Invasive species in the Baltic Sea and surrounding inland waters

Over 100 new species established themselves in the Baltic Sea during the 20th century. This is a significant addition to the biodiversity of this species-poor, brackish sea, which only supports approximately 900 species altogether. Since the Baltic is very young in evolutionary terms, its colonization is still not complete, and newcomers are easily filling available space and ecosystem functions.

Why so many and can we do something about this?

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Why so many?

- **1. Heavy Maritime Traffic**
- The Baltic Sea is one of the busiest shipping areas in the world.
- Ships often discharge **ballast water** taken on in other regions, which can contain non-native organisms like plankton, larvae, and small invertebrates.
- These organisms can establish themselves in the Baltic if conditions are suitable.

- **2. Brackish Water Environment**
- The Baltic Sea has a unique **brackish water** mix (low salinity), which is stressful for many native marine and freshwater species.
- This creates ecological niches that **invasive species**, which are often more adaptable, can exploit.

- **3. Limited Native Biodiversity**
- The Baltic Sea has relatively **low species diversity** due to its young geological age and harsh conditions.
- This makes it easier for invasive species to establish themselves, as there is **less competition** and fewer natural predators.

- **4. Climate Change**
- Warming waters and changing salinity levels are making the Baltic more hospitable to species that previously couldn’t survive there.
- This increases the **range and survival** of invasive species.

Invasive species in the Baltic Sea – *first, small organisms…*

1. Invertebrates

Invertebrates represent the most numerous and ecologically impactful group of invasive species in the Baltic Sea. Many originate from the Ponto-Caspian region and have been introduced via ballast water or canals.

- **Marenzelleria spp.** (polychaete worms): First observed in the 1980s, these worms have colonized much of the Baltic, especially in deeper sediments. They alter benthic ecosystems by increasing bioturbation and outcompeting native species [1].
- **Cercopagis pengoi** (predatory water flea): Introduced in the early 1990s, this species competes with native zooplankton and clogs fishing nets, affecting both biodiversity and fisheries [1].
- **Gammarus tigrinus** (amphipod): A North American species that displaces native amphipods and alters food web dynamics.
- **Dreissena polymorpha** (zebra mussel): Known for its biofouling capabilities, it competes with native bivalves and affects water filtration processes.

Discovery of mud crab in Matsalu Bay can disrupt marine ecosystems

NEWS

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An adult specimen of estuarine mud crab (Rhithropanopeus harrisii) was discovered in Matsalu Bay for the first time. Source: Jonne Kotta

Last week, an adult species of estuarine mud crab (Rhithropanopeus harrisii) was discovered in Matsalu Bay for the first time. Although the crab poses no danger to humans, it can upset the natural balance of their new habitat, which is already evident in Pärnu Bay, where the crab has been living for the last ten years.

Rhithropanopeus harrisii, the estuarine mud crab, is native to the northwestern Atlantic, ranging from Canada to northern Brazil. The crab was discovered in Pärnu Bay off the coast of Estonia in 2011.

🦀 1. Predation Pressure

Mud crabs are **opportunistic predators**. They feed on:

- Bivalves (like mussels and clams)
- Small crustaceans
- Fish eggs and larvae

This can lead to:

- **Declines in native shellfish populations**
- **Disruption of fish recruitment**, especially for species that rely on shallow nursery habitats

🌿 2. Competition with Native Species

Mud crabs compete with native crabs and bottom-dwelling species for:

- Food
- Shelter
- Breeding grounds

This can result in:

- **Displacement of native species**
- **Reduced biodiversity**

🧱 3. Habitat Modification

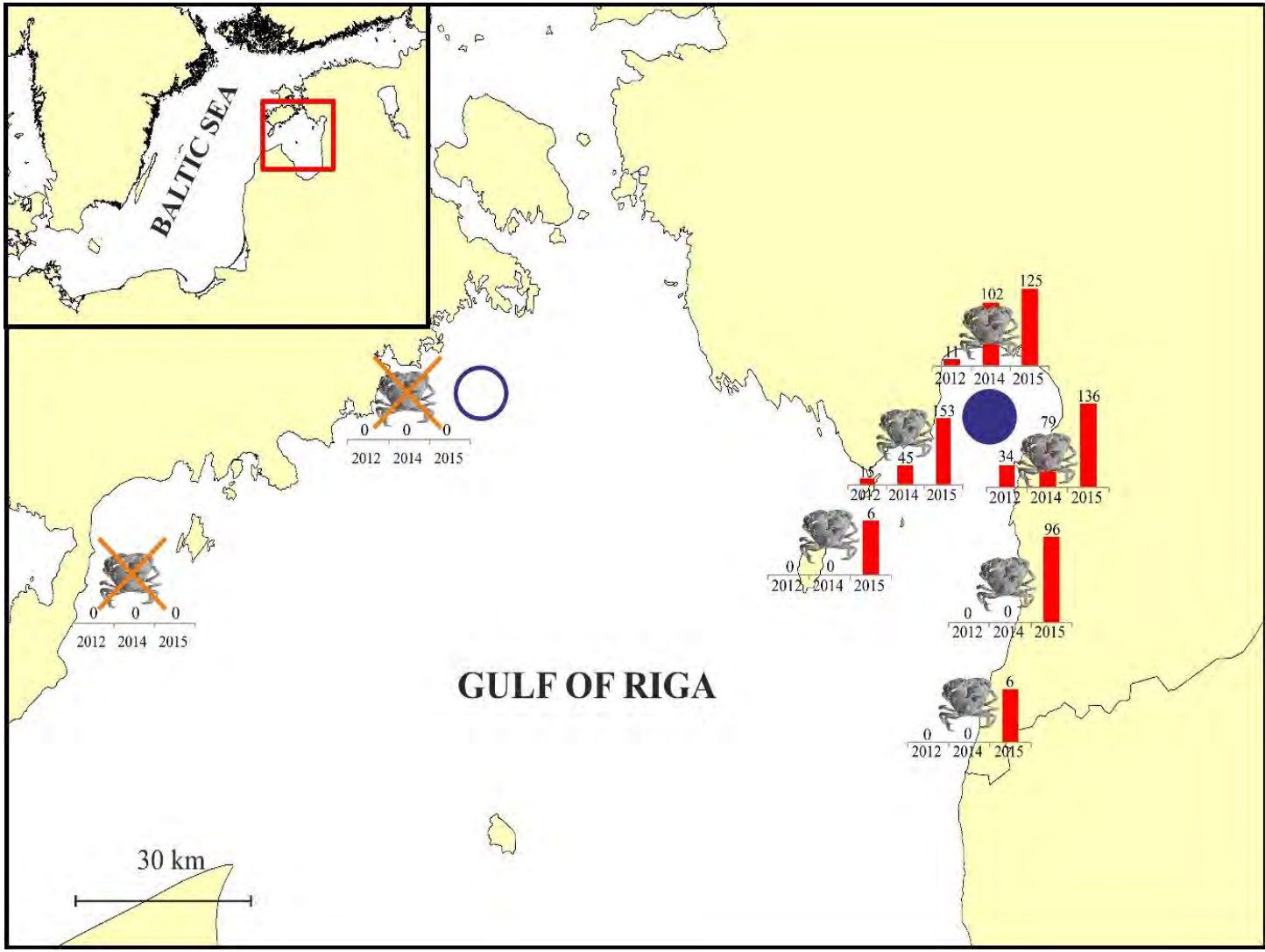
Mud crabs burrow and disturb sediments, which can:

- Increase **turbidity** (cloudiness of water)
- Damage **eelgrass beds** and other important habitats
- Alter **nutrient cycling** in the benthic (seafloor) environment

🔁 4. Trophic Cascade Effects

By preying on herbivores and filter feeders, mud crabs can indirectly:

- Increase **algal blooms** (due to fewer grazers)
- Reduce **water clarity**
- Shift the **balance of the food web**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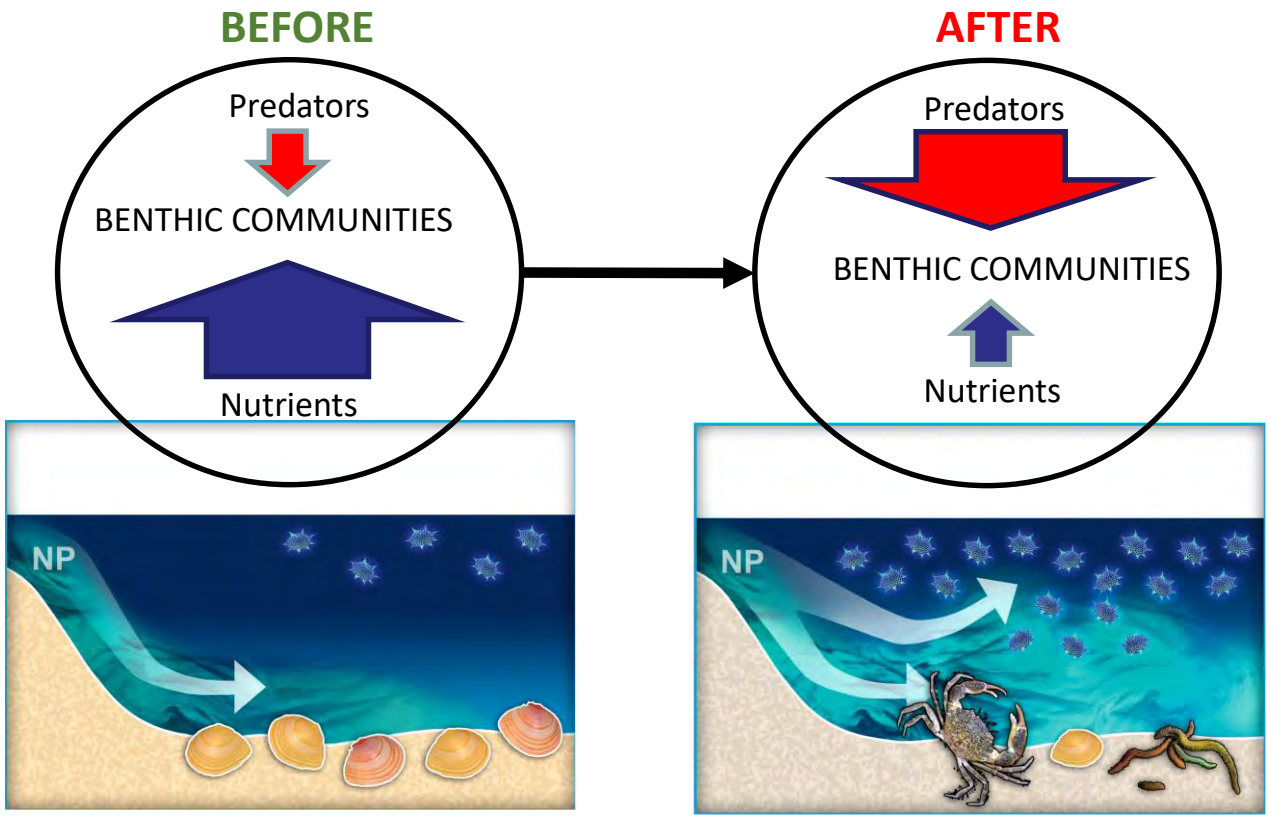
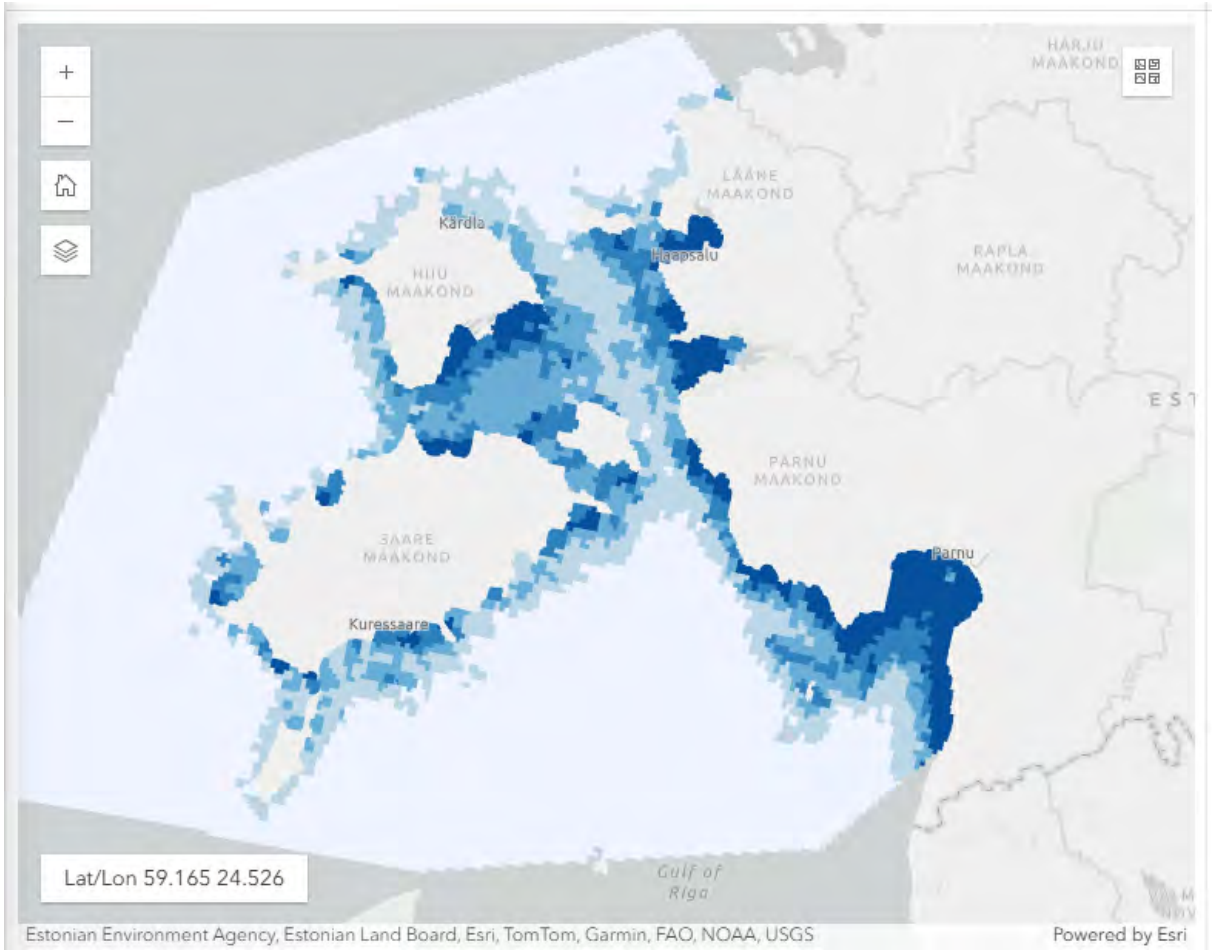
Mudakrabi e. tavaline rändkrabi
mud crab *Rhithropanopeus harrisii*



NEAT

NEAT: Web tool for assessing and mapping the impact of alien species

https://gis.sea.ee/neat/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ORIGINAL RESEARCH article

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Sec. Marine Ecosystem Ecology
Volume 9 - 2022 |
https://doi.org/10.3389/fmars.2022.849878

This article is part of the Research Topic
Biological Invasions in Marine and Estuarine Ecosystems

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Novel Fish Predator Causes Sustained Changes in Its Prey Populations

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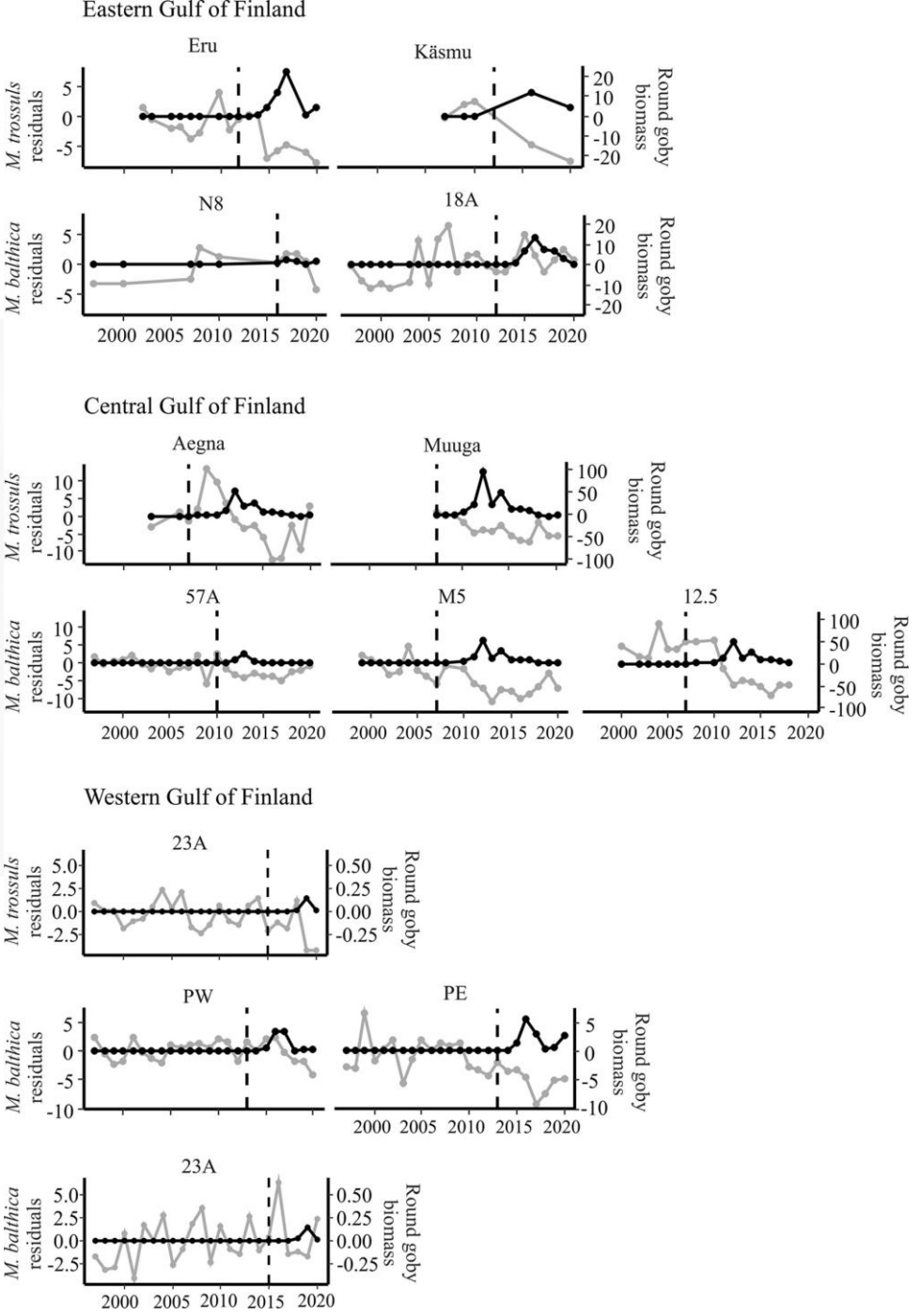


Panga, Saaremaa island

Round goby is already very important for coastal fishery!

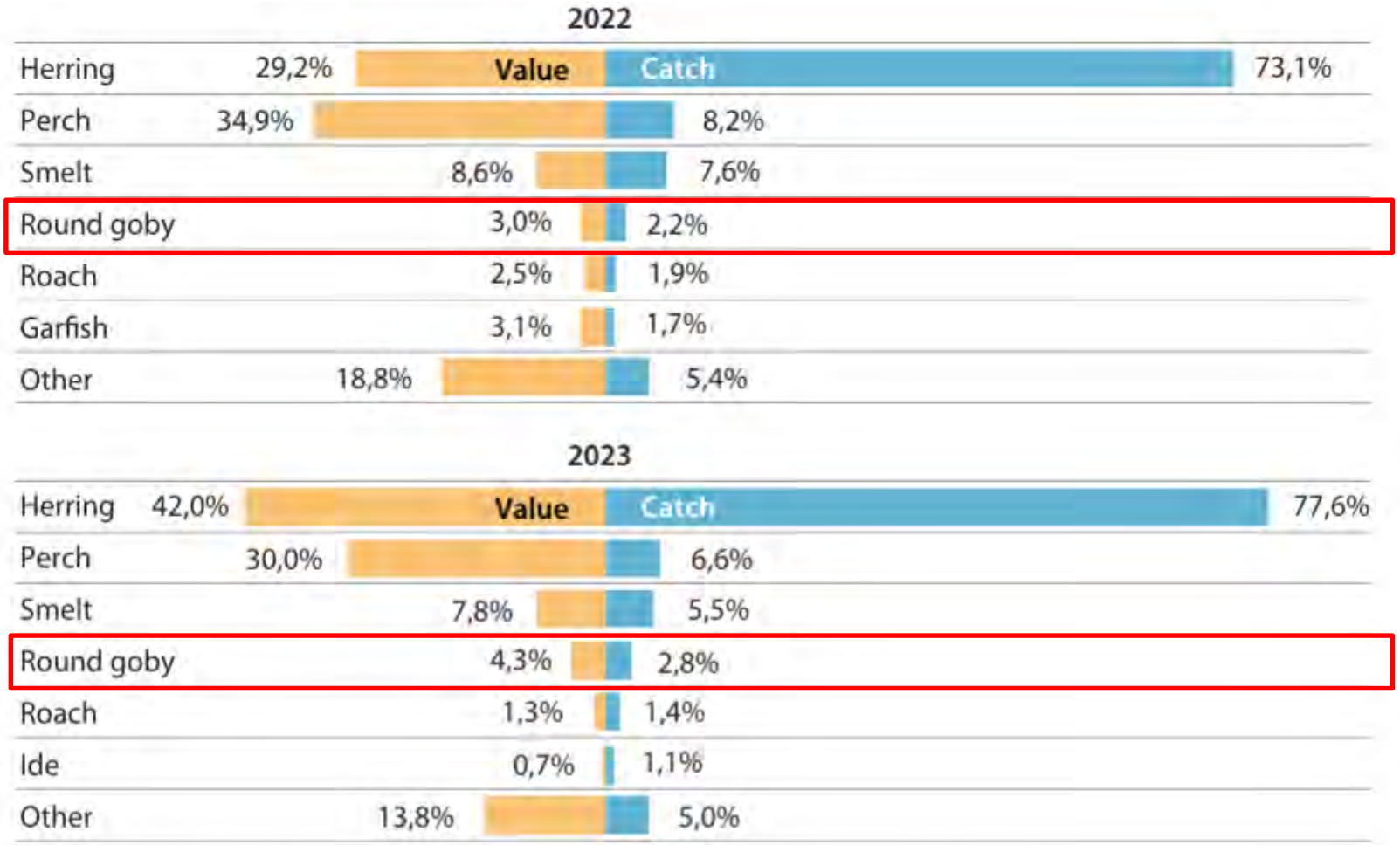


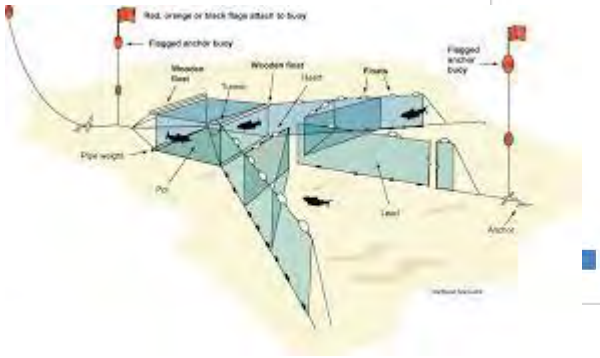
FIGURE 7. Proportions (%) of catches and revenues in coastal fishery, by species, 2022 and 2023 Source: AFB.

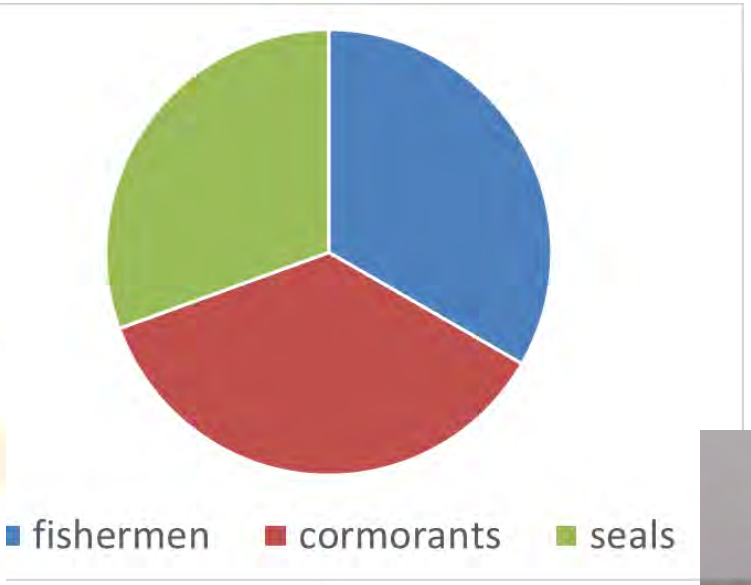

Cormorant is the most important invasive newcomer
in Estonia from the point of view of fishery!

Joonis 1. Kormorani arvukus Eestis 1983–2022 (Keskkonnaagentuur).

Users of fish resource in Estonia

- *Open sea trawling to sprat and herring 40000 – 50000 t*
- Coastal fishery catch: ca 12000 t
- Cormorants: ca 11000 - 16000 t
- Seals: ca 10000 - 15000 t





The actual management of fish stocks in Estonia is therefore handled by the Ministry of Climate, as 60-70% of the use of coastal fish stocks falls within its administrative area!

Changes in fish stocks in an Estonian estuary: overfishing by cormorants?

Markus Vetemaa, Redik Eschbaum, Anu Albert, Lauri Saks, Aare Verliin, Kristiina Jürgens, Martin Kesler, Kalvi Hubel, Rögnvaldur Hannesson, and Toomas Saat

Vetemaa, M., Eschbaum, R., Albert, A., Saks, L., Verliin, A., Jürgens, K., Kesler, M., Hubel, K., Hannesson, R., and Saat, T. 2010. Changes in fish stocks in an Estonian estuary: overfishing by cormorants? – ICES Journal of Marine Science, 67: 1972–1979.

In Estonia, the cormorant *Phalacrocorax carbo sinensis* is a newcomer, and its numbers have increased rapidly since 1985. In the shallow protected (no fishery) Käina Bay in Väinameri (West Estonia), the colony was established in 1995. Gillnet sampling indicated that roach was the most abundant spawning fish species in 1995. Ten years later, when the study was repeated, the catch per unit effort was already more than 100 times lower than in 1995. The number of spawning perch decreased tenfold from 1995 to 2005. During the same period, commercial fishing effort in the entire Väinameri area decreased several times. The change in fish abundance in the Käina Bay and in the coastal fish-monitoring areas in the archipelago sea nearby, together with an analysis of food of cormorants, indicates that the decline in fish abundance might be related to the increased numbers of cormorants. The conclusion is drawn that the establishment of a cormorant colony could have seriously damaged or even prevented normal functioning of historically important spawning grounds and affected fish recruitment to adjacent areas. Therefore, expanding bird colonies might play a role similar to an expanding fishing fleet, by overexploiting the resource.

Keywords: Baltic Sea, effect of cormorants, *Perca fluviatilis*, *Phalacrocorax carbo sinensis*, *Rutilus rutilus*.

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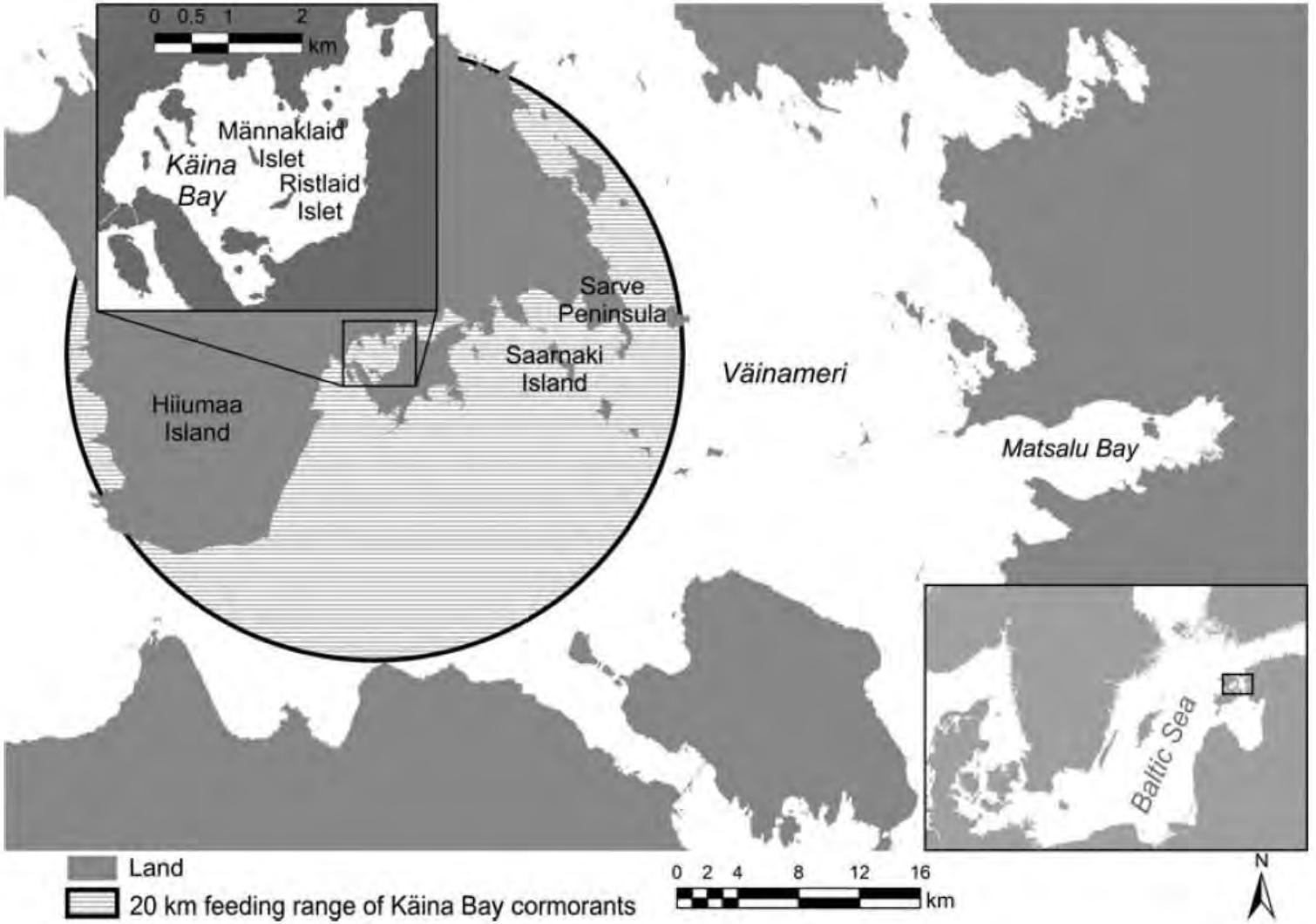


Figure 1. The Väinameri with the location of the regular fish-monitoring surveys (Sarve, Saarnaki, and Matsalu Bay) and the study area in Käina Bay (inset). The cormorant colonies are located on Männaklaid and Ristlaid islets and their approximate feeding range is indicated by the circle.

Impact of cormorants on spawning fish in Käina Bay 1995 – 2005 Over 10 years, the abundance of perch decreased by about 10 times and the abundance of roach decreased by about 100 times (whereas elsewhere in the Väina Sea, the change in abundance was not large)

Table 1. Number of nesting pairs of cormorants (occupied nests) in Käina Bay, 1994 – 2005.

Year	Nesting pairs
1994	0
1995	18
1996	0
1997	18
1998	150
1999	335
2000	500
2001	390
2002	611
2003	No data
2004	724
2005	1 401

In 2005 cormorants eat daily 1,7 kg of (spawning) fish

2024 3607

Sindi dam, until 2018

Sindi pais taasavati kaladele 2018. aastal.

FOTO: FOTO: KESKKONNAAGENTUUR

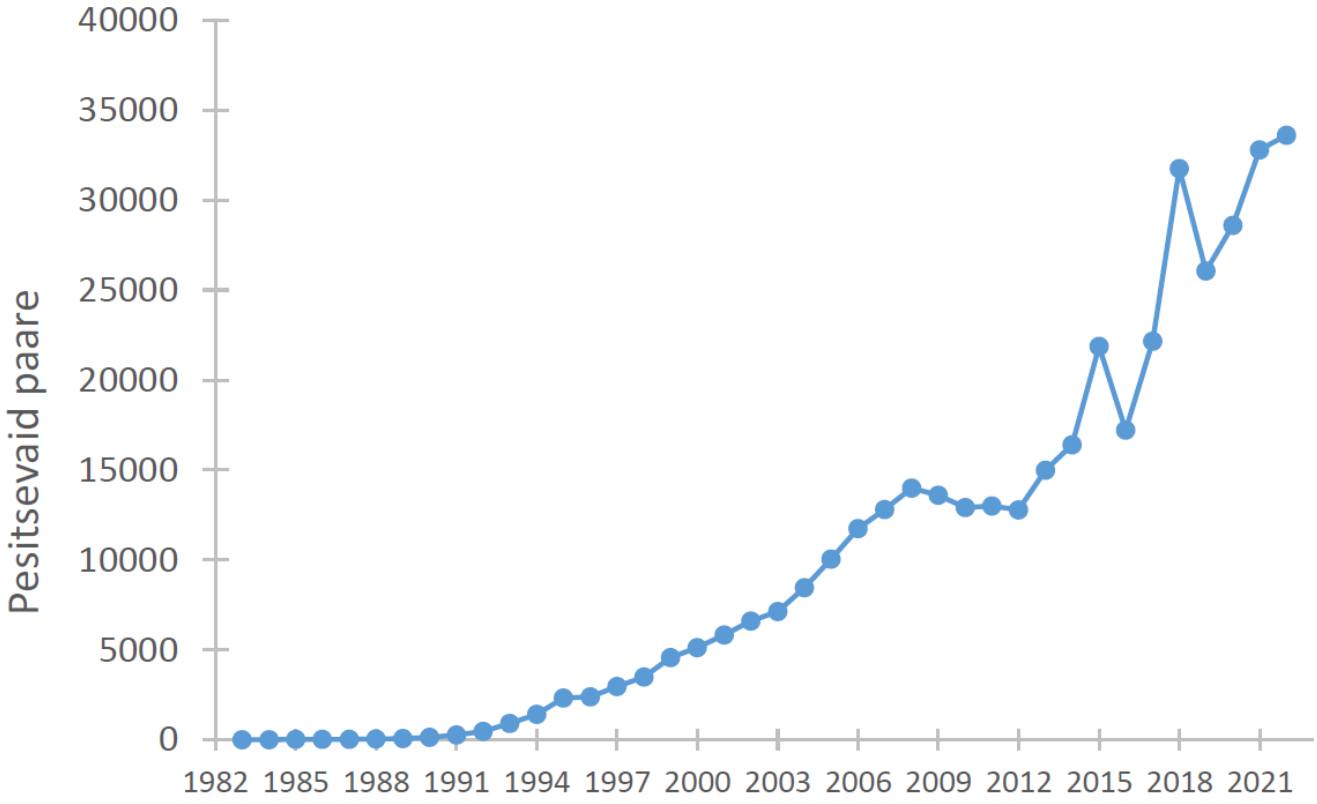
Sindi rapids, after 2018

Sindi kalapüügikeeluala sätestatakse vanast paisutammist ülesvoolu vähemalt väliujulani, kuna seegi jõelõik on nüüd kärestikuline ja sobib kudemiseks mitmele siirdekalaliigile. FOTO: KESKKONNAAGENTUUR

After the removal of the Sindi Dam, the largest river system in Estonia opened up to migratory fish. Unfortunately, cormorants quickly discovered the area, and in 2024-2025, up to 5,000 cormorants were counted in the area per day during the spring spawning season of smelt (*Osmerus eperlanus*)

Kormorani kaitse ja ohjamise tegevuskava perioodil 2024-2034 saab lugeda tulemuslikuks, kui asurkonna kasv on pidurdunud, arvukus langenud ja pesitsuskolooniate arv vähenenud; selgitatud on täpsem mõju kalavarudele; saavutatud on kokkulepped mõju vähendamise meetodites ja mahus ning illegaalne vaenamine vähenenud; on kokku lepitud kormorani arvukuse ülem- ning alampiir Eestis. Kormorani arvukuse jõudmine sellesse vahemikku on pikaajaliseks kaitse ning ohjamise-eesmärgiks.

The Cormorant Conservation and Management Action Plan for the period 2024-2034 can be considered effective if population growth has slowed, abundance has decreased and the number of breeding colonies has decreased; more precise impacts on fish stocks have been clarified; agreements have been reached on the methods and extent of impact reduction and illegal encroachment has decreased; upper and lower limits for cormorant abundance in Estonia have been agreed. Reaching cormorant abundance within this range is a long-term protection and management goal.



Joonis 1. Kormorani arvukus Eestis 1983–2022 (Keskkonnaagentuur).

- Thank you for attention!