Seal and Fisheries conflict:

Is there a problem? What can we do about it?

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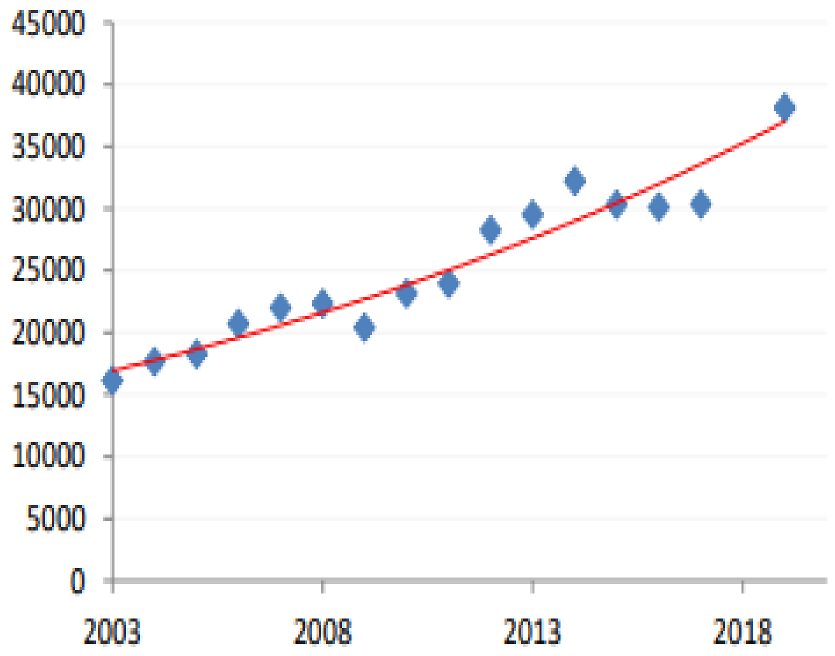
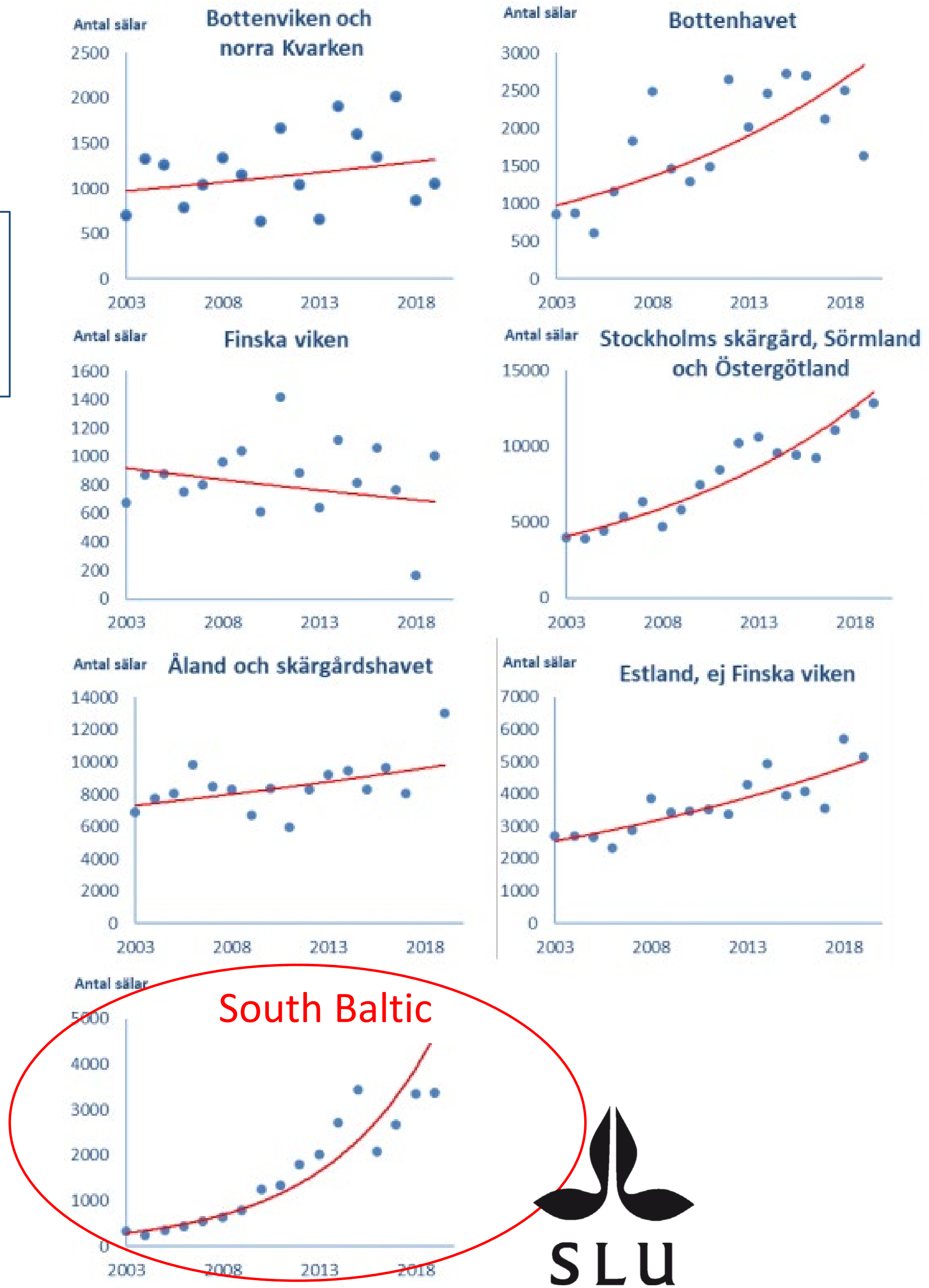
Grey seals in the Baltic

Number of counted grey seals: 38 121
Estimated population size: 47 500 till 63 000

Number of counted grey seals in the Baltic





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Complicated Conflict……….

- Direct damage to gear and catch
    - (including hidden damage)

Hidden damage

Complicated Confict……….

Seals affecting fisheries

- Direct damage to gear and catch

  (including hidden damage)

- Competition of the resource

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Complicated Confict……….

Seals affecting fisheries

- Direct damage to gear and catch
  (including hidden damage)

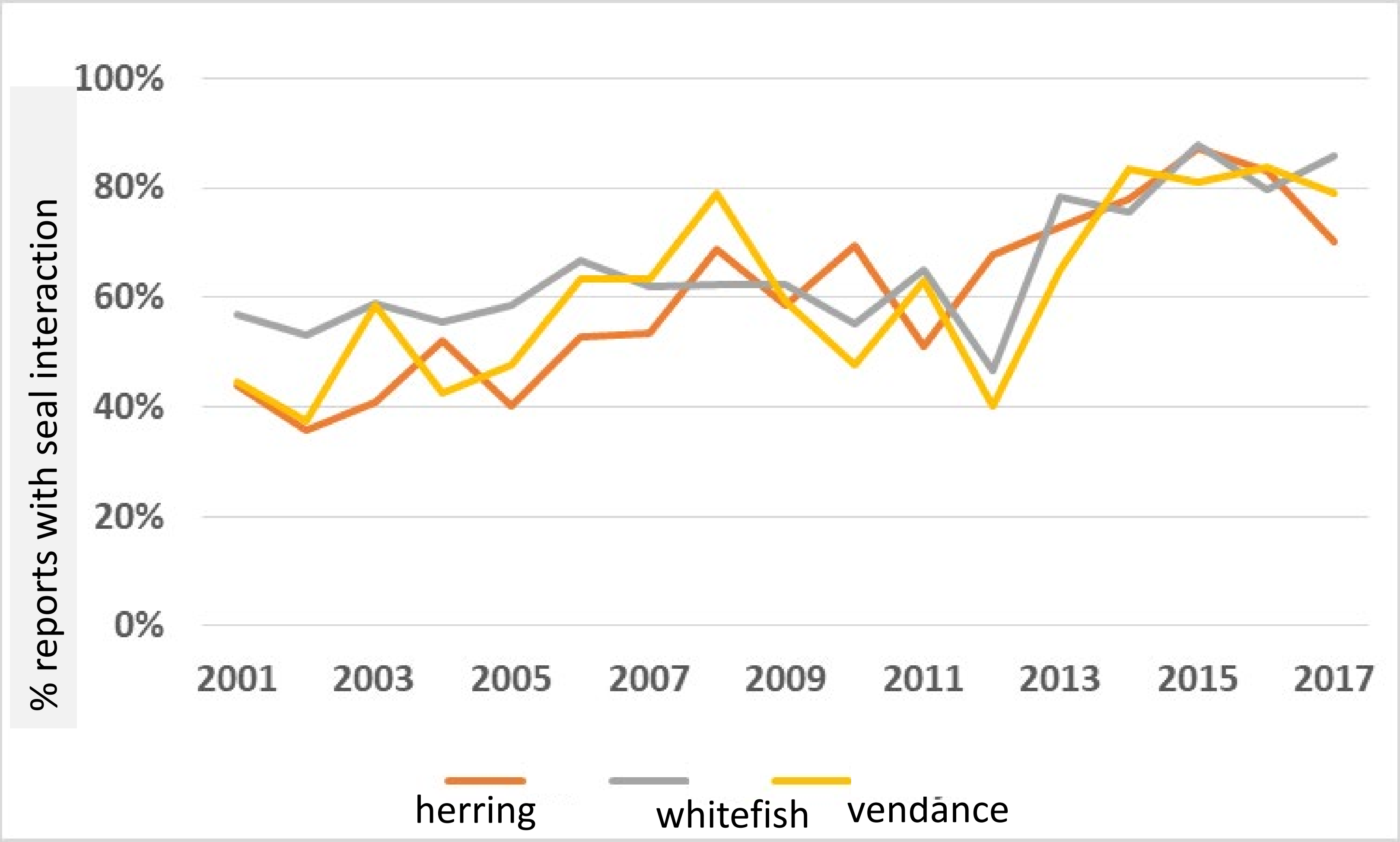
- Competition of the resource

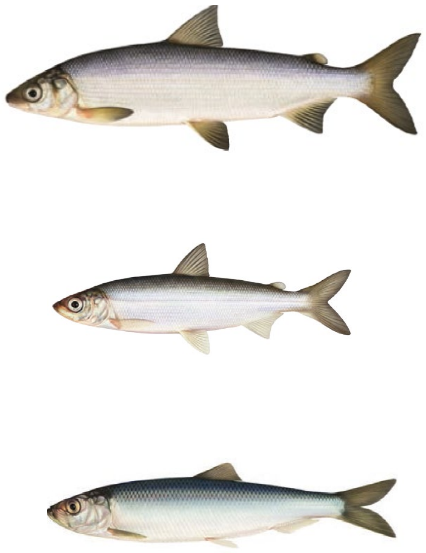
- Spreading of parasites

Direct damage to gear and catch

Coastal fisheries

North Baltic: Seal interactions in fishermens´ loggbooks





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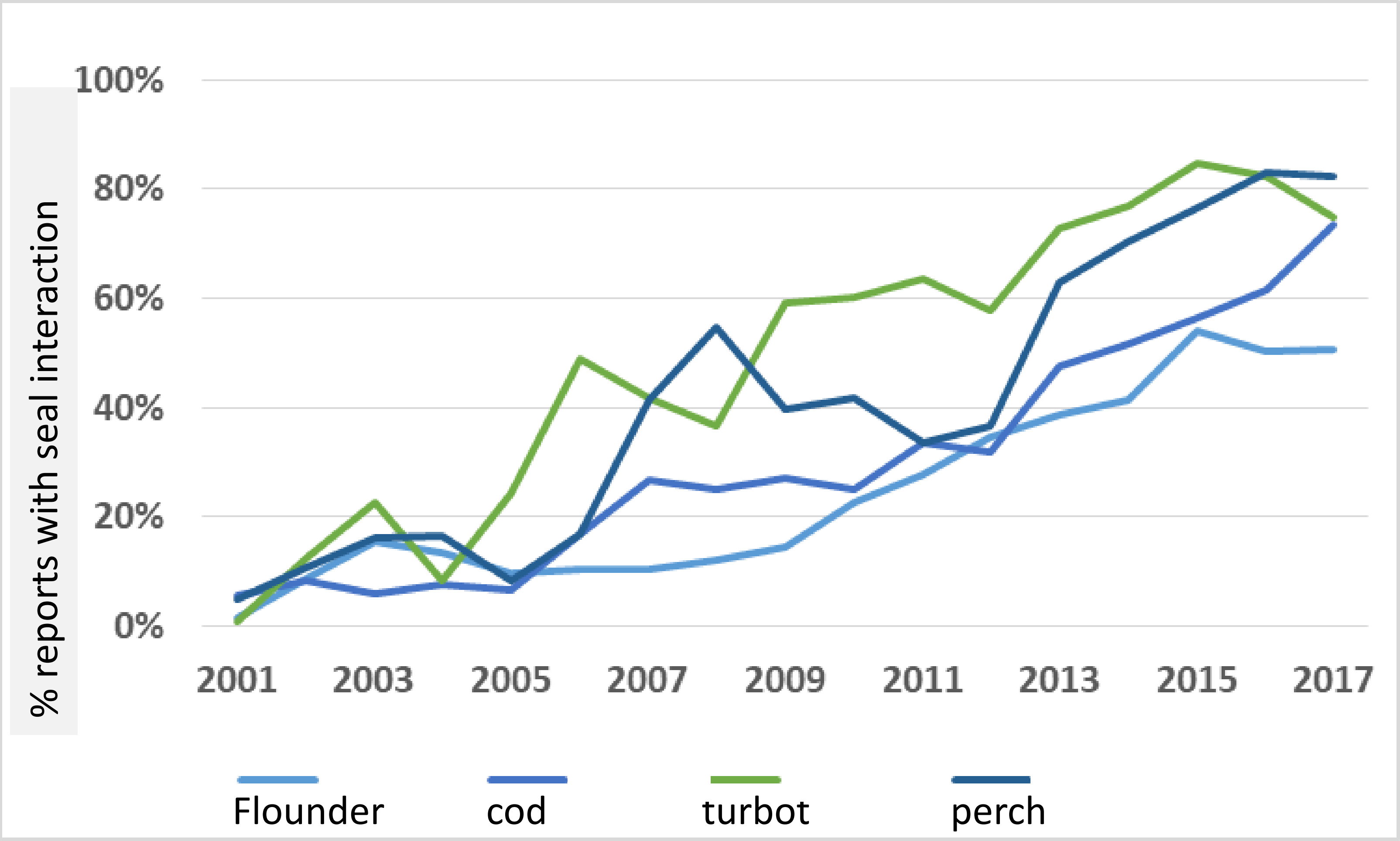
Direct damage to gear and catch

Coastal fisheries

Central Baltic Baltic: Seal interactions in fishermens´ loggbooks



Artdatabanken, Linda Nyman

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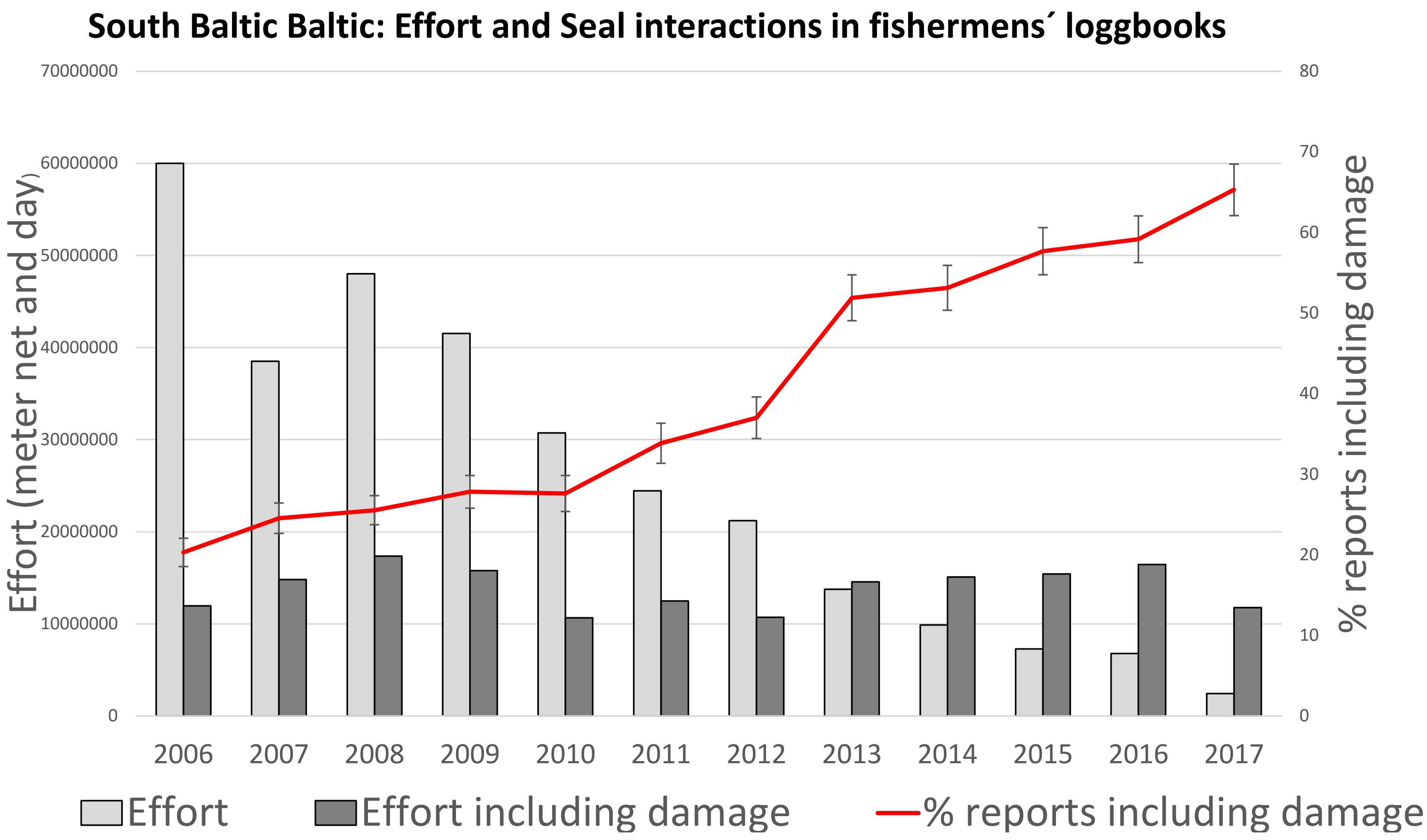
Direct damage to gear and catch

Coastal fisheries



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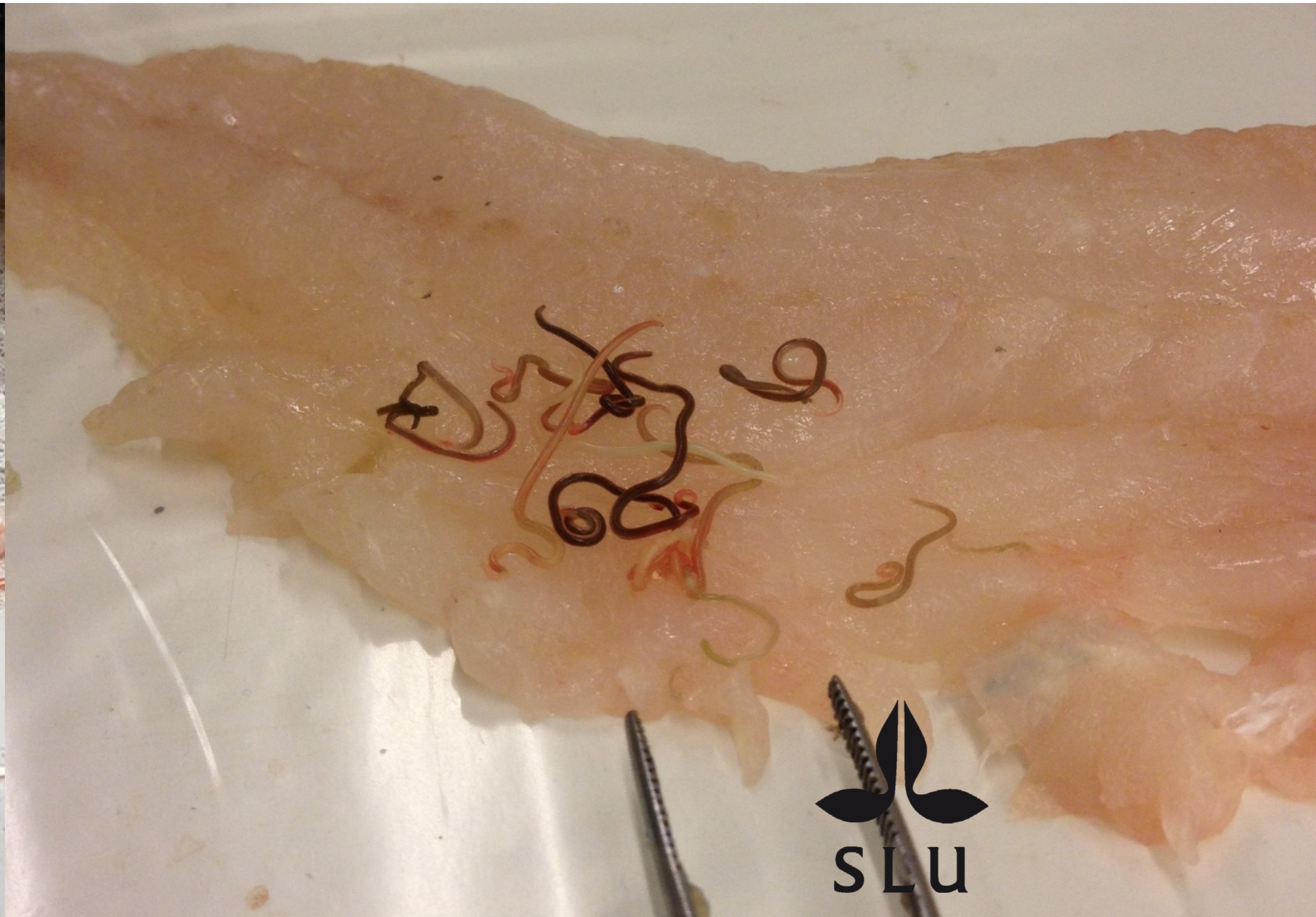
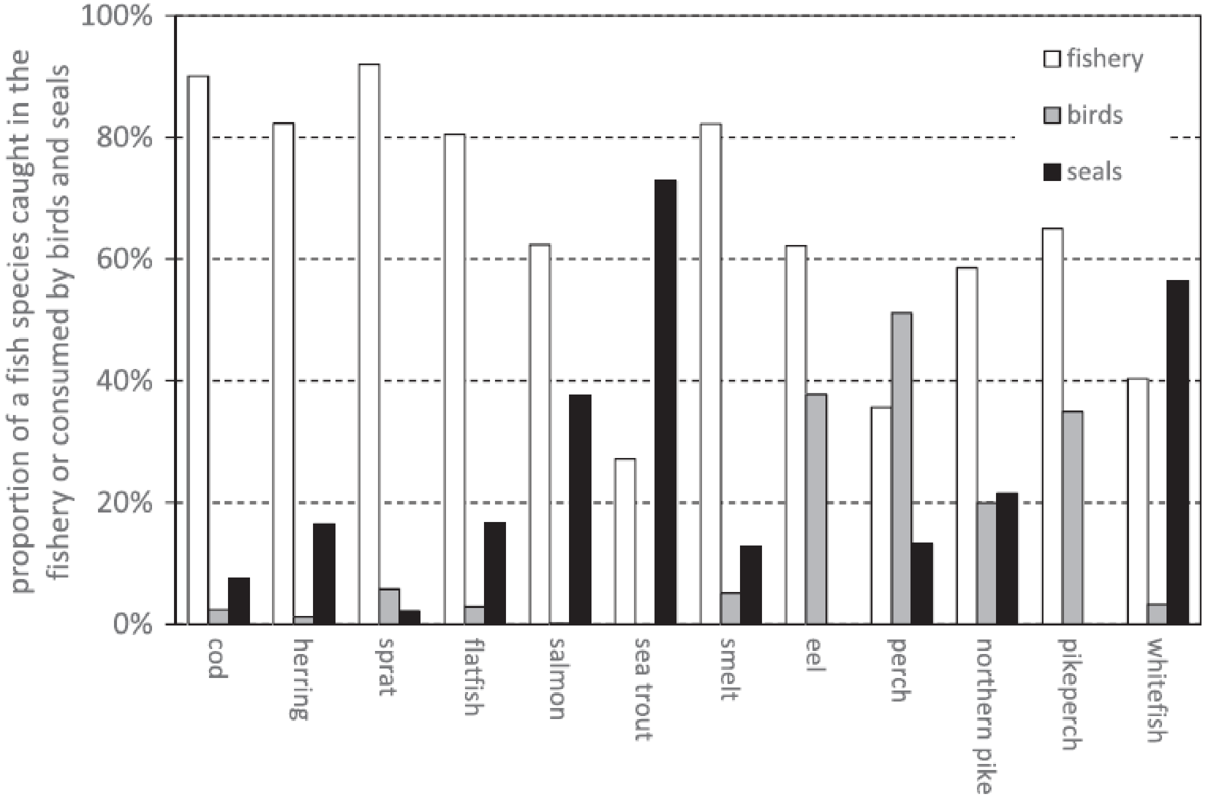
Liverworm *Contracaecum osculatum*

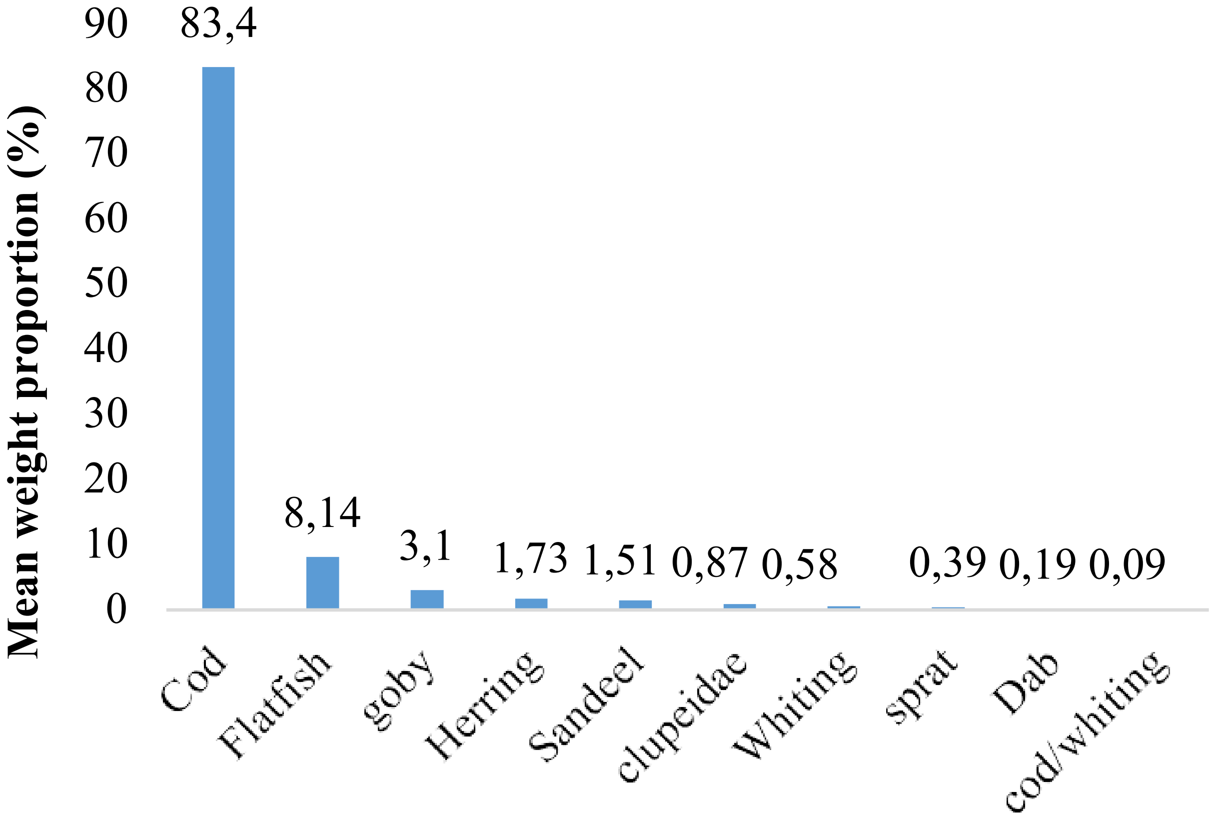
Sealworm *Pesudoterranova decipiens*



Competition of the resource



Proportions of different fish species extracted from the Baltic Sea through fishery catch and predation by birds and seals. Hansson et al., 2018



- Proportion of fish species in grey seal diet, DTU Aqua 2019

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REFERENCES on: Effects on fisheries due to increase in seal populations (Direct impact)

Baltscheffsky, S. 1997. Seals in the Bothnian Sea: From endangered species to coastal nuisance. *Enviro*, 23.

Bruckmeier, K., Westerberg, H., and Varjopuro, R. 2010. Findings from the case studies in the Baltic Sea, reconciliation in practice. In R.A. Klenke, I. Ring, A. Kranz, N. Jepsen, F. Raushmayer, and K. Henle (Eds.), *Human – Wildlife Conflicts in Europe.* Berlin: Springer.

Butler, J., Middlemas, S., Graham, I., Thompson, P., and Armstrong, P. 2006. Modelling the impacts of removing seal predation from Atlantic salmon, Salmo salar, rivers in Scotland: A tool for targeting conflict resolution. *Fisheries Management and Ecology*, 13:285–291.

Carter, T., Pierce, G., Hislop, J., Houseman, J., and Boyle, P. 2001. Predation by seals on salmonids in two Scottish estuaries. *Fisheries Management and Ecology*, 8:207–225.

Fjälling, A. 2004. Assessment and reduction of the conflicts between commercial fisheries and grey seals (Halichoerus grypus) in Swedish waters. Licentiate thesis, Institute of Technology, Linköping University.

Fjälling, A. 2005. The estimation of hidden seal-inflicted losses in the Baltic Sea set-trap salmon fisheries. *ICES Journal of Marine Science*, 62:1630–1635.

Holma, M., Lindroos, M. 2014. The economics of conflicting interests: Northern Baltic Salmon fishery adaption to gray seal abundance. *Natural Resource Modelling*, 27:3.

Jounela, P., Suuronen, P., Millar, R.B., and 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(5): 936–945.

Königson, S. 2007. Seal behaviour around fishing gear and its impact on Swedish fisheries. Licentiate thesis, Department of Marine Ecology, Göteborg University.

Königson, S. 2011. Seals and fisheries, A study of the conflict and some possible solutions. PhD thesis, Göteborg University

Königson, S., Lundström, K., Hemmingsson, M., Lunneryd, S-G., and Westerberg, H.. 2006. Feeding preferences of harbour seals (*Phoca vitulina*) specialised in raiding fishing gear. *Aquatic Mammals*, 32(2).

Königson, S., Fjälling, A., and Lunneryd, S-G. 2007. Grey seal induced catch losses in the herring gillnet fisheries in the Northern Baltic. NAMMCO Scientific Publications, 1.

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.

Lunneryd, S-G. 2001. Fish preference by harbour seal (*Phoca vitulina*), with implications for the control of damage to fishing gear. *ICES Journal of Marine Science* 58(4): 824–829.

Lundström, K., Lunneryd, S-G., Königson, S., and Hemmingsson, M. 2011. Interactions between harbour seals and coastal fisheries along the Swedish west coast: An overview. NAMMCO Scientific Publications, 8:42.

Königson, S., Fjälling, A., Berglind, M., and Lunneryd, S-G. 2013. Male grey seals specialize in raiding salmon traps. *Fisheries Research*, 148.

Kauppinen, T., Siira, A., and 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 damage. *Fisheries Research*, 73:99–109.

Oksanen, S.M., Ahola, M.P., Lehtonen, E. & Kunnasranta, M. 2014. Using movement data of Baltic grey seals to examine foraging-site fidelity: implications for seal-fishery conflict mitigation. Marine Ecology Progress Series Vol. 507:297-308, 2014.

Waldo, S., Waldo, Å., Blomqvist, J., Königson, S., Persson, A., and Johansson, M. Solutions to a Human-Wildlife Conflict – the Case of Seals and the Swedish Baltic Sea Coastal Fishery. In preparation

Westerberg, H., Fjälling, A., and Martinsson, A. 2000. Sälskador i det svenska fisket. (Seal damage in the Swedish fishery). *Fiskeriverket Rapport* 3:4–38.

Westerberg, H., Lunneryd, S-G., Fjälling, A., and Wahlberg, M. 2006. Reconciling Fisheries Activities with the Conservation of Seals throughout the Development of New Fishing Gear: A Case Study from the Baltic Fishery–Grey Seal Conflict. American Fisheries Society Symposium, 587–598.

Wickens, P. 1995. A review of operational interactions between pinnipeds and fisheries. FAO Fisheries Technical Paper, 346.

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What can we do about it?

- Helcom seal recommendation – should accounts for for both socioeconomic and ecological aspects in seal management
- Development and implementation of seal-safe fishing gear or other methods
- Managing seal populations by hunting to reduce the seal population increase

Not a quick fix – combination of measures needed

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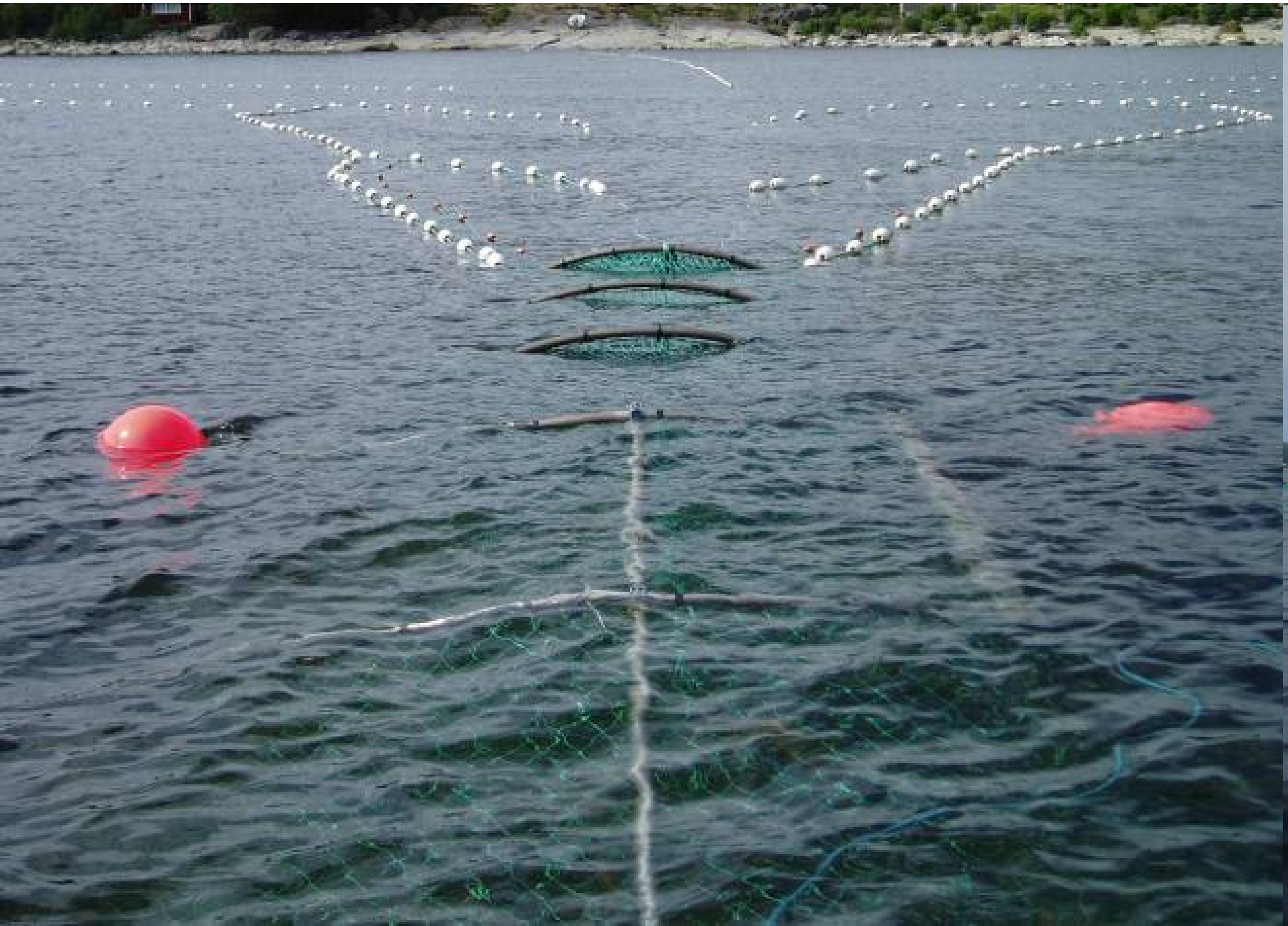
What can we do about it?

Development and implementation of seal-safe fishing gear

Passiv fishing gears

Pushup (pontoon) trap-nets, saved the salmon fishery in North Baltic

Developed for herring, vendance, white-fish , perch and cod



What can we do about it?

Development and implementation of seal-safe fishing gear

Pots and fykenets to catch cod

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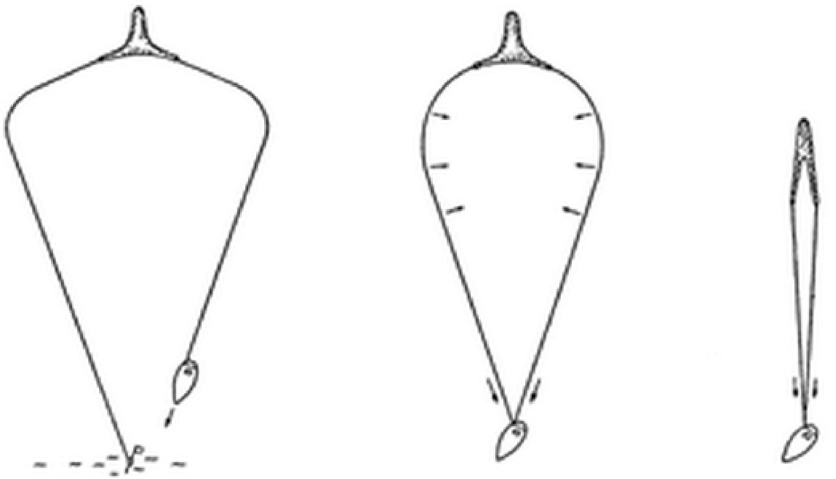
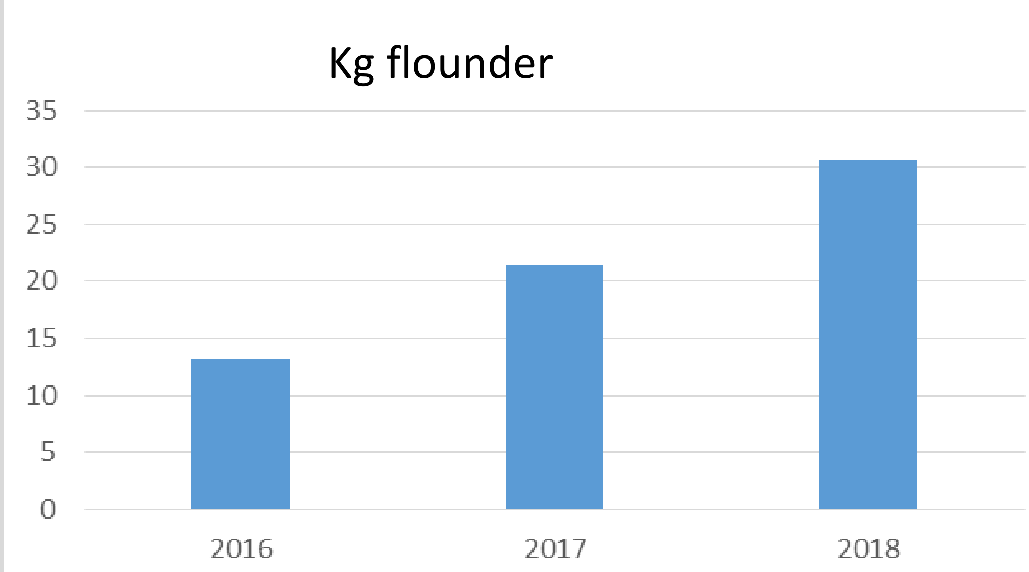
What can we do about it?

Development and implementation of seal-safe fishing gear

Seine nets

Developed for a a small-scale fishery





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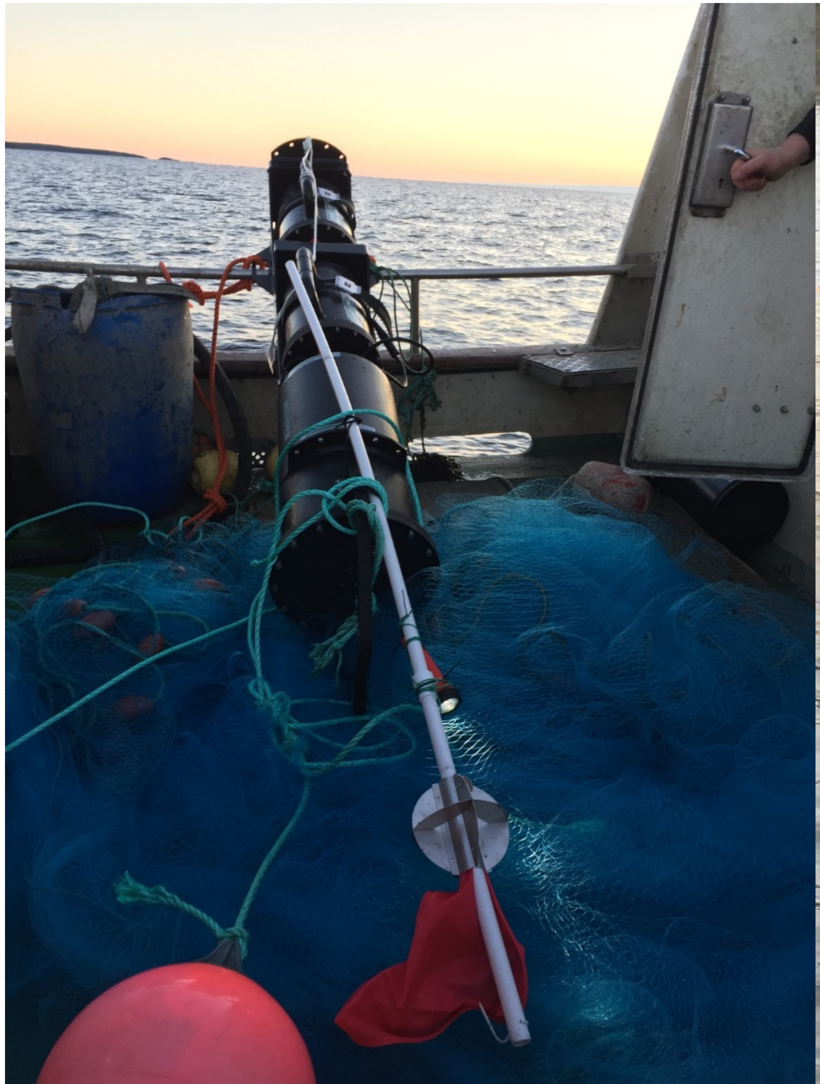
What can we do about it?

Development and implementation of seal-safe fishing gear

Seal-traps and seal-scarers



REFERENCES: Mitigation methods to decrease the seal-fishery conflict

Bryhn, A., Königson, S., Lunneryd, S-G., and Bergenius, M. 2013. Visual stimuli affecting the catch efficiency of floating cod (*Gadus morhua*) pots in the Baltic Sea. *Fisheries Research*. 157

Calamnius, L., Lundin, M., Fjälling, A., and Königson, S. 2018. Pontoon trap for salmon and trout equipped with a seal exclusion device catches larger salmons. *PloS ONE*, 13.

Fjälling, A., Wahlberg, M., and Westerberg, H. 2006. Acoustic harassment devices reduce seal interaction in the Baltic salmon-trap, net fishery. *ICES Journal of Marine Science*, 63:1751–1758.

Hedgärde, M., Willestofte Berg, C., Kindt-Larsen, L., Lunneryd, S-G., and Königson, S. 2017. Explaining the catch efficiency of different cod pots using underwater video to observe cod entry and exit behaviour. *Journal of Ocean Technology*, 11(4).

Hemmingsson, M., and Lunneryd, S-G. 2007. Pushup-fällor i Sverige, Introduktionen av ett nytt sälsäkert fiskeredskap. (Push-up traps in Sweden, the introduction of a new seal-safe fishing gear). Finfo Fiskeriverket informerar 8 (in Swedish, with English summary).

Hemmingsson, M., Fjälling, A., and Lunneryd, S-G. 2008. The pontoon trap: Description and function of a seal-safe trap-net. *Fisheries Research*, 93:357–359.

Königson, S., Hemmingsson, M., Lundström, K., and Lunneryd, S-G. 2007. Seals and fyke nets: An investigation of the problem and its possible solution. *Marine Biology Research*, 2007:3.

Königson, S., Fjälling, A., and Lunneryd, S-G. 2002. Reactions in individual fish to strobe light. Field and aquarium experiments performed on whitefish (*Coregonus lavaretus). Hydrobiologia*, 483.

Königson, S., Lövgren, J., Ovegård, M., Ljunghager, F., and Lunneryd, S-G. 2015. Seal Exclusion Devices prevent seal bycatch in cod pot fisheries without necessarily reducing the catchability of the gear. *Fisheries Research*, 167.

Königson, S., Fredriksson, R., Bergström, U., Lunneryd, S-G and Strömberg, P. 2015. Cod pots in the Baltic. Are they efficient and what affects their efficiency? *ICES Journal of Marine Science*, 72:5.

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

Lehtonen, E., Oksanen, S., Ahola, M., Aalto, N., Peuhkuri, N. & Kunnasranta, M. 2013. Satellittelemetriundersökning av gråsälar, fångade i ryssjor i Finska viken åren 2010-2012. Riista- ja kalatalous-Tutkimuksia ja selvityksiä 1B / 2013. 34 sid.

Lehtonen, E., Oksanen, S., Aalto, N., Lappalainen, A., Peuhkuri, N. & Kunnasranta, M. (2012). Satellittelemetriundersökning av gråsälar, fångade i ryssjor i Bottenhavet åren 2008-2009. Riista- ja kalatalous-Tutkimuksia ja selvityksiä 2 / 2012. 40 sid.

Lehtonen, E. & Suuronen, P. 2004. Mitigation of seal-induced damage in salmon and whitefish trapnet fisheries by modification of the fish bag. ICES Journal of Marine Science 61: 1195-1200.

Ljungberg, P., Ovegård, M., Öhman, K., and Königson, S. 2019. Correlation between catch method, condition and diet patterns in Atlantic Cod (*Gadus morhua*). Accepted to *ICES Journal of Marine Science*.

Ljungberg, P., Lunneryd, S-G., Lövgren, J., and Königson, S. 2017. Including cod (Gadus Morhua) behavioral analysis to evaluate entrance behavioural analysis to evaluate entrance type dependent pot catches in the Baltic Sea. *Journal of Ocean Technology*, 11(4).

Lunneryd, S-G., Fjälling, A., and Westerberg, H. 2003. A large-mesh salmon trap: A way of mitigating seal impact on a coastal fishery. *ICES Journal of Marine Science*, 60:1194–1199.

Ovegård, M., Königson, S., Persson, A., and Lunneryd, S-G. 2010. Effects of escape windows on the capture of cod in floating pots. *Fisheries Research.* 107

Stavenow, J., Ljungberg, P., Kindt-Larsen, L., Lunneryd, S-G., Königson, S. 2017. What attracts Baltic Sea grey seals to seal-safe cod pots and when do they attempt to attack fish in pots? *Journal of Ocean Technology*, 11(4).

Suuronen, P., Siira, A., Kauppinen, T., Riikonen, R., Lethonen, E., and Harjunpää, H. 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*, 19:129–138.

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Important conclusion!

Thank you for listening!

Not a quick fix – combination of measures needed