Ecotoxicology results on aluminium and chemical risk analysis

Matthieu Dussauze, France Energies Marines

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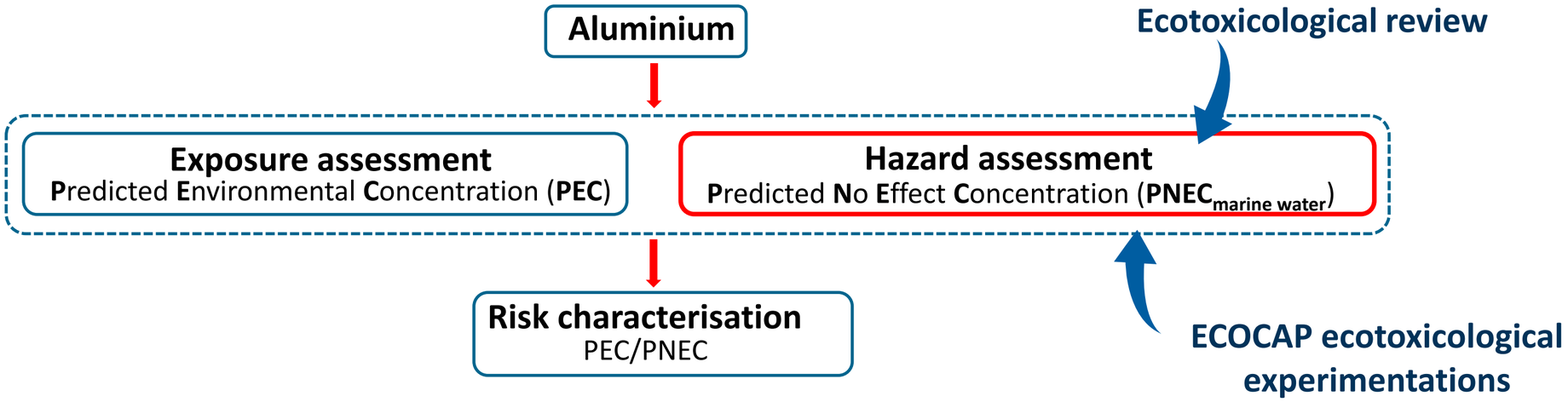
- Main objectif of ECOCAP was to define an ecotoxicological Al threshold value for seawater



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- Main objectif of ECOCAP was to define an ecotoxicological Al threshold value for seawater

Litterature : Two water quality guidelines values based on species sensitivity distribution (SSD)

- **Golding *et al* (2015)** proposed for tropical marine species the thresholds of :
  - 24 µg L^{-1} of total Al to protect 95 % of species
  - 2.1 µg L^{-1} of total Al to protect 99 % of species
- **Van Dam *et al* (2018a)** established for temperate marine species the thresholds of :
  - 22 µg L^{-1} of total Al to protect 95 % of species
  - 1.2 µg L^{-1} of total Al to protect 99 % of species

BUT no validation based on REACH technical guidance

Ecotoxicology results on aluminium and chemical risk analysis

PNEC definition water column following REACH technical guidance described by the European Chemical Agency

$$PNEC = \frac{\text{The lowest value (EC, LC, NOEC…) from aquatic toxicity studies}}{\text{Assessment factor}}$$

PNEC type	Available data	Assessment factor
$PNEC_{water}$	At least 1 short-term EC_{50} from each of 3 trophic levels	1000
	1 long-term EC_{10} or NOEC from 1 trophic level	100
	2 long-term EC_{10} or NOEC from species representing two trophic levels (algae + crustacean or fish)	50
	Long-term results from at least 3 species representing 3 trophic levels (algae, crustacean, fish) + 2 additionnal marine taxonomic groups (echinoderm, mollusc)	10

$EC_{10/50}$: Effect concentration at which 10 (or 50)% effect (mortality (lethal concentration), inhibition of growth, reproduction, etc) is observed compared to the control group

NOEC (No Observed Effect Concentration)

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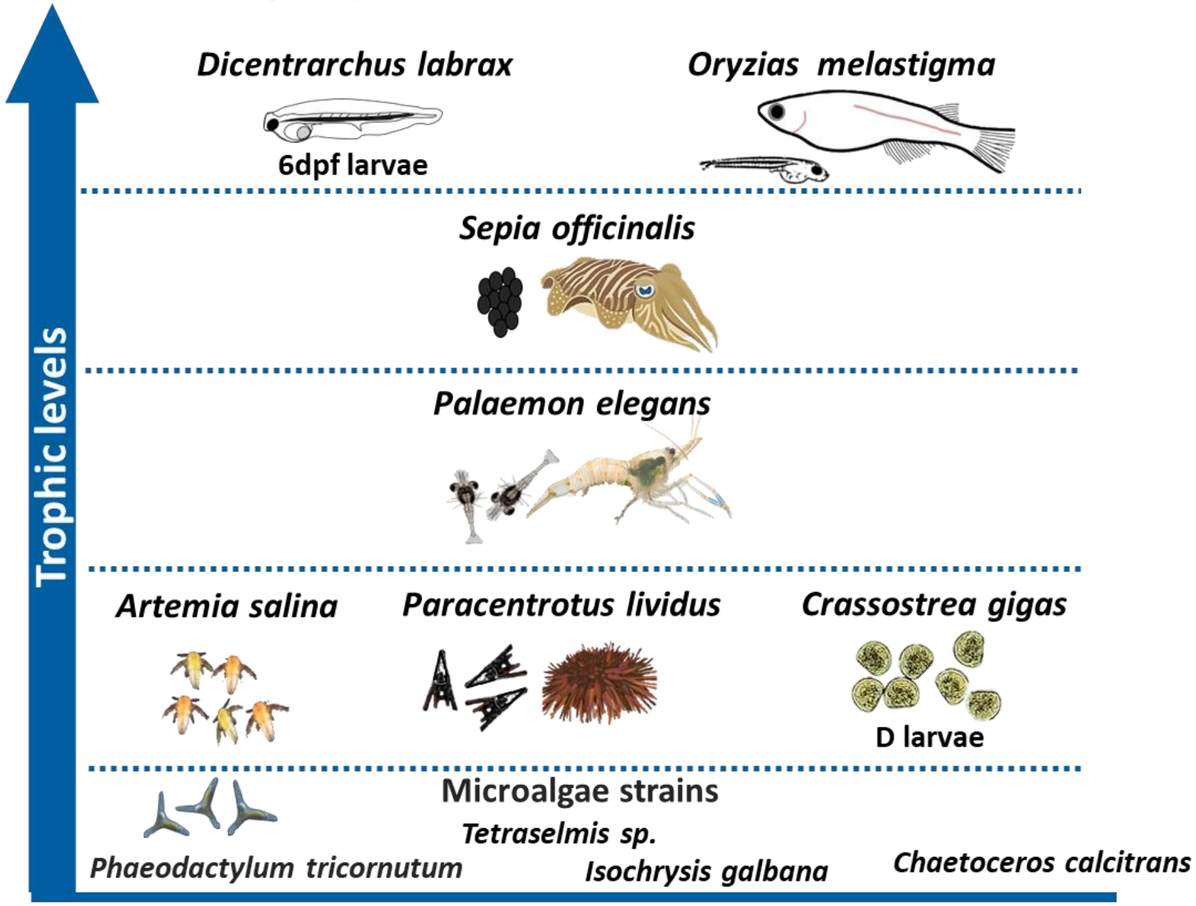
ECOCAP has conducted series of acute and chronic laboratory experiments to define PNEC Al for seawater:

- Representative model species from various taxonomic groups
- Representative trophic levels
- Focused at differents life cycle stages
- Acute and chronic assays



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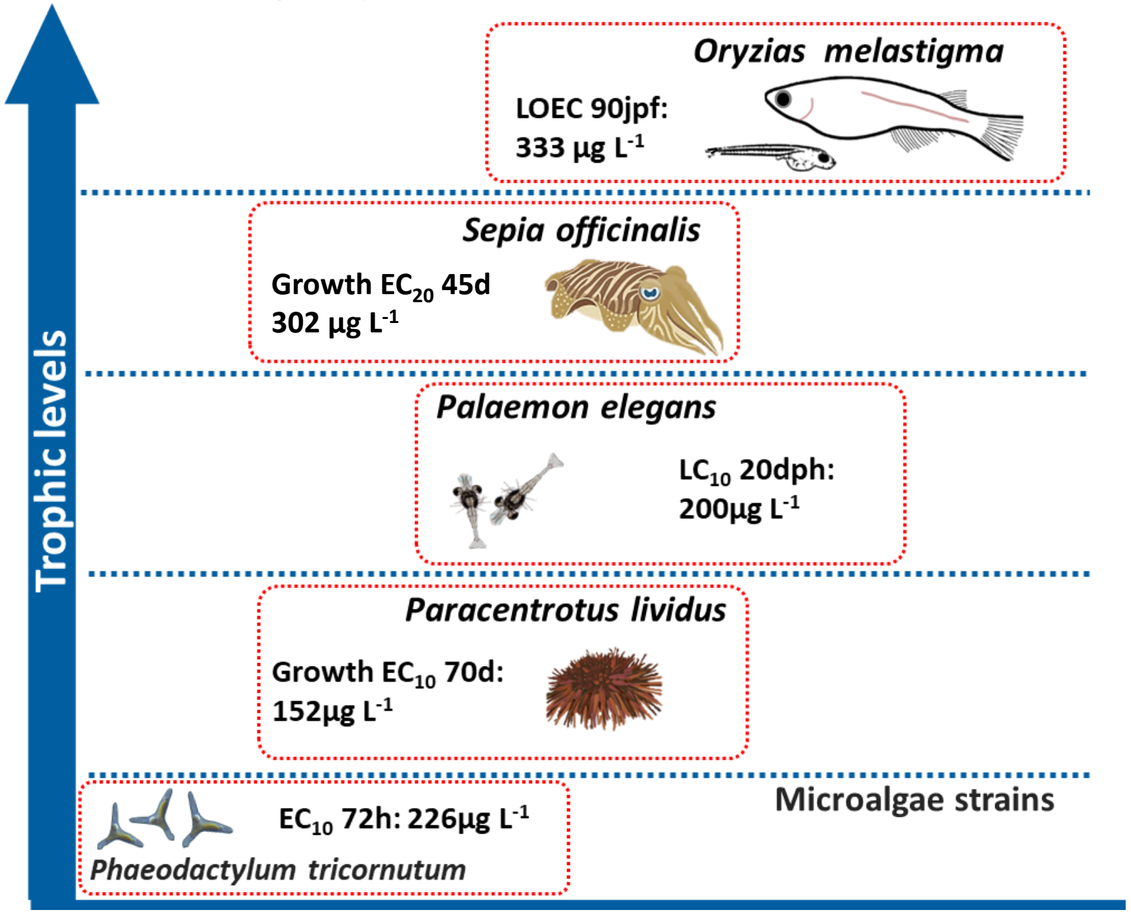
Endpoints (Concentration Al total L^{-1})
Al salt for Chemical risk assessment as Golding *et al* and Van Dam *et al*



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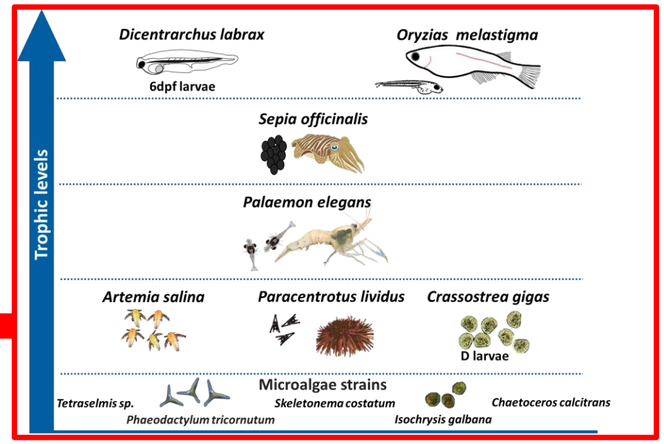

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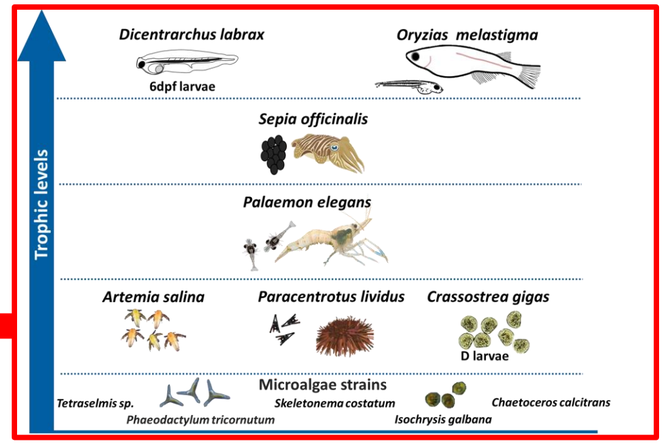

Inhibition concentration (IC)

the diatom microalgae *Ceratoneis closterium*

IC_{10} : 14 µg L^{-1} Al (Harford et al., 2011)
IC_{10} : 16 µg L^{-1} Al (Golding et al., 2015)
IC_{10} : 80 µg L^{-1} Al (Gillmore et al., 2016)

Average: 37 µg L^{-1}

Assessment factor

$PNEC_{seawater}$ Al = 3,7µg L^{-1}

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Risk caracterisation for Al in seawater :

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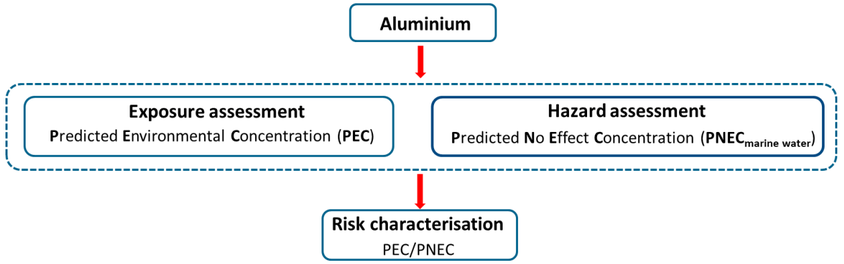

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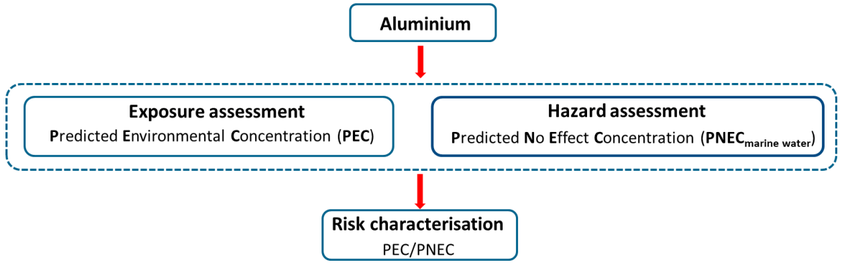

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Case studies with GACP scenario	PEC_{OWF} for Al (µg L^{-1})	$PEC_{cumulated}$ for Al (µg L^{-1})
Seine bay OWF	1.11	3.48
St-Nazaire OWF	0.56	21.56
GOL Area 1 -750MW	1.83	6.95
GOL Area 2 -750MW	1.54	9.74

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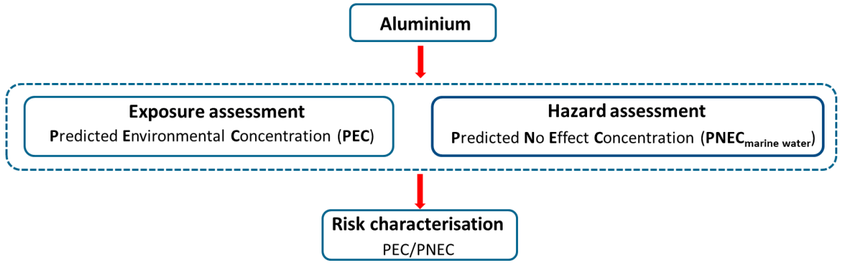

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Seine bay OWF	1.11	3.48	**3.14**
St-Nazaire OWF	0.56	21.56	**38.5**
GOL Area 1 -750MW	1.83	6.95	**3.80**
GOL Area 2 -750MW	1.54	9.74	**6.32**

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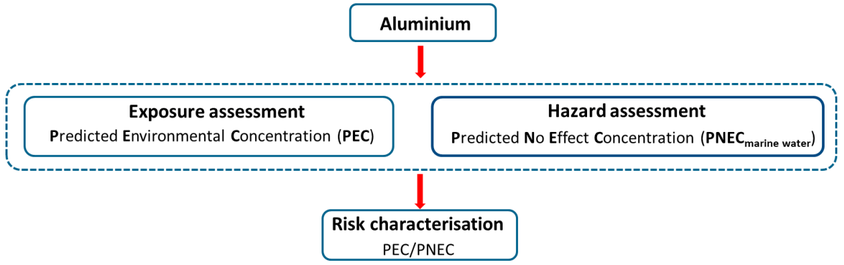
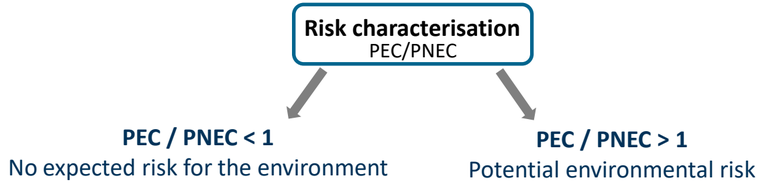


Case studies with GACP scenario	PEC_{OWF} for Al (µg L^{-1})	$PEC_{cumulated}$ for Al (µg L^{-1})	Ratio $PEC_{cumulated}$ / PEC_{OWF}	PEC_{OWF} /PNEC
Seine bay OWF	1.11	3.48	**3.14**	**0,30**
St-Nazaire OWF	0.56	21.56	**38.5**	**0,15**
GOL Area 1 -750MW	1.83	6.95	**3.80**	**0,49**
GOL Area 2 -750MW	1.54	9.74	**6.32**	**0,42**



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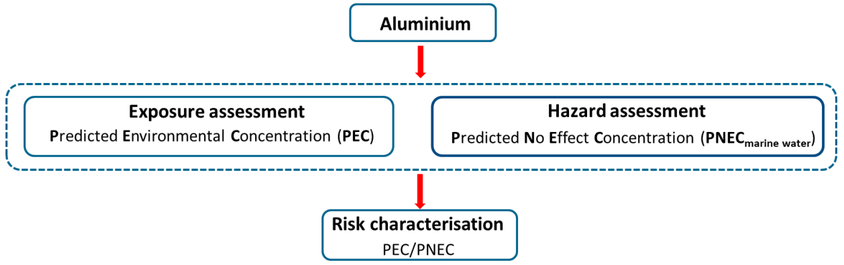
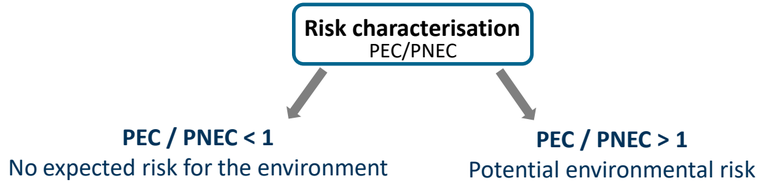


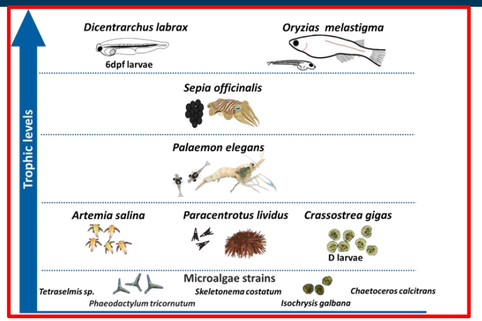
Case studies with GACP scenario	PEC_{OWF} for Al (µg L^{-1})	$PEC_{cumulated}$ for Al (µg L^{-1})	Ratio $PEC_{cumulated}$ / PEC_{OWF}	PEC_{OWF} /PNEC	$PEC_{cumulated}$/PNEC
Seine bay OWF	1.11	3.48	**3.14**	**0,30**	**0,94**
St-Nazaire OWF	0.56	21.56	**38.5**	**0,15**	**5,83**
GOL Area 1 -750MW	1.83	6.95	**3.80**	**0,49**	**1,88**
GOL Area 2 -750MW	1.54	9.74	**6.32**	**0,42**	**2,63**

Main driver Loire river

Main driver atmospheric inputs



Conclusion Ecotoxicology of GACP



- Aluminium threshold values from ECOCAP lab experiments are all higher than concentrations from modelling approaches in the water column

- Considering only OWF inputs: no expected risk for Al in water column (REACH directive) **1st step**

- Other steps for improve ecotoxicological knowedge ofAl from GACP:
  - Risk assesment for sediment
  - Trophic investigation,
  - Sub-lethal assessment

- But other chemical in GACP: Zn, In, Ga + cocktail…

FRANCE ENERGIES MARINES

Thank you for you attention