Für Mensch & Umwelt

Umwelt Bundesamt

Workshop ‚Environmental monitoring of biocides in Europe - compartment-specific strategies “
25/26 June 2015 in Berlin

Antifouling biocides in German marinas - Studies to support exposure prognoses for risk assessment

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Background

Biocidal Products (BP) (EU 528/2012)

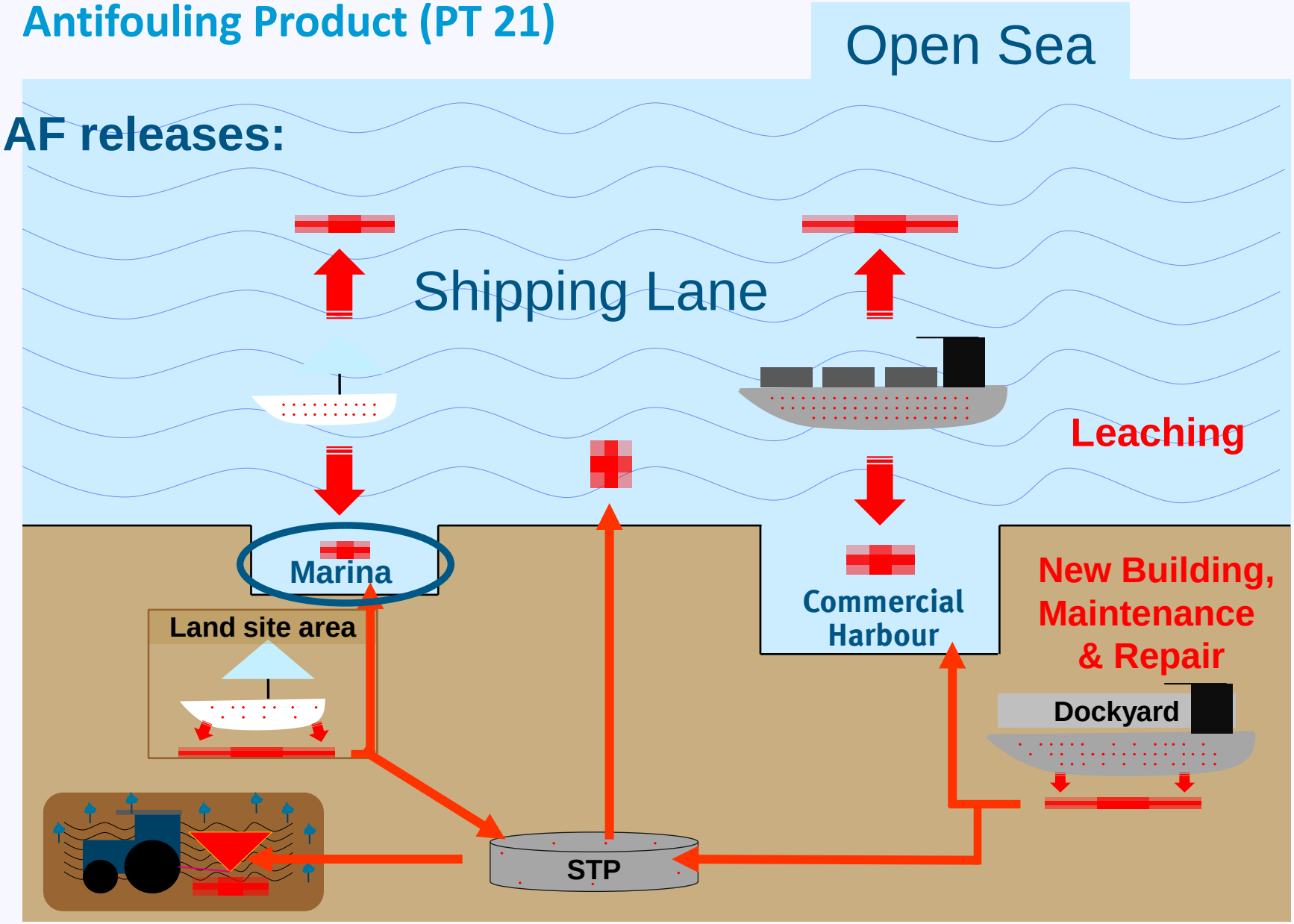
- 1. Step: Approval of active agent(s) → EU-level
- 2. Step: Authorization of BP → national level
  if BP already authorized in 1 EU MS, request other MS to recognize this authorization (Mutual recognition)

Risk Assessment - Environment

- Exposure Assessment:
  Emission Scenarios & Models→ predicted environ. concentration (PEC)
  Comparison: Exposure concentration & Effect levels (PNEC)
  Monitoring data → to check the outcome of PEC assessment

by courtesy of T. Setzer (IV 1.2)

Antifouling Product (PT 21)

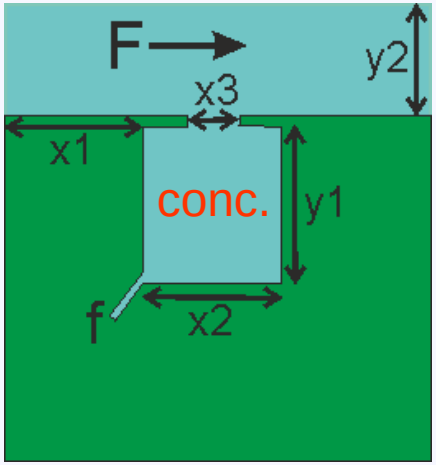


Background

- MAMPEC
  (Marine Antifoulant Model to Predict Environ. Conc.)
  (financed by CEPE)

Marina Scenario Input Parameters

- Site specific:
  Marina size & structure (LxWxD, entrance W, D)
  No of berths / boats, Boat size classes
  UW hull surface
  Hydrology (tidal period, height, flush in, etc.)
  Water quality: silt, temp., salinity, pH, DOC/POC, ….



- Substance specific: Fate (degradation, sorption, etc.)
- Product specific: Application factor, Leaching rate, etc.
- Marina scenario: 5 marine / brackish + 1 fresh water (unproved)
- **no data** on total stock boats **or** typical structure of German marinas

Project: Project structure

Working packages

- WP 1: Census
- WP 2. Screening (Survey)
- WP 3: Modelling

Further characteristics

- Runtime: Oct. 2011- Dec. 2014
- Project holder: LimnoMar (Hamburg, Norderney)
  Burkard Watermann
- Financier: UBA (UFOPLAN FKZ 3711 67 432)
- Short-Title: ‚Verlässlichkeit der Antifouling-Expositionsschätzung sicherstellen‘
- Published soon: www.umweltbundesamt.de

Project: WP 1 - Census

Concept

- Nationwide inventory on marinas (of at least 80 % of the total stock)
- Parameters: geogr. location, size, infrastructure, grad of embankment, No of berths (relevant for AF application: no dinghies or rowing boats), etc.
- Data sources: aerial photos, marina guides, nautical maps, etc.

Outcome

- 200 600 mooring berths at 3 090 marinas

  Note: berths = boats (incl. visitor's berths)

  Blind spot: small mooring places (<5 berths), boathouses, mobile 'trailer captains': expected underestimation of ca. 20 000 boats (max.)
- Mell (2008): 250 000 motor- + sailing boats (total: ca. 500 000 boat) (extrapolated survey interviews)

Project: WP 1 - Census

Results on regional scale

- Percent share:

  salt water: 3 %

  brackish w.[1]: 26 %

  fresh water: 71 %

- High density areas

  (≥ 10 000 berths):

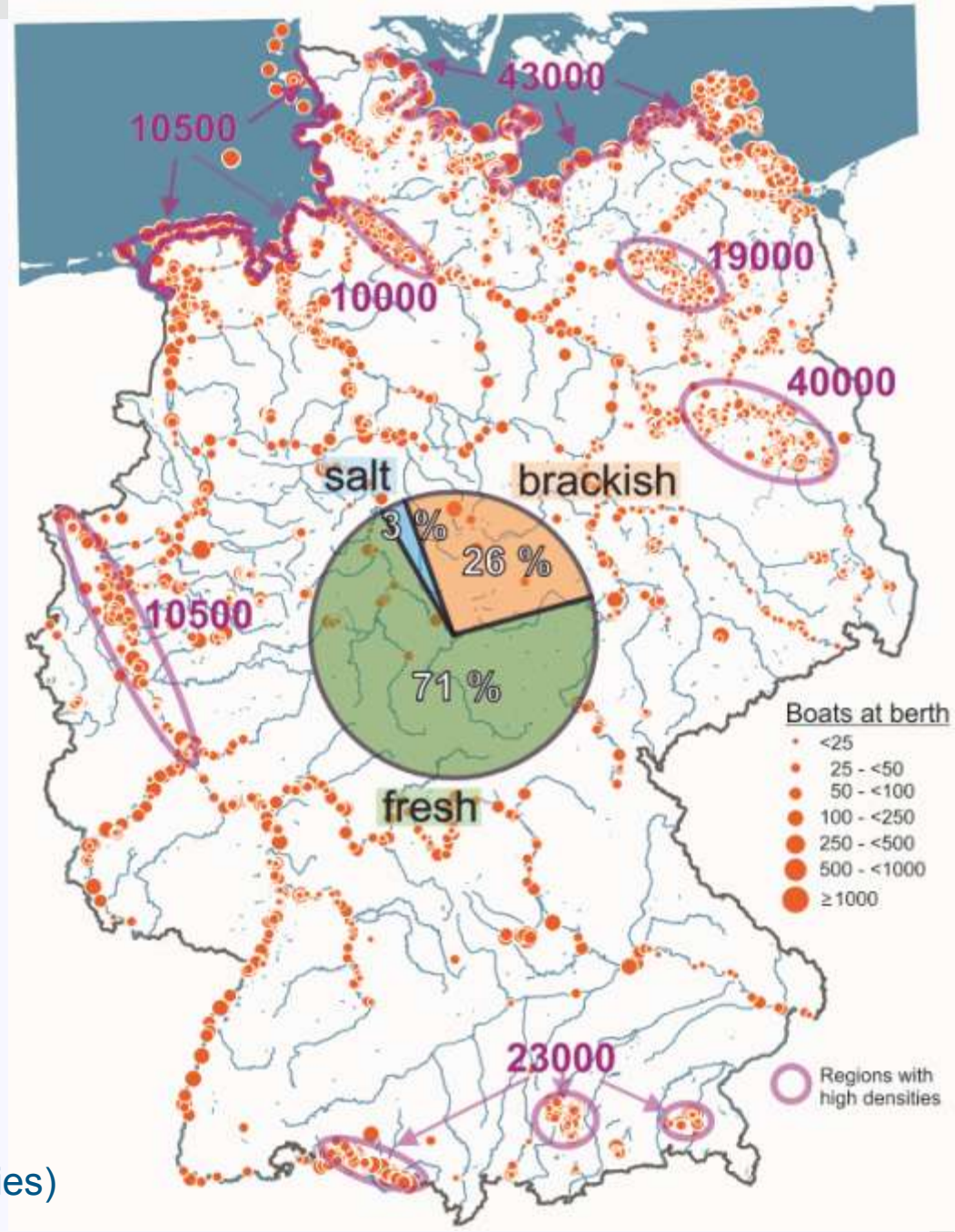
  freshwaters: 5

  (in total ~102 500 = 50%)

  salt - brackish waters: 2

  (in total ~53 500 = 26%)

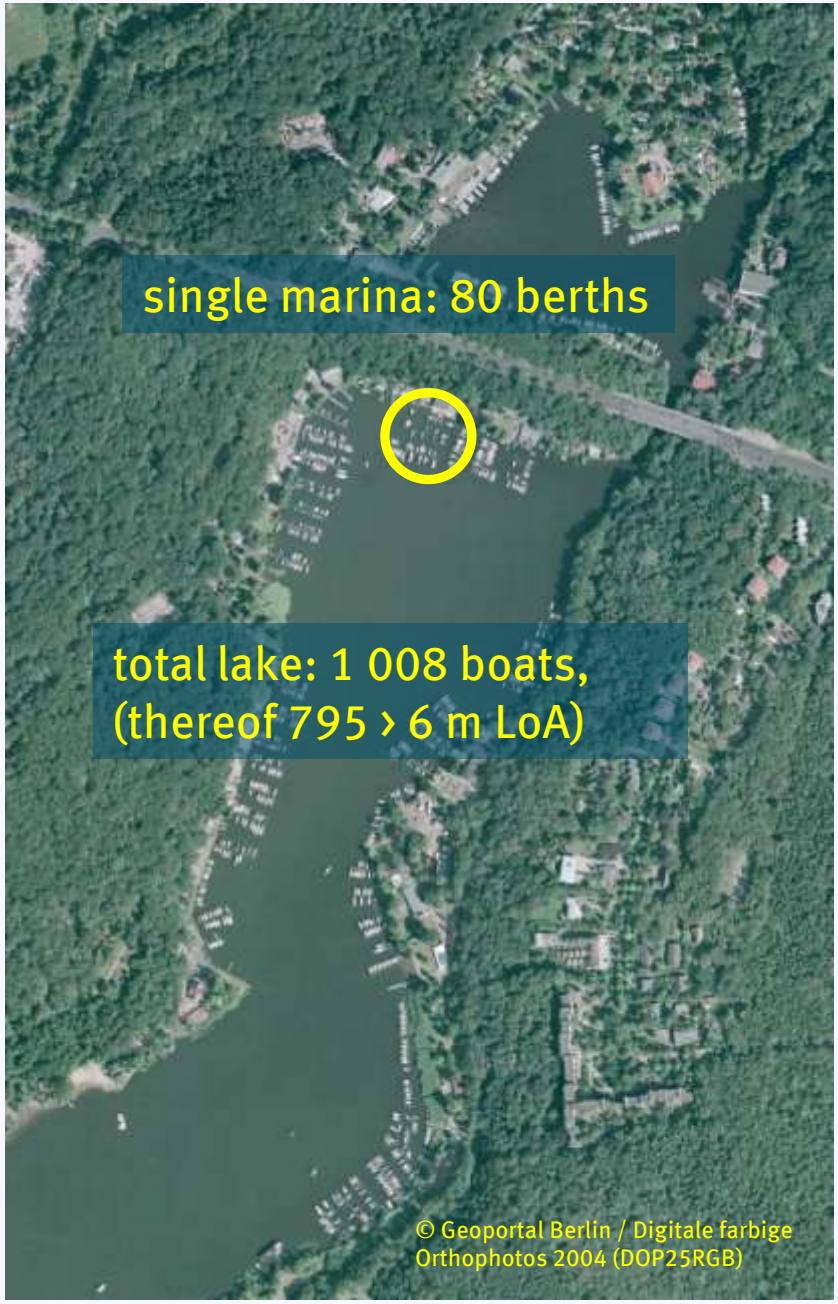
[1]: 1 - 18 ‰ Salinity (Baltic Sea, estuaries)



Project: WP 1 - Census

Results on local scale

- marinas & landing stages: often closed-packed at lakefronts & riverbanks
- clusters of small marinas often exceed >1 000 berths in total (slow running or stagnant waters)



Project: WP 1 - Census

Results on (infra) - structure

- Embankment :

  salt: > 70% ‘closed[1]’ (‘save haven’)

  fresh: <80 % ‘open’

  → water exchange

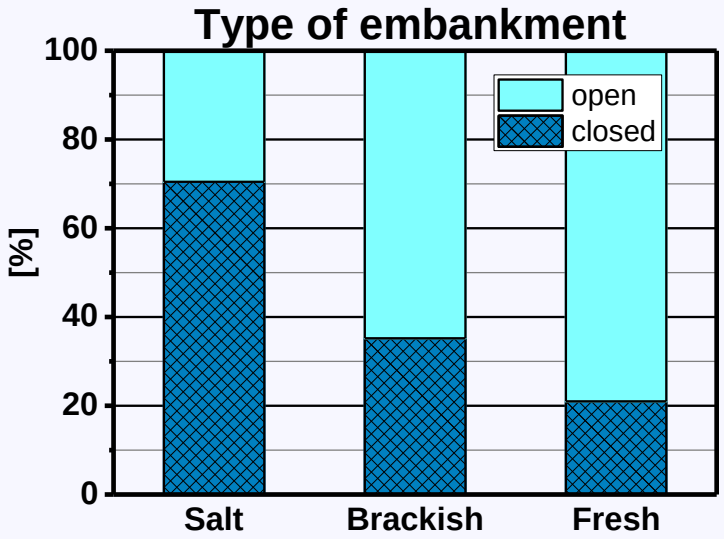
- Infrastructure:

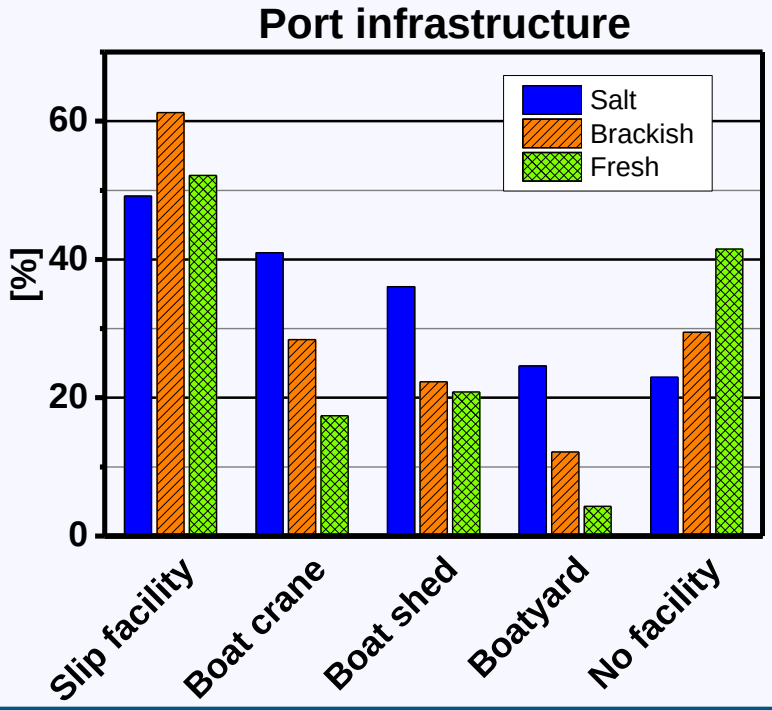
  salt: well equipped

  fresh: less equipped

  → additional AF inputs from M&R

[1]: closed: 3-sided embankment





Project: WP 1 - Census

Results on marina size & berths

- Berths per marina:

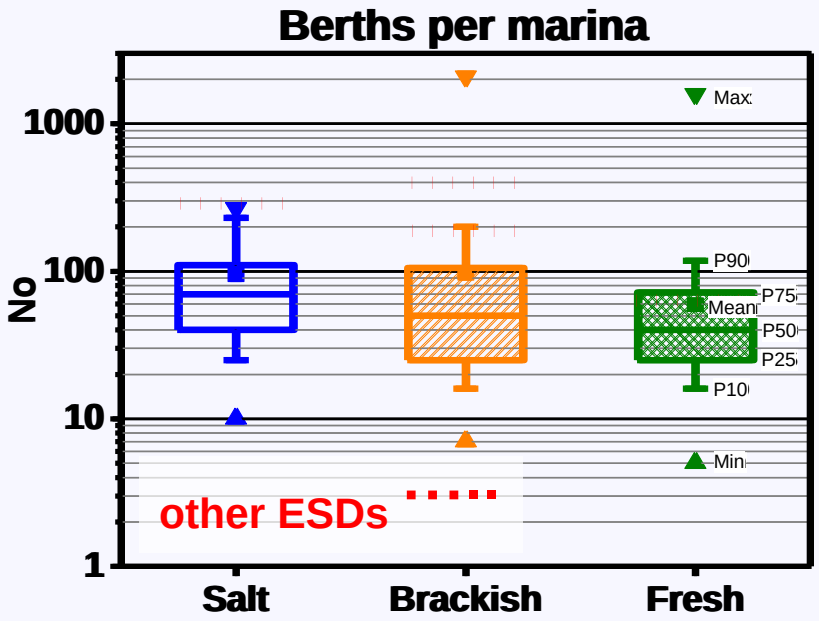
  P50: salt: 70; brackish: 50; fresh: 40

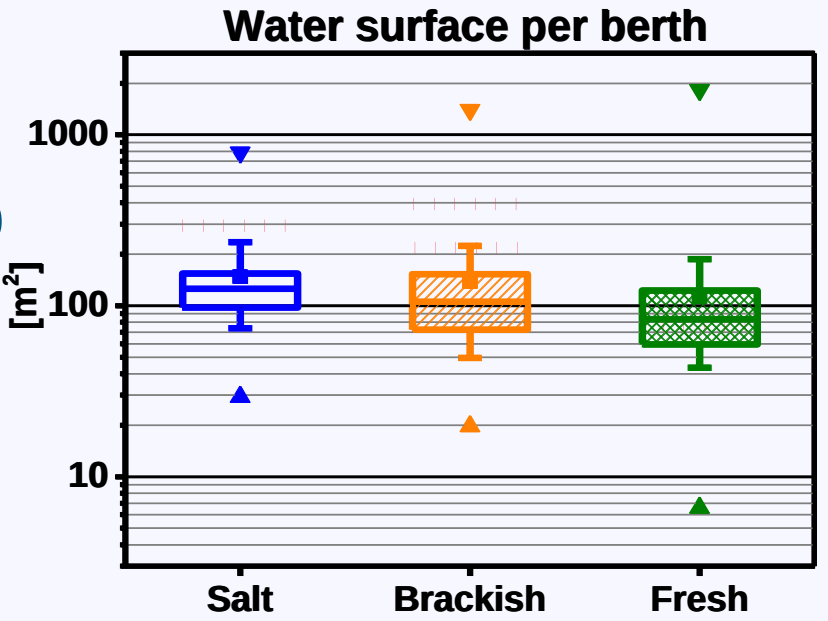
  extreme sizes at brackish & inland waters

- Water surface per berth:

  P50: salt: 120; brackish: 105; fresh: 80

  → modeled AF concentration





Project: WP 2 - Screening

Concept

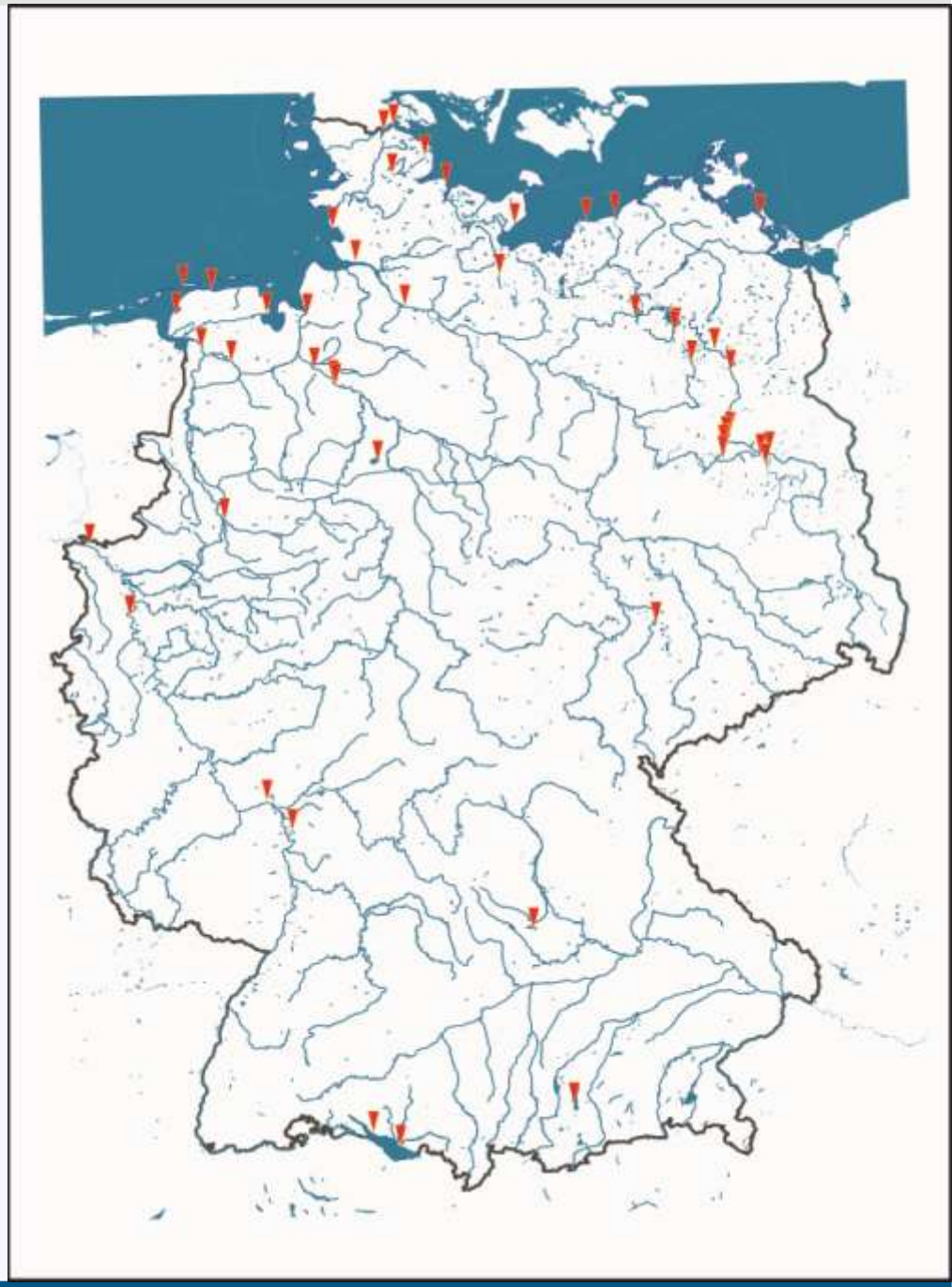
- Survey on AF agents, recently on the D market (water samples)
- Water quality parameters
- Actual No of boats at berth and marina infrastructure

Sampling Sites

- 50 marinas selected:

Salt:	5
Brackish[1]:	11
Fresh:	34

[1]: 1 – 18 ‰ Salinity (Baltic Sea, estuaries)



Project: WP 2 - Screening

Results: AF active agents & break-down products (BDP):

- Pyrithione (as Cu-complex) + PSA (BDP)
- Zineb only as ETU (BDP)
- DCOIT[1] + NNOA, NNOMA, NNOOA (BDP)

all < LoQ

- Dichlofluanid + DMSA (BDP)
- Tolylfluanid + DMST (BDP)

only BDP > LoQ

- Cu + Zn (filt. samples)

Cu 6x, Zn 9x > PNEC[3]

- Cybutryn[2] + M1 (BDP)

5x > MAC-QS[4]

Additional non-AF agent:

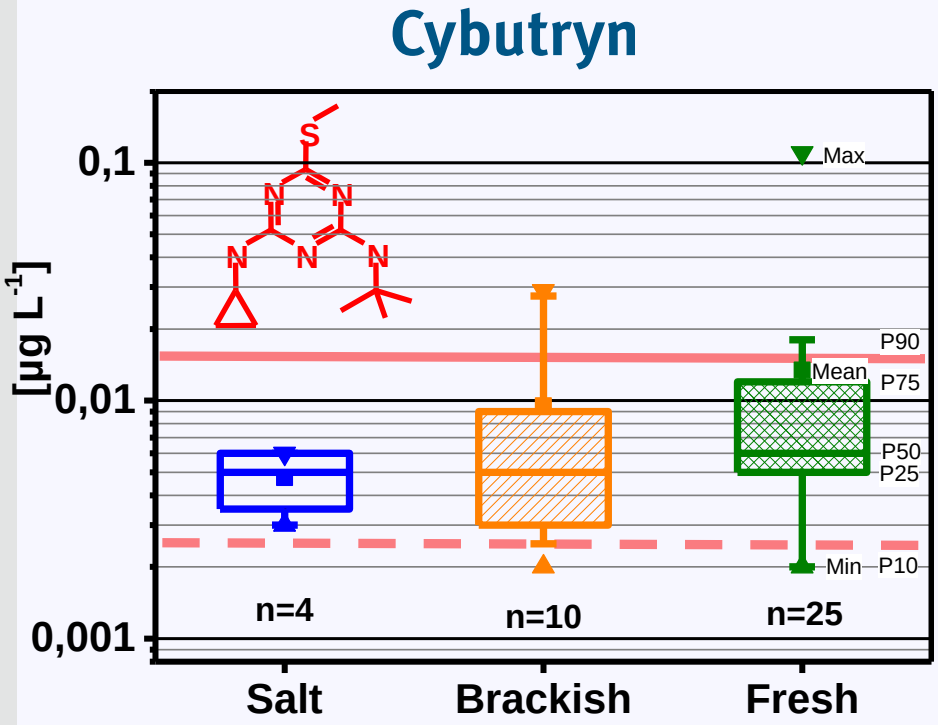
- Terbutryn

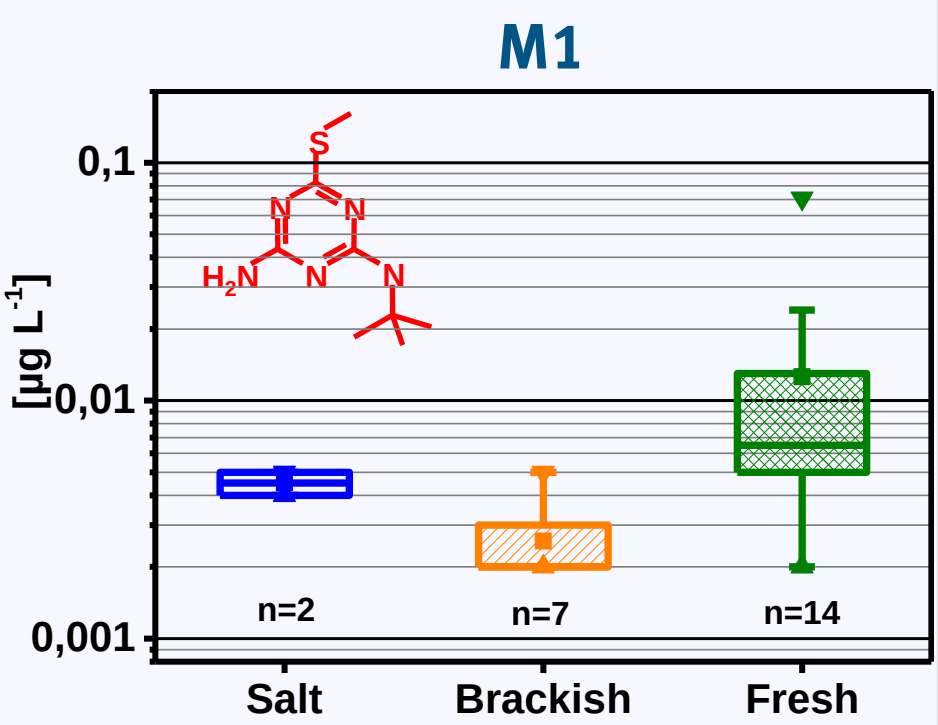
[1] : Sea-Nine 211
[2] : Irgarol
[3] : ECI 2008, EU 2010
[4] : EU 2013/39/EU

Project: WP 2 - Screening

AF active agents

- Booster-Biocide: Cybutryn (Irgarol) + BDP M1





MAC-QS: 0,0160 µg/L
AA-QS: 0,0025 µg/L

(QS acc. 2013/39/EU Parliament)

Project: WP 3 – Modelling

Concept

- Comparing measured AF biocides with model result (MAMPEC) on the basis of real marinas (incl. background data)

Sampling Sites

- 10 marinas selected:

  Salt: 2

  Brackish[1]: 4

  Fresh: 4

[1]: 1 -18 ‰ Salinity (Baltic Sea, estuaries)

Input

- Leaching rate[2]

  Cu: 50 µg/m²/d

  Booster: 2,5 µg/m²/d

- Application factor[3]

  Cu: 100%

  Booster: 10 - 20%

- Percentage % per weight[4]

  Cu: 40%

  Booster: 2,5 - 10%

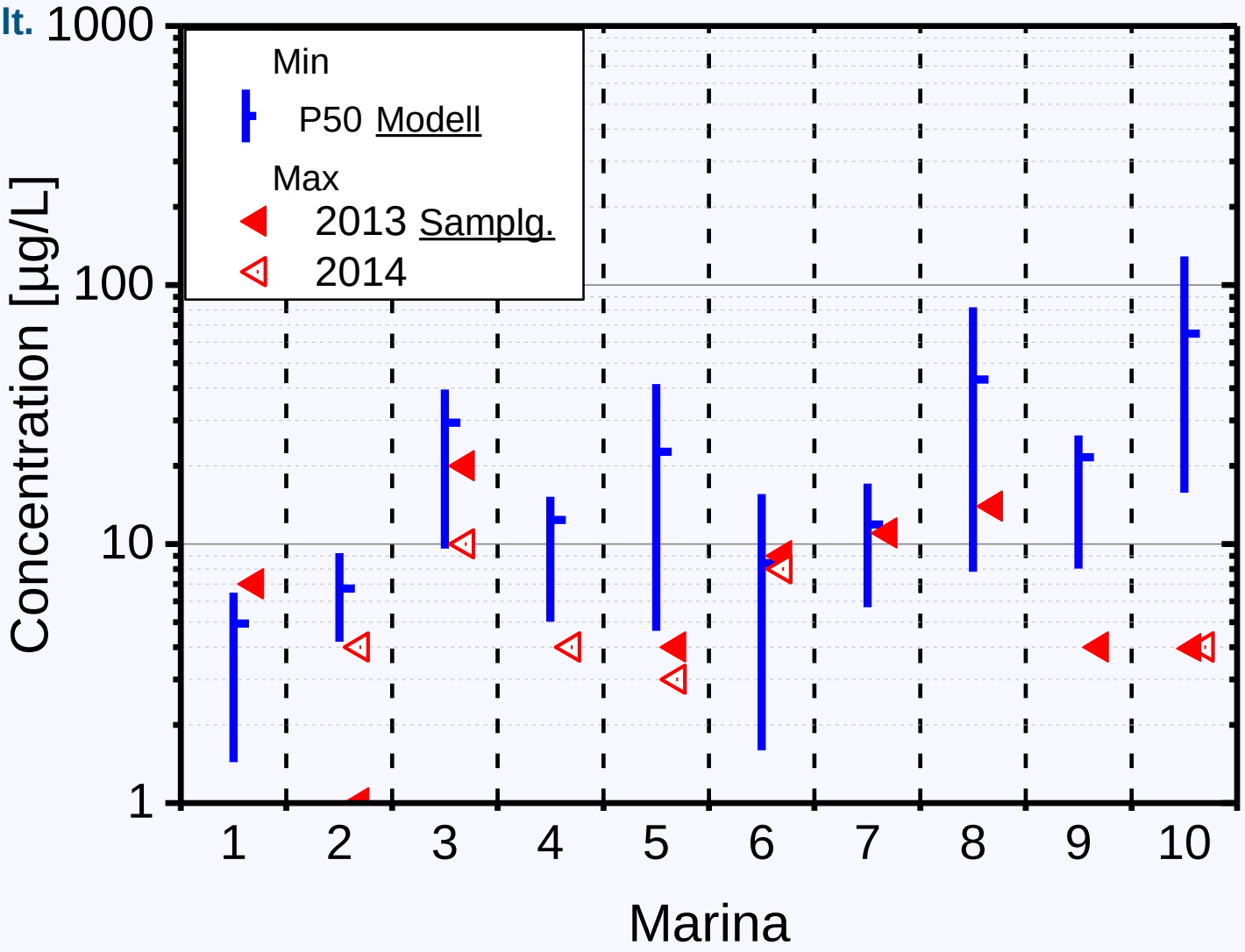
[2]: Default MAMPEC

[3]: LimnoMar 2013: market survey

[4]: SDS: highest level

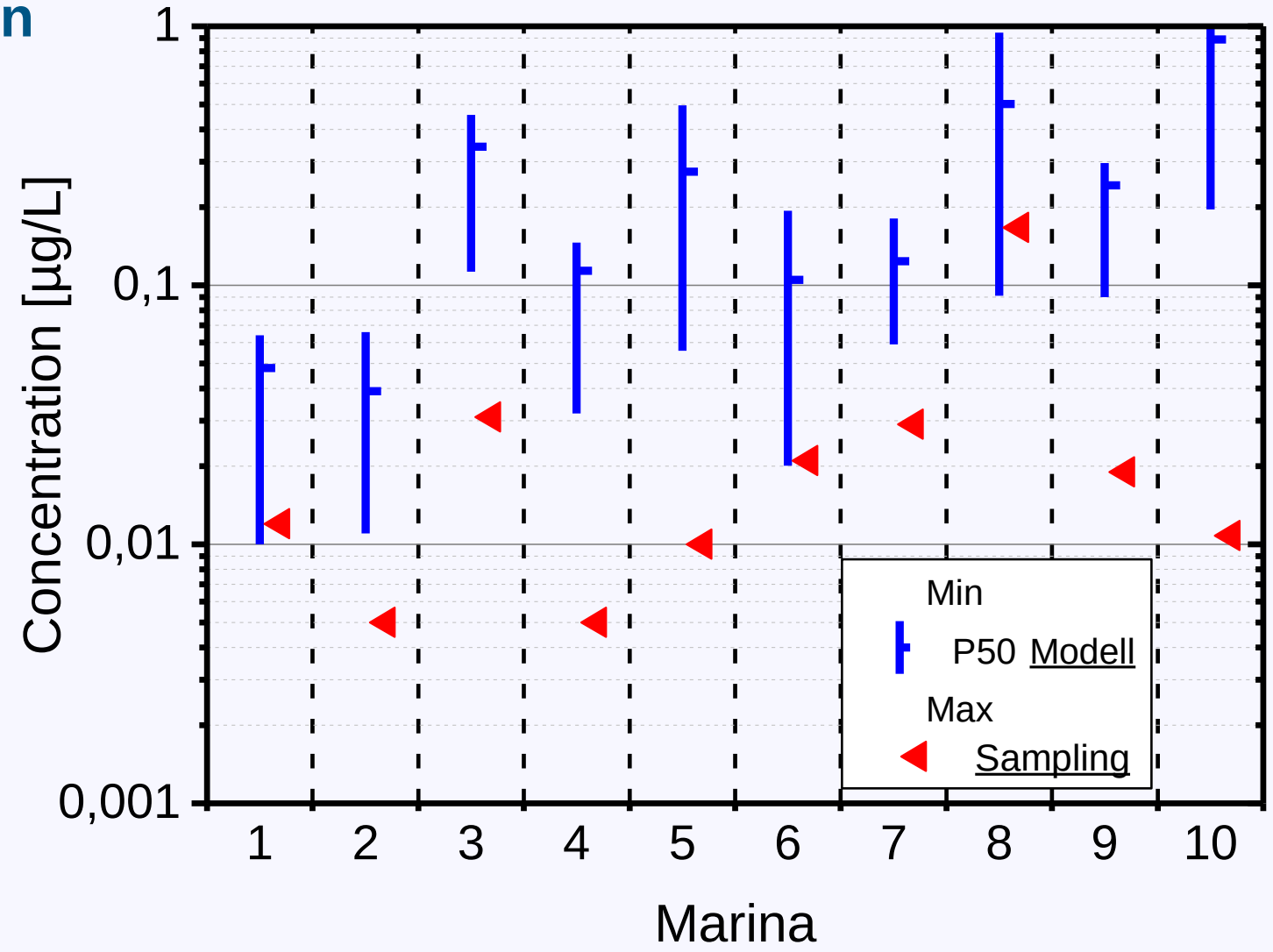
Project: WP 3 – Modelling

Copper, filt.



Project: WP 3 – Modelling

Cybutryn



Project: WP 3 – Modelling

Results

Outcome is very different:

- Product:

  local application factor, product concentration, leaching rate level

- Single measurements:

  low representativeness due to short-term events (flood, wind,..)

- Model limitation: initially: dyked marinas + regular flow condition (tide)

  - upgrade: wind driven hydrology

  - unsolved: un-embanked marinas
    agglomerations of marinas
  - missing: an actual comprehensive
    model description

Wind Speed [m/s]	Water Exchange [% Vol. Marina]
0	4,1
0.5	32,6
1	62,9

Project: WP 3 – Modelling

Summary

- WP 1: outstanding importance of leisure boat activity at German inland waters (in total, on regional + local scale)
  basic data to set up a freshwater scenario on single marina,
  need to assess agglomerations of marinas
- WP 2: ‘snap shop’ on actual used (permitted) AF active agents
  Cybutryn: exceedances of WFR limit values (ECHA, NL, ...),
  Input of Zn + Cu might be relevant for some sites in the water
  (sediment may act as sink, but were not investigated here)
- WP 3: some need for improvement of MAMPEC: un-dyked inland marinas, documentation (VCI, van Hattum)

Thanks for your attention

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