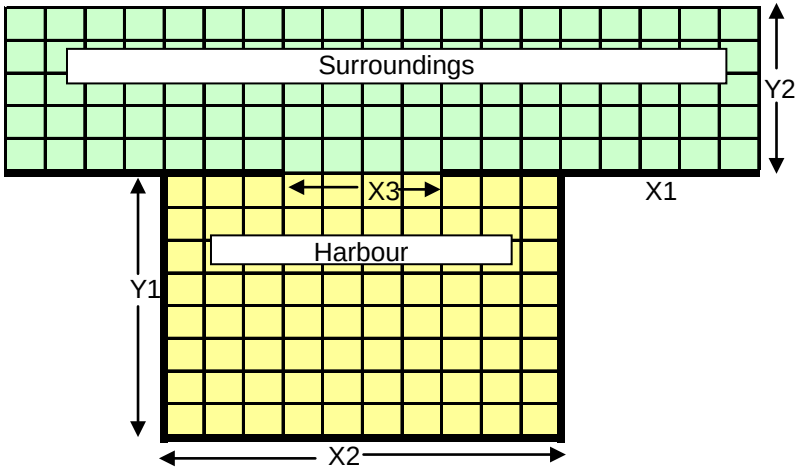
Emission

Load

Background conc.

Run date 7/13/2010 3:58 PM





Distribution of antifoulant at steady state | Analysis of fate and fluxes of antifoulant at steady state | Surrounding pollution

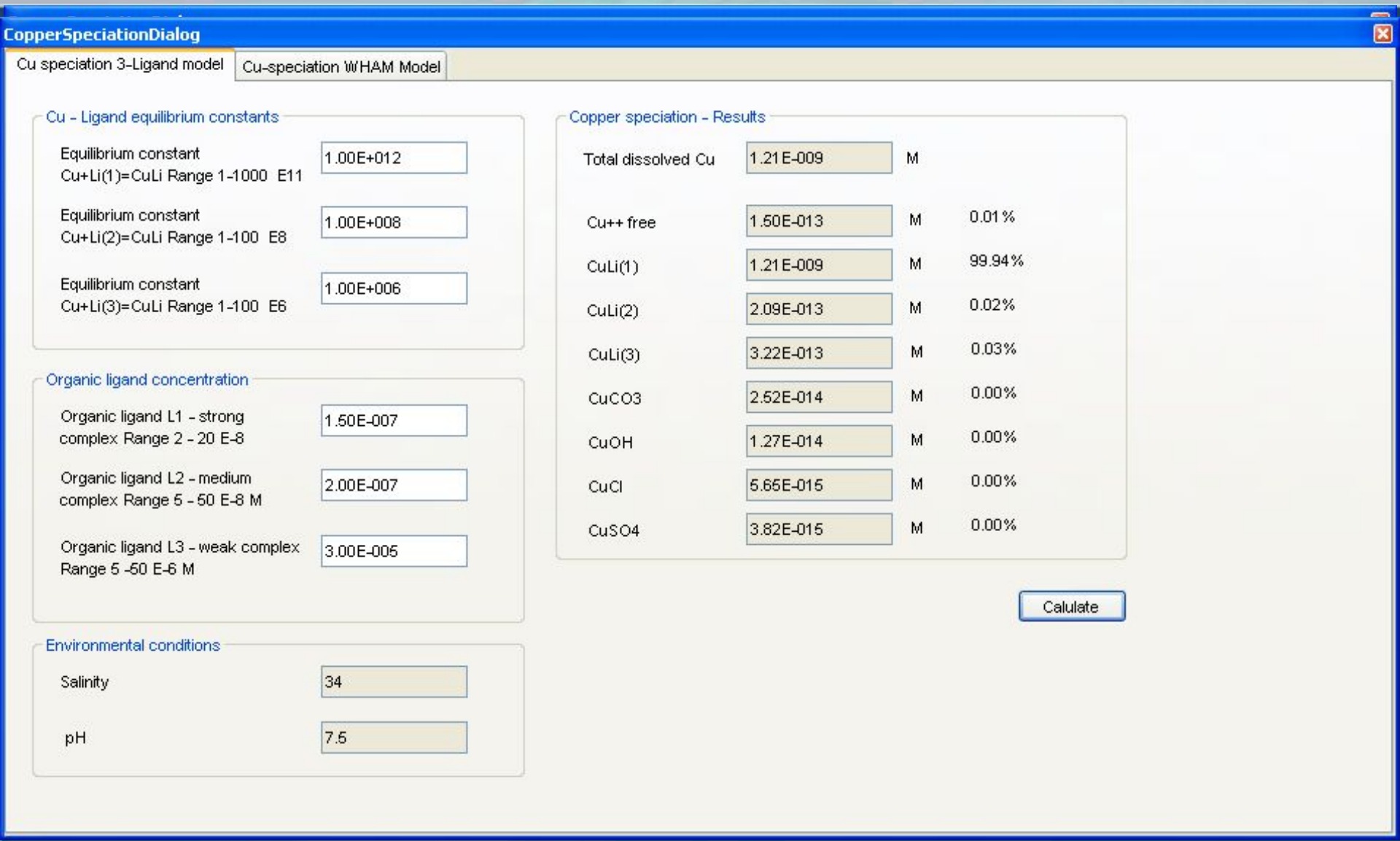
Harbour

	Total conc.	Dissolved	DOC	Suspended matter	Sediment after 1 Years	Sediment after 2 Years	Sed
Maximum concentration	2.01E-001 ug/l	1.91E-001 ug/l	2.28E-003 ug/l	7.60E-003 µg/g oc	3.70E-004 µg/g oc	5.78E-004 µg/g oc	7.98
95 % concentration	1.96E-001 ug/l	1.87E-001 ug/l	2.23E-003 ug/l	7.43E-003 µg/g oc	3.61E-004 µg/g oc	5.65E-004 µg/g oc	7.80
Average concentration	7.29E-002 ug/l	6.93E-002 ug/l	8.28E-004 ug/l	2.76E-003 µg/g oc	1.34E-004 µg/g oc	2.10E-004 µg/g oc	2.90
Median concentration	2.53E-002 ug/l	2.41E-002 ug/l	2.88E-004 ug/l	9.59E-004 µg/g oc	4.67E-005 µg/g oc	7.29E-005 µg/g oc	1.01
Minimum concentration	3.21E-003 ug/l	3.05E-003 ug/l	3.64E-005 ug/l	1.21E-004 µg/g oc	5.91E-006 µg/g oc	9.24E-006 µg/g oc	1.28

Surroundings

	Total conc.	Dissolved	DOC	Suspended matter	Sediment after 1 Years	Sediment after 2 Years	Sed
Maximum concentration	1.00E-002 ug/l	9.53E-003 ug/l	1.14E-004 ug/l	3.80E-004 µg/g oc	1.85E-005 µg/g oc	2.89E-005 µg/g oc	3.99
95 % concentration	6.21E-003 ug/l	5.91E-003 ug/l	7.05E-005 ug/l	2.35E-004 µg/g oc	1.14E-005 µg/g oc	1.79E-005 µg/g oc	2.47
Average concentration	2.24E-003 ug/l	2.13E-003 ug/l	2.54E-005 ug/l	8.46E-005 µg/g oc	4.12E-006 µg/g oc	6.44E-006 µg/g oc	8.89
Median concentration	1.57E-003 ug/l	1.50E-003 ug/l	1.79E-005 ug/l	5.96E-005 µg/g oc	2.90E-006 µg/g oc	4.53E-006 µg/g oc	6.26
Minimum concentration	5.99E-009 ug/l	5.70E-009 ug/l	6.80E-011 ug/l	2.27E-010 µg/g oc	1.10E-011 µg/g oc	1.72E-011 µg/g oc	2.38

Cu Speciation: WHAM / BLM, 3L-Model



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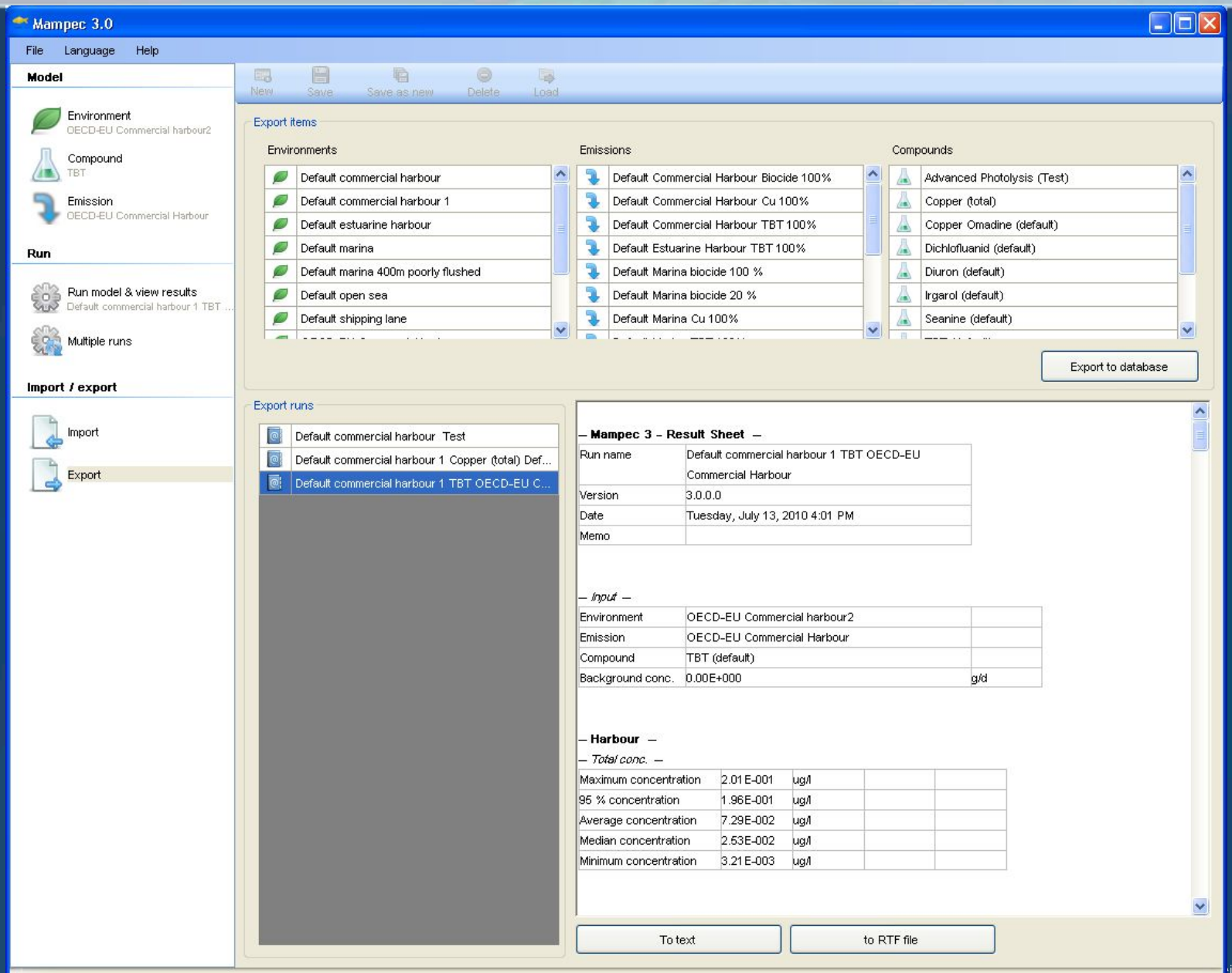
V3.0 Export settings and results



New Developments

- Currently the US Copper Task Force are developing a freshwater inland marina scenario for the US
- Looking to conduct copper monitoring data during this summer along with usage surveys to determine how antifouling paints are used in freshwater
- Will include existing monitoring data in the US and GIS data for water quality characteristics and water exchange data

Concluding remarks

- MAMPEC result of proactive role of industry in risk assessment of antifoulants.
- Model is constantly being adapted to need of users (applicants, authorities, water managers, students), software developments, and state of the art in ERA.
- Recognized by regulatory authorities in EU, Switzerland, USA, Australia, Japan, China, and other OECD countries
- Version 3.0 meets modern software standards, has a number of useful new extensions, bug fixes, and works much easier and faster
- Multi-run option: useful for sensitivity analysis and risk assessment of mixtures

Thank you for your attention

- Websites:
  - delftsoftware. wldelft.nl (official download & support)
  - www.antifoulingpaint.com
  - www.cepe.org

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