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From Offshore Wind to Marine Food Webs

Tracking Critical Raw Materials, Rare Earth Elements and Mercury in North Sea Ecosystems

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KEY FINDING **First mercury baseline for a Belgian offshore wind farm food web reveals marked differences among taxa**

1 · Why investigate trace elements in OWF ecosystems?

New habitats: Offshore wind farms (OWFs) create artificial substrates that support diverse communities and new food webs.

Emerging contaminants: Corrosion and weathering of these structures may release critical raw materials (CRMs), including rare earth elements (REEs), into the marine environment.

Legacy contaminants: OWF driven changes in habitat, organic matter deposition and food-web structure may influence mercury (Hg) and methylmercury (MeHg) accumulation and trophic transfer.

The bioaccumulation and trophic transfer of these elements in OWF ecosystems remain poorly understood.

2 · Project MARE-WIND

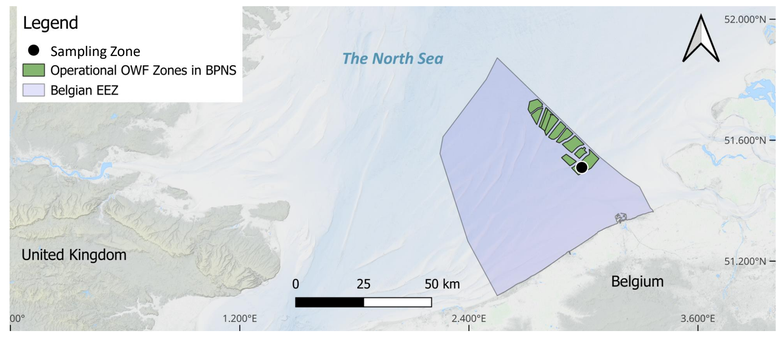
By integrating emerging and legacy contaminants with food-web ecology, MARE-WIND aims to inform environmentally responsible marine renewable energy development. Its objectives are to -

i **Characterise occurrence**
CRMs, REEs and Hg in organisms on turbine structures and in surrounding habitats

ii **Investigate trophic transfer**
Combine contaminant analysis with $\delta^{13}C$, $\delta^{15}N$ and $\delta^{34}S$ to resolve food-web structure

iii **Extend to top predators**
CRM and REE screening in stranded seals and harbour porpoises (BE & DE coasts)

3 · Study design & analytical workflow



May 2026	11	47
1st campaign	Sampling stations within a Belgian OWF	Samples analysed for total mercury (THg)

Sampling: Biofouling organisms collected from underwater mooring platforms and fish by open-water angling within a Belgian OWF

Preparation: Tissue selection, freeze-drying, homogenisation

COMPLETED **THg · DMA (Presented here)**

ONGOING MeHg · GC-AFS CRMs/REEs · ICP-MS Isotopes · IRMS

4 · Preliminary findings: total mercury varies across sampled taxa

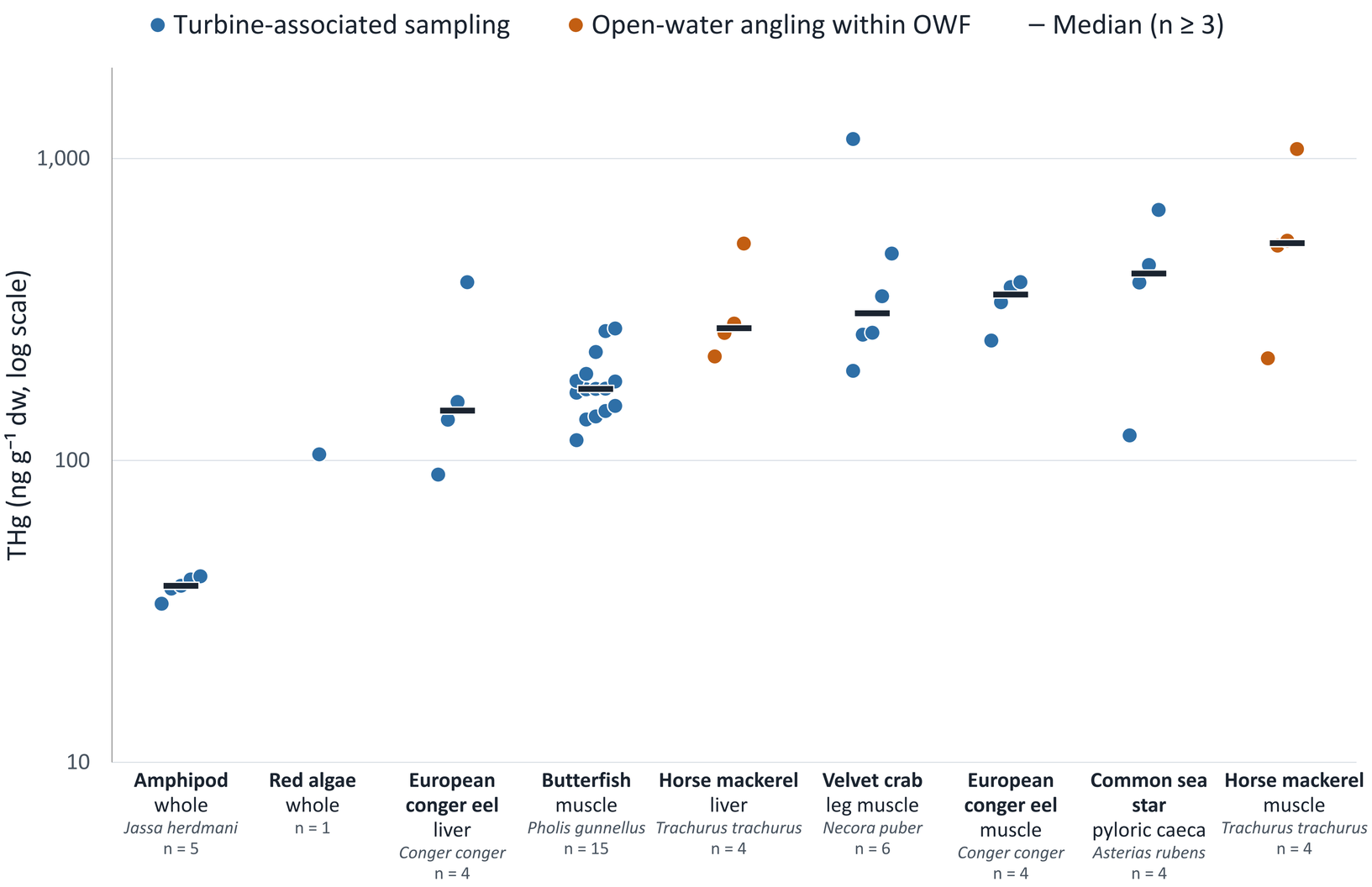


Fig. 1 · Total mercury in 47 biological samples from the first OWF campaign (May 2026). Points are individual or pooled samples; horizontal markers show medians where n ≥ 3. (*Dry-weight basis)*

Key findings

- **Biofouling base:** The amphipod *Jassa herdmani* had the lowest median THg (38 ng g^{-1} dw).
- **Benthic predators:** Common sea stars (416) and velvet crabs (307 ng g^{-1} dw) had far higher THg than amphipods.
- **Fish:** Median THg concentrations were 172 in butterfish, 354 in conger eel and 524 ng g^{-1} dw in horse mackerel, the highest among sampled taxa.

Questions ahead

- Does mercury biomagnify along the OWF food web?
- Do turbine-derived CRMs and REEs accumulate in organisms?
- Do these elements reach marine mammals?

5 · What these first results tell us

From amphipods to fish, Hg was found throughout the studied Belgian OWF food web, with median THg varying more than tenfold among taxa. This first baseline sets the stage for MeHg and stable isotope analyses to identify what drives these differences, and to trace CRMs and REEs through the same food web.

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