

Interactions between pinnipeds and fisheries: the Baltic grey seal case



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The Baltic Sea

- Baltic Sea is an arm of the Atlantic Ocean
- Surface area: 377,000 km² (146,000 sq mi)
- A shallow brackish water sea
- About 85 million people live in the Baltic drainage basin



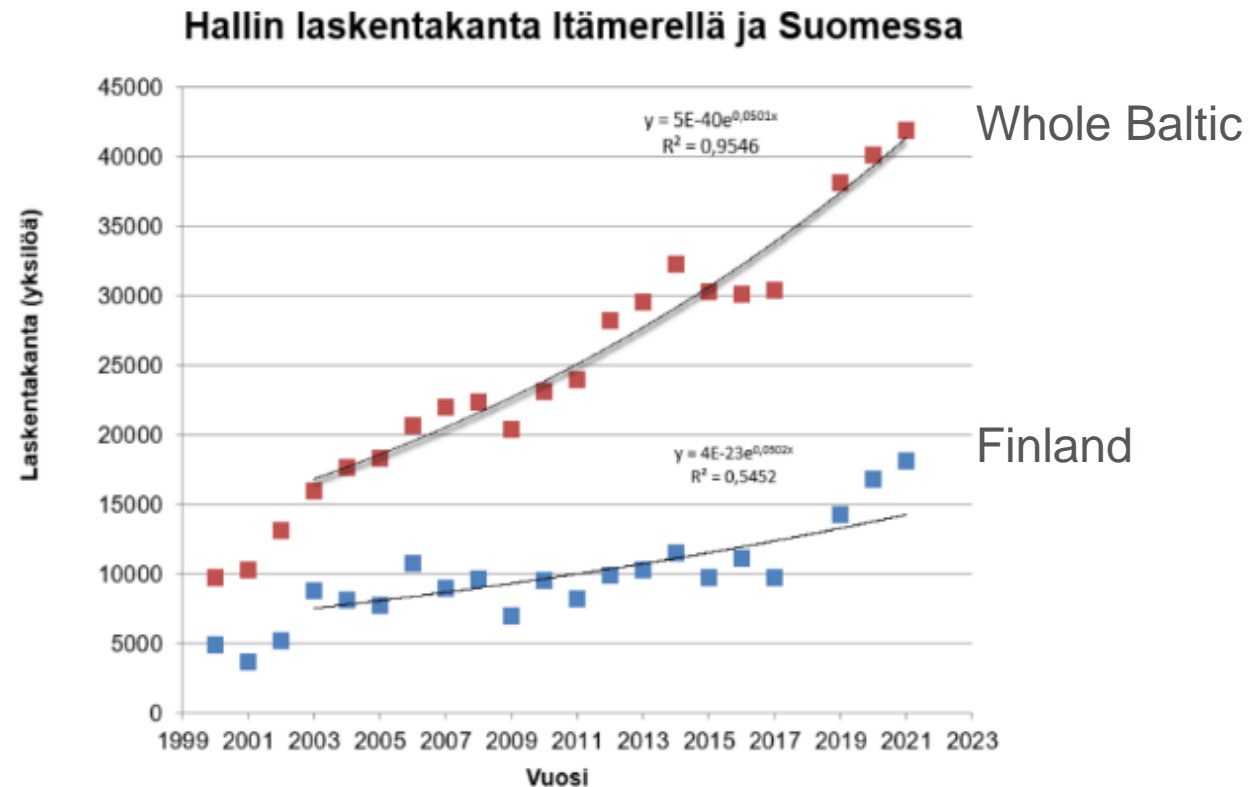
Grey seal (*Halichoerus grypus*)

- Grey seals occur in the entire Baltic Sea, but the population is densest in the northern regions:
 - center of distribution is on the coasts of Finland, Estonia and Sweden
- Largest and most common seal species in the Baltic.
- Size of population in early 1900s ca 100,000 ind.
- During 1900-1975 population was depleted down to ca 4000 individuals:
 - extensive hunting
 - hazardous substances at sea



Population recovery started in 1980s

- Grey seal population started to recover very fast in mid-1980s
- Since early 2000s, annual growth rate 5%
 - recently, population has expanded also in the southern Baltic - annual increase ca 17%
- Current population size ca 60,000 ind.
- The population keeps growing.



Number of grey seals counted in 2003–2021 in the Baltic Sea (**red squares**) and in Finland only (**blue squares**).

Fishing gears attract seals – risky dinner



DVR Video Snapshot

Välipesä-kamera1 : Hylje kamerat [Problem Reported]
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Event: No event selected



Video Capture Size: 704 x 576 pixels
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DVR Location: Hylje kamerat
DVR Serial #: KBAAP1455-5308
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Incidentally caught grey seals

- In early 2000s, numbers of incidentally caught grey seals was ca 2000 ind. annually (*mainly males*).
 - since then, numbers may have reduced because coastal fisheries are declining (+ zero-bycatch-policy)
- Seal-proof traps are widely used along Baltic coast:
 - smaller risk of entanglement compared to traditional trap-nets
 - little information of how many seal caught in gillnet fisheries
- No analysis of effect of incidentally caught seals on population has been made:
 - large incidental catches are not necessarily unsustainable
 - many pinniped populations can withstand large bycatches
 - seals have early maturity and high reproductive rates



Vanhatalo et al. 2014. By-Catch of Grey Seals (*Halichoerus grypus*) in Baltic Fisheries—A Bayesian Analysis of Interview Survey. PLoS ONE 9(11): e113836. doi:10.1371/journal.pone.0113836.

This is a common sight – catch destroyed by grey seal



Kauppinen, T., Siira, A. & Suuronen, P. 2005. Temporal and regional patterns in seal-induced catch and gear damage in the coastal trap-net fishery in the northern Baltic Sea: effect of netting material on damages. *Fisheries Research* 73: 99-109.

Seal-induced catch and gear damage

- With growing seal population, seal-induced catch and gear damages increased dramatically in coastal fisheries.
- There are also various type of hidden losses:
 - fish are taken from gear without a trace
 - seals are scaring fish out from fishing areas
- The seal-fishery conflict has expanded over the whole Baltic region
- Fishers lack the tools to handle the situation
- This has contributed to wide-scale frustration and also willingness to exit fisheries livelihoods



Seal predation on fish stocks

- Seals and fishers compete for the same fish resources
- Grey seal predation on fish stocks is substantial and can pose a significant threat to stocks that are either in decline or endangered
- Fishers have a strong opinion that seals have major impact on all commercially exploited fish stocks
- Nonetheless, fish populations are governed by multiple natural and anthropogenic processes

Suuronen, P. & Lehtonen, E. 2012. The role of salmonids in the diet of grey and ringed seals in the Bothnian Bay, northern Baltic Sea. *Fisheries Research* 125-126: 283-288.

Hansson et al. 2018. Competition for the fish – fish extraction from the Baltic Sea by humans, aquatic mammals and birds. *ICES Journal of Marine Science*, 75: 999–1008.



Stomach content of a grey seal

Seals are spreading parasites harmful to people and fish

- Grey seals are final host for two parasitic nematodes: seal worm and liver worm
- Baltic cod that are infected generally have a deteriorated condition
- The increase in parasite infection has coincided with the growing grey seal population



Lunneryd et al. 2015. Sealworm *Pseudoterranova decipiens* infection in grey seals *Halichoerus grypus*, cod *Gadus morhua* and shorthorn sculpin *Myoxocephalus scorpius* in the Baltic Sea. *Parasitology Research*, 114: 257–264.

Mitigation technologies – seal-proof fishing gears

- Mitigation technologies intensively developed to support fishing sector in the conflict.
- Seal-proof fishing gear modifications have been successful in trap-net fisheries → **pontoon trap**
 - the likelihood of incidental capture of seal reduces dramatically with seal-proof gears (= **seal-safe gear**).
- These actions, although helpful, have been inadequate in resolving the overall problem
- With the growing seal population, the conflict is intensifying and coming increasingly more difficult solve



Cod pot

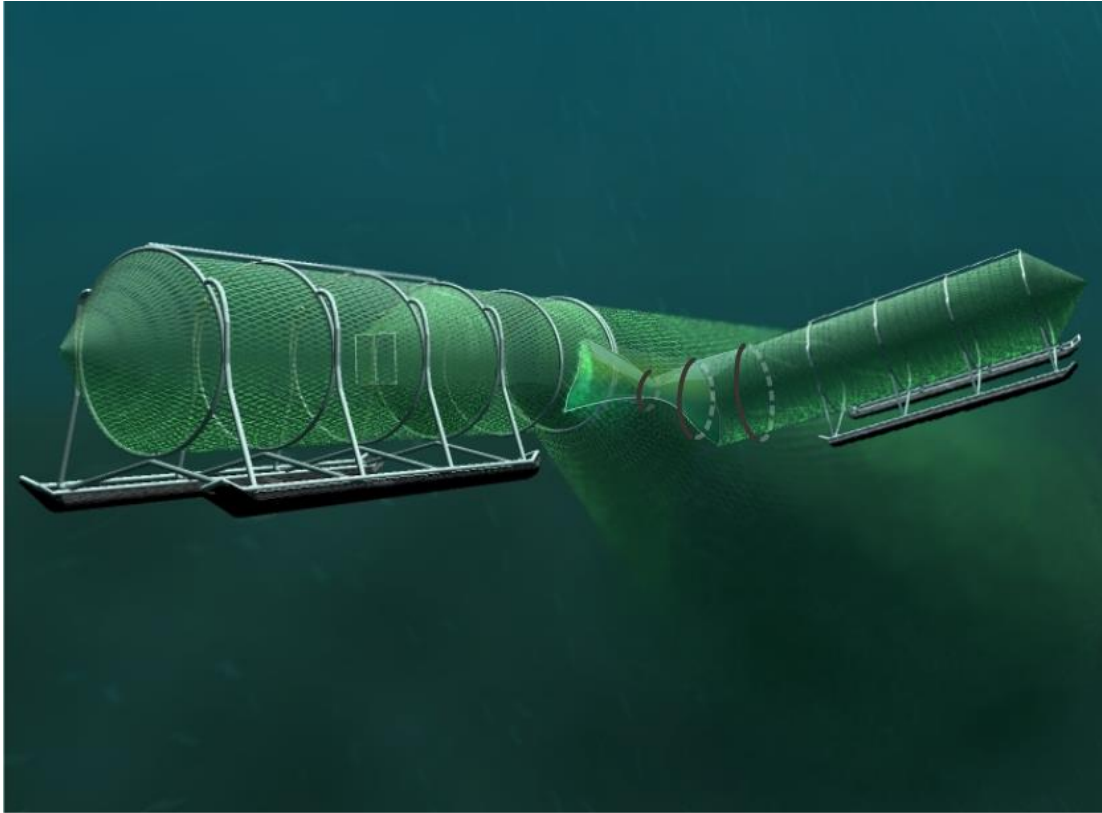
Seal-proof gear solutions



Suuronen et al. 2006. Reduction of seal-induced catch and gear damage by modification of trap-net design: Design principles for a seal-safe trap-net. *Fisheries Research* 79: 129-138.

Königson et al. 2015. Cod pots in a Baltic fishery: are they efficient and what affects their efficiency? *ICES Journal of Marine Science*, 72: 1545–1554.

How to capture a seal alive?

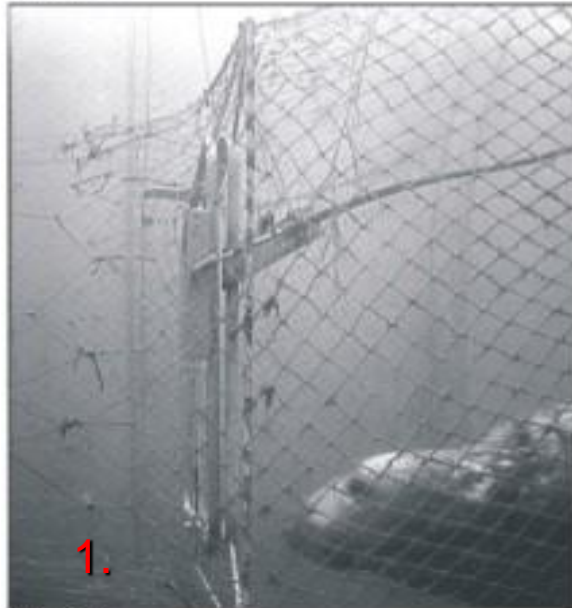


Lehtonen, E. & Suuronen, P. 2010. Live-capture of grey seals in a modified salmon trap. *Fisheries Research*, 102: 214-216.

A grey seal captured alive



DVR Video Snapshot
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25. Nov 2009, 7:22:21 AM EST
Event No: 00000000000000000000



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25. Nov 2009, 7:22:21 AM EST
Event No: 00000000000000000000



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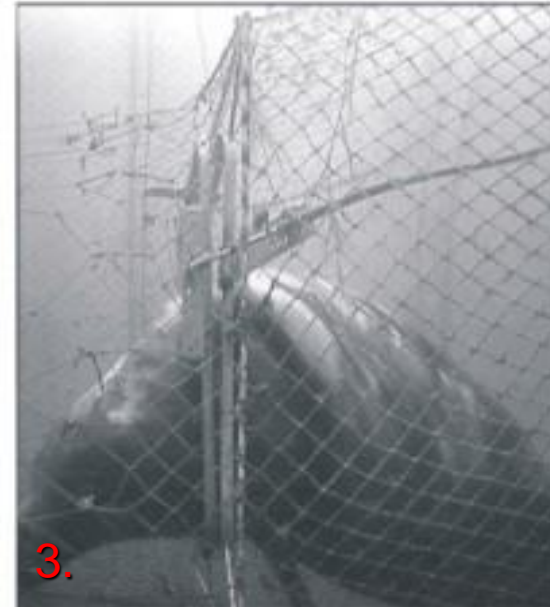
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5.

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Media Input Name: Pan Camera 1
DVR Location: Hops Kennel

DVR Video Snapshot
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3.

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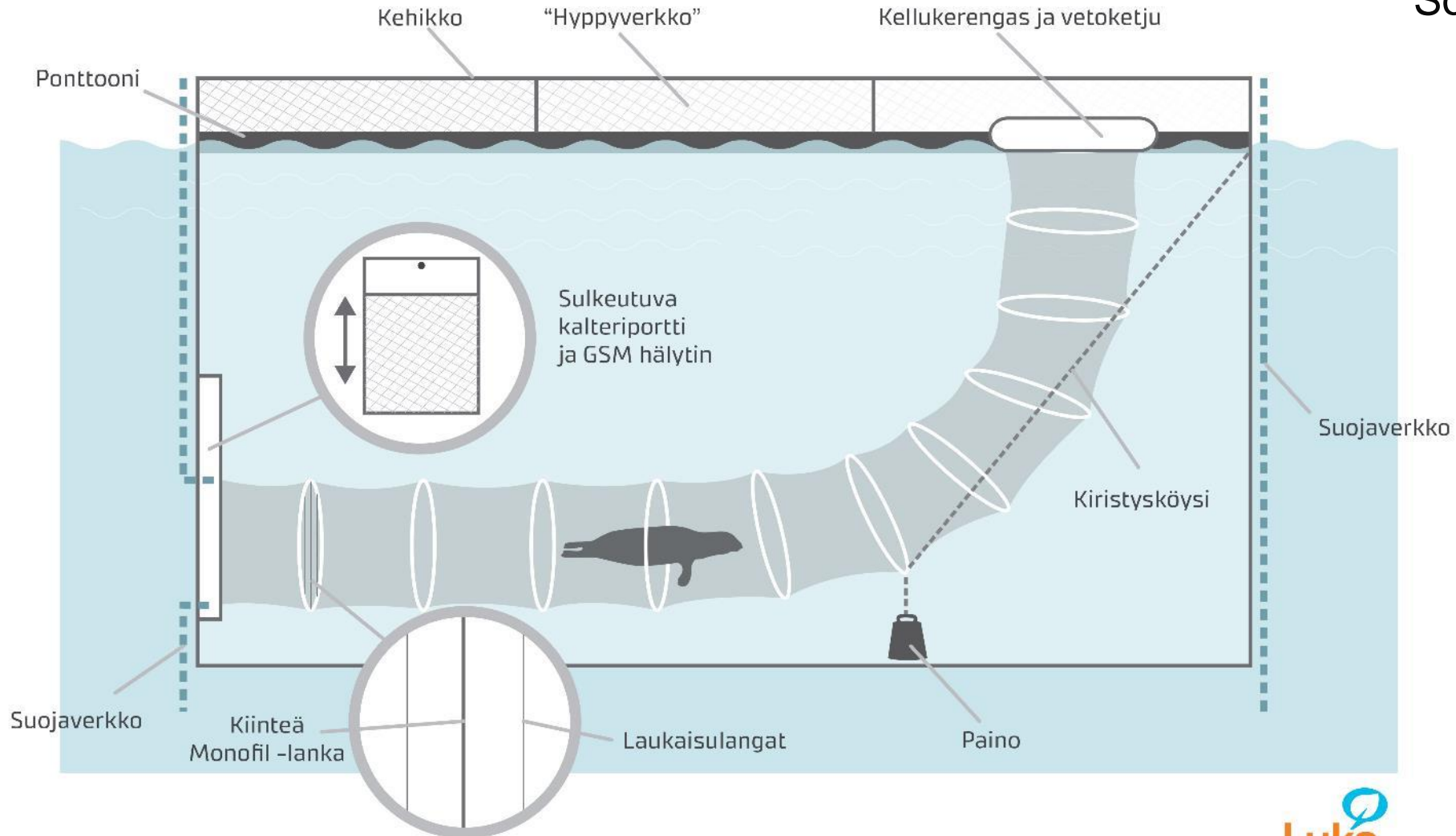
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Luke/EL

Video Capture Size: 704 x 576 pixels
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Hylkeenpyyntimenetelmä kalanviljelyn tarpeisiin

Seals attack also
aquaculture cages:
Solutions tested

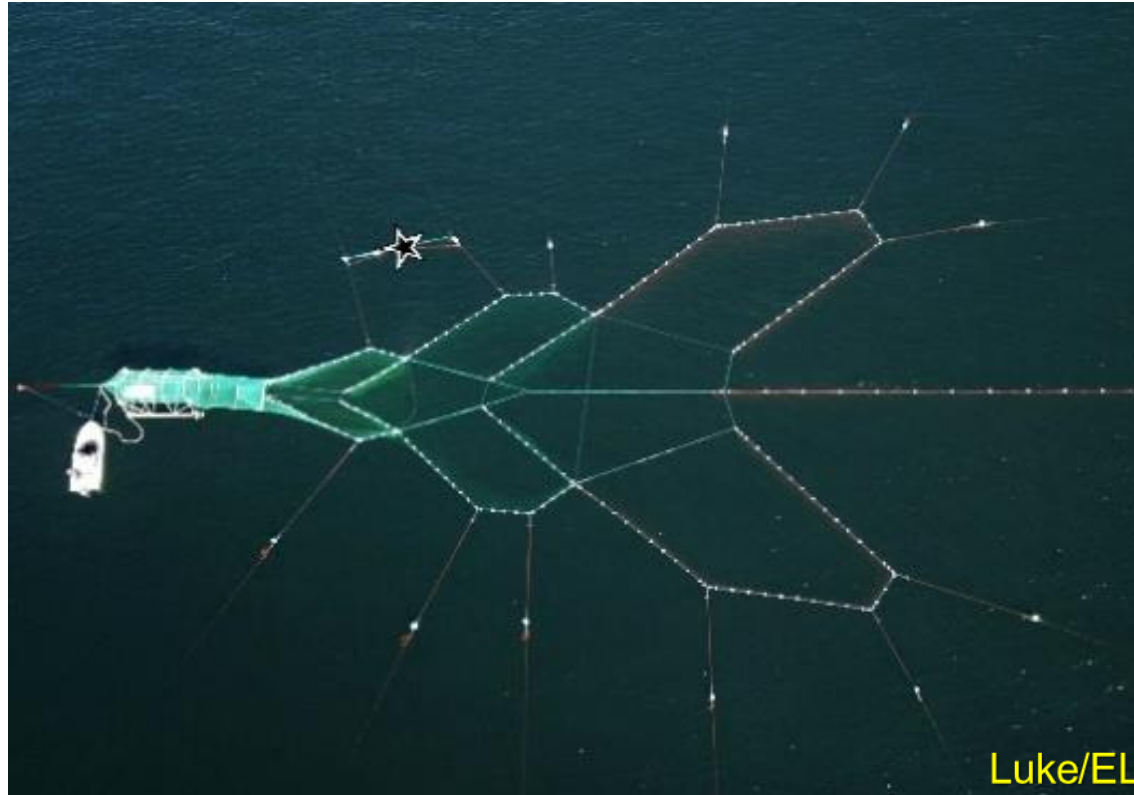


Seal deterrents in coastal trap-net fishing

- Promising results obtained by **acoustic deterrent devices (ADDs)** to keep seals away from the vicinity of a gear
- In Baltic salmon trap-net fisheries, deployment of ADDs indicated an average increase of 64 % in salmon catches
- Furthermore, with ADD the likelihood of incidental capture of a seal reduces dramatically
- ADD is a useful and economically viable mitigation tool for reducing seal-induced catch losses
- Potential risks of ADDs to wildlife; an issue.



A pontoon trap-net equipped with a mobile ADD



Seal deterrent marked with a star symbol



Mobile ADD



Lehtonen, E., Lehmonen, R., Kostensalo, J., Kurkilahti, M. & Suuronen, P. 2022. Feasibility and effectiveness of seal deterrents in coastal trap-net fishing – development of a novel portable deterrent. *Fisheries Research*, *In Press*

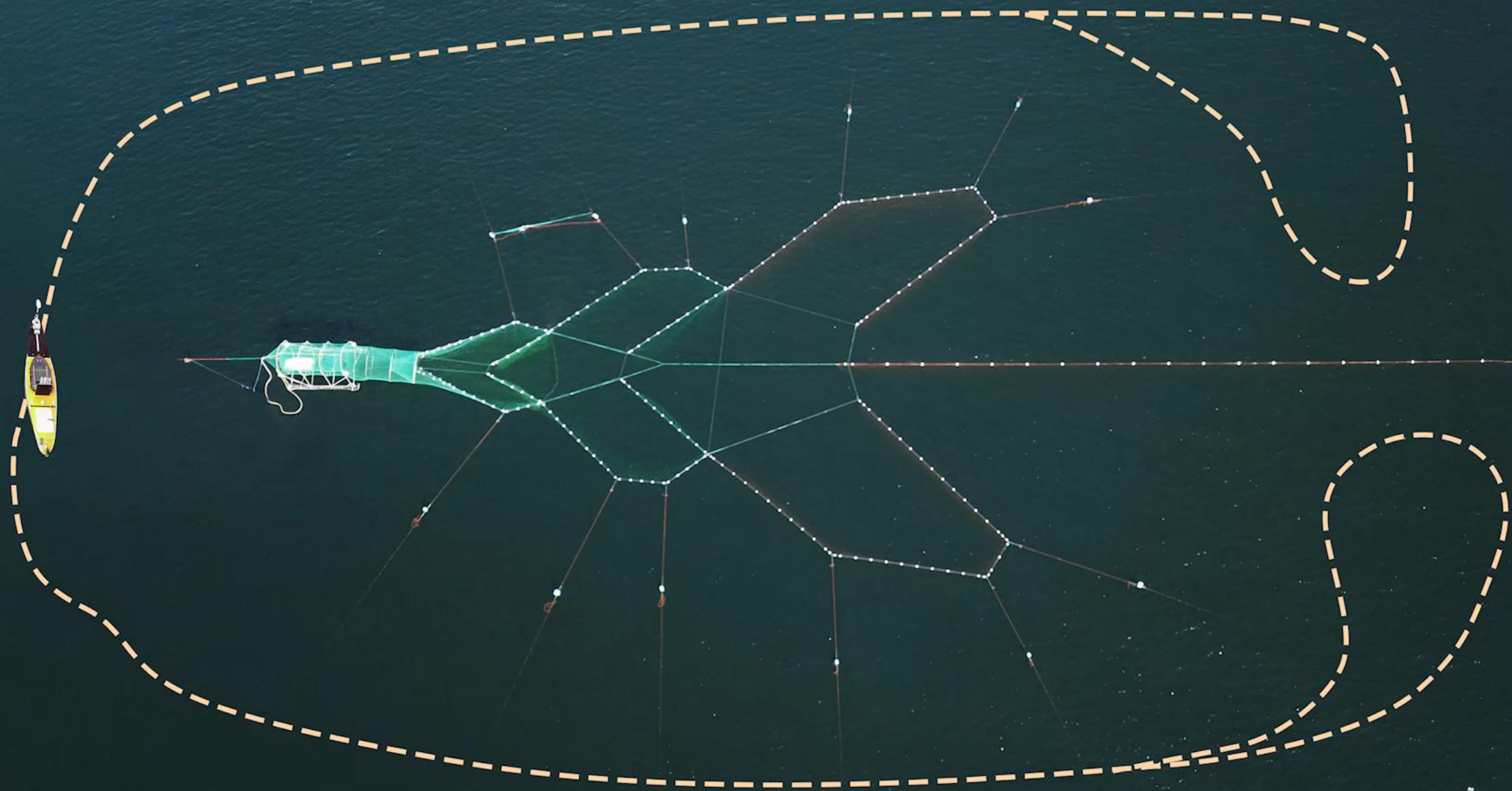
Alternative energy source for an ADD – solar and wind



Autonomous mobile deterrent – under development

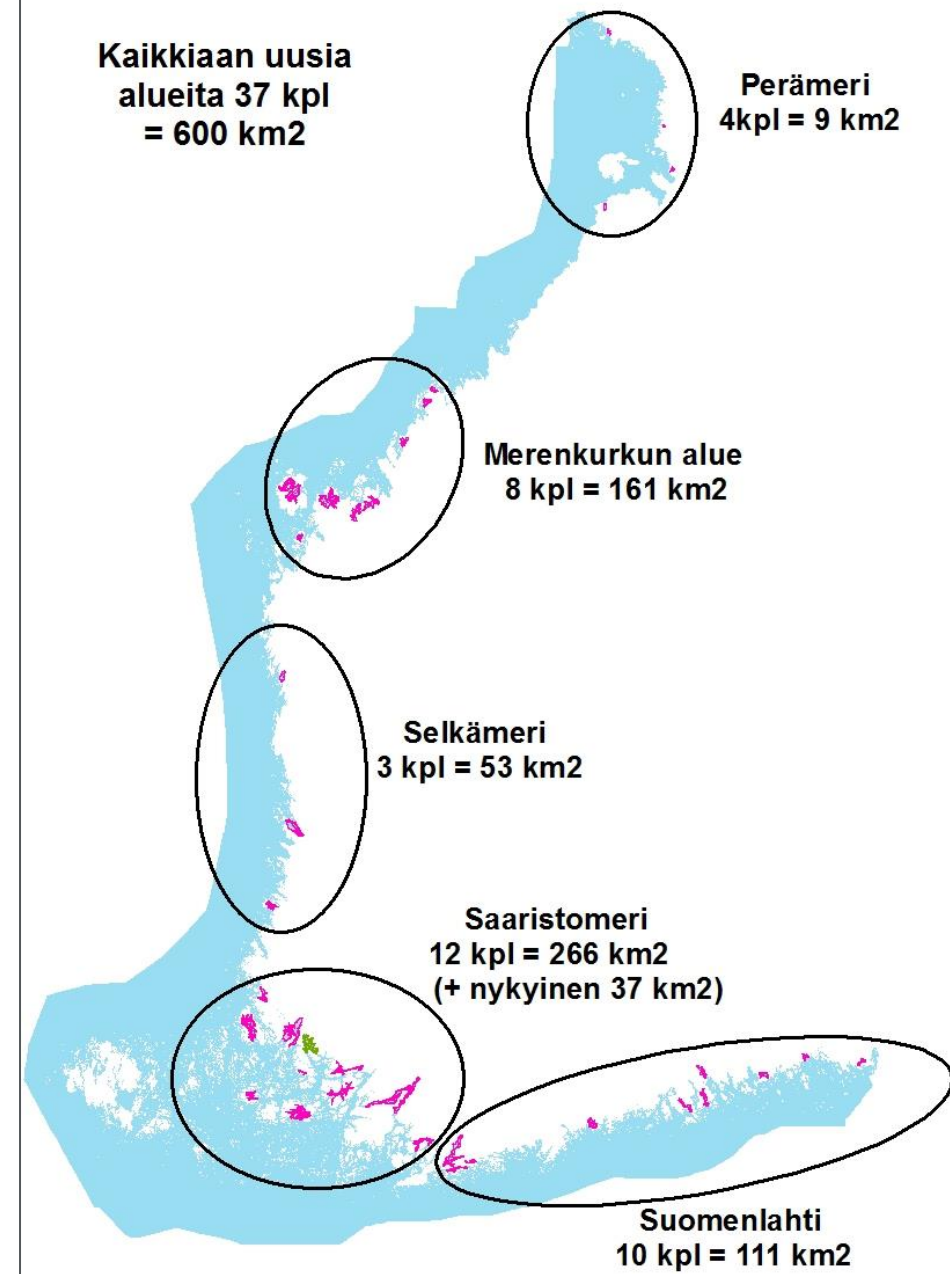


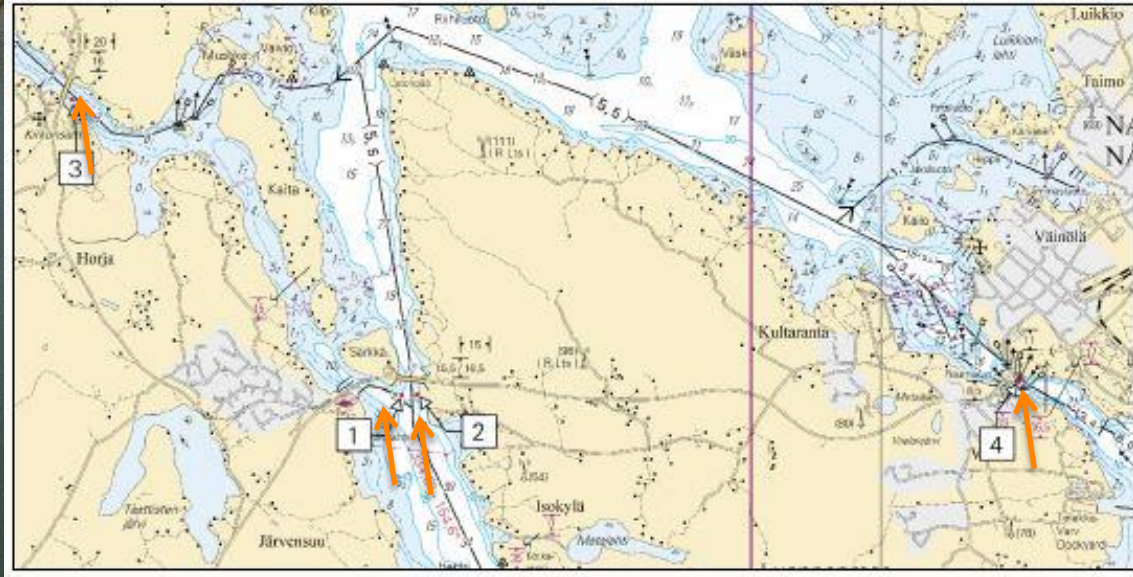
Prototype



Creating seal-free fishing areas

- There are important in-shore fishing grounds that could be “protected” by closing with ADDs the straits leading to them.
- This would help all fishers fishing inside the area.
- At the same time, it would reduce the incidental capture of seals.





Karkotin



Karkotin





Closing the straits

Population control by hunting

- Hunting quotas are small and not fully utilized.
 - Hunting rules are strict (season/areas).
 - Seal hunting is difficult and time consuming.
- EU trade ban on seal products → seal has no economic value:
 - this has caused poor motivation for hunting
 - few hunters



A striking conservation success and a source of conflicts

- Many seal populations are exhibiting strong recoveries from past depletions:
 - in NW Atlantic the grey seal population has increased from 7500 animals (in 1960) to over 0.5 million animals at present
 - In Baltic, 4000 grey seal in late 1970s; at present 60 000 seals
- These recoveries represent a remarkable conservation success, but also serious problems:
 - the unintended consequences of recoveries have created complex issues for resource managers to solve
 - Note! In some regions, seals provide livelihoods in tourism business
- The current management approach in the Baltic Sea strongly mandates the protection of seals:



Failure to implement an ecosystem-based approach

- Conservation objectives for charismatic species are often established as nonnegotiable.
 - When something is hacked into the “holy book”, it is there and stays there.
- In real life, management objectives concerning seals and fish stocks may be highly contradictory.
- Managers must confront various trade-offs:
 - Should managers allow grey seals to continue to increase and accept the serious impacts?
 - Or increase grey seal removals?
 - Or find alternative solutions (and combinations)?
- **An efficient and perhaps most sensible approach to ecosystem restoration would be the synchronous recovery of predators and prey.**



Conclusions

- Baltic grey seal population has reached a sustainable abundance and is not at risk (*approaching the carrying capacity*).
- Protection should no more be the sole objective of the grey seal management.
 - the level of protection should match with the need of protection
- We need to find an optimal balance between the size of grey seal population and the viability of the fishing sector.
- The current criteria regarding grey seal protection in Baltic Sea are not justified from social, cultural and ecological point of views.



Thank you!



Luke/EL

Selected papers (1)

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Lehtonen, E. & Suuronen, P. 2004. Mitigation of seal-damages in salmon and whitefish trap-net fishery by modification of the fish bag. *ICES Journal of Marine Science* 61: 1195-1200.

Suuronen, P., Siira, A., Ikonen, E., Riikonen, R., Kauppinen, T., Aho, T., Lunneryd, S-G., Hemmingsson, M., Königson, S., Fjälling, A., Westerberg, H. & Larsen, F. 2004. Mitigation of seal damages by improved fishing technology and by alternative fishing strategies. Final Report of Project 661045-30248 (2004), Journal No: 66010.21.138/02, Nordic Council of Ministers. 38 p.

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Jounela, P., Suuronen, P., Millar, R.B. & Koljonen, M-L. 2006. Interactions between grey seal (*Halichoerus grypus*), Atlantic salmon (*Salmo salar*), and harvest controls on the salmon fishery in the Gulf of Bothnia. *ICES Journal of Marine Science* 63: 936-945.

Lehtonen, E. & Suuronen, P. 2010. Live-capture of grey seals in a modified salmon trap. *Fisheries Research*, 102: 214-216.

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Selected papers (2)

- Königson, S., Fjälling, A., and Lunneryd, S.-G. 2007.** Grey seal induced catch losses in the herring gillnet fishery in the northern Baltic. NAMMCO Scientific Publications, 6: 203–213.
- Königson, S., Lunneryd, S.-G., Stridh, H., and Sundqvist, F. 2009.** Grey seal predation in cod gillnet fisheries in the Central Baltic Sea. Journal of Northwest Atlantic Fisheries Science, 42: 41–47.
- Königson, S., Fjälling, A., Berglind, M., Lunneryd, S.-G. 2013.** Male grey seals specialize in raiding salmon traps, Fish. Res. 148: 117–123, <https://doi.org/10.1016/j.fishres.2013.07.014>.
- Königson, S. J., Fredriksson, R. E., Lunneryd, S.-G., Strömberg, P., and Bergström, U. M. 2015.** Cod pots in a Baltic fishery: are they efficient and what affects their efficiency? ICES Journal of Marine Science, 72: 1545–1554.
- Lunneryd, S. G., Boström, M. K., and Aspholm, P. E. 2015.** Sealworm *Pseudoterranova decipiens* infection in grey seals *Halichoerus grypus*, cod *Gadus morhua* and shorthorn sculpin *Myoxocephalus scorpius* in the Baltic Sea. Parasitology Research, 114: 257–264.
- Svels, K., Salmi, P., Mellanoura, J., Niukko, J., 2019.** The impacts of seals and cormorants experienced by Baltic Sea commercial fishers. Natural resources and bioeconomy studies 77/2019. Natural Resources Institute Finland, Helsinki. 50 p.
- Waldo, A., and Johansson, M. 2019.** Fiske och säl—en analys av möjligheter till samexistens. AgriFood Fokus 2019: 2 (in Swedish).
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- Waldo, S., Paulrud, A., Blomquist, J., 2020b.** The economic costs of seal presence in Swedish small-scale fisheries. ICES Journal of Marine Science, 77: 815–825.