Nordic Seals

Workshop 29.4.2021

Jonas R. Viðarsson - Matís

Welcome

Welcome to this workshop where the aim is to discuss various issues regarding seal populations in the N-Atlantic and adjacent areas.

The workshop is a part of a small networking project funded by the Nordic Counsel of Ministers Working Group for Fisheries (AG-Fisk).

My name is Jónas R. Viðarsson and I am the project coordinator

I work for Matís in Iceland, and before we go further, I want to stress that we at Matís are not experts on seal populations, seal management, modelling, or species interaction in the ecosystem. That is why we have you here ☺

Agenda

12:00 – 12:10	Welcome and introduction – Jónas R. Viðarsson (Matís)
12:10 – 12:20	Tour de table
12:20 - 12:30	The Nordic Seals project – Jónas R. Viðarsson (Matís)
12:30 – 12:45	The MSE project - Henrik Sparholt (University of Copenhagen)
12:45 – 13:00	Baltic Ecosystem modelling and seals - Valerio Bartolino (SLU)
13:00 – 13:15	*Coffee break*
13:15 – 13:30	Seal research in Iceland: population ecology, fluctuations in the seal populations and anthropogenic interactions - Sandra Magdalena Granquist (MFRI)
13:30 - 13:40	Seal populations and climate change - Jónas R. Viðarsson (Matís)
13:40 - 13:50	*Coffee break*
13:50 - 14:15	Draft of the Nordic seals report presented and discussed – Elvar Traustason (Matís)
14:15 - 14:30	Speakers for the Nordic seals conference suggested/discussed – Jónas R. Viðarsson (Matís)
14:30 - 15:00	Discussions and closing

Tour de table

Attending:

1. **Jónas R. Viðarsson –** Director of division of value creation at Matís ltd. A governmentally owned Icelandic food & biotech research company.
2. **Elvar Traustason –** Research scientist at Matís
3. **Gunnar Þórðarson** – Station manager for Matís in Ísafjörður
4. **Sandra Magdalena Granquist** – Icelandic MFRI, Head of Seal Research at The Icelandic Seal Center
5. **Bjarki Elvarsson** – Icelandic MFRI
6. **Eric dos Santos** – Icelandic MRFI
7. **Heather Burke** - Director, Centre for Aquaculture and Seafood Development, Fisheries and Marine Institute, Memorial University of Newfoundland
8. **Unn Laksá** – CEO of Sjókovin / Blue Resource in Faroe Islands
9. **Genevieve Desportes** – General secretary of NAMMCO

Tour de table

10. **Jóhannes Pálsson –** CEO of FF Skagen. Member of Scandic Pelagic, EFFOP, IFFO and Marine ingredients Denmark
11. **Søren Anker Pedersen** - Marine Ingredients Denmark & European Fishmeal (EFFOP)
12. **Henrik Sparholt** – University of Copenhagen and coordinator of the MSE project
13. **Valerio Bartolino** – SLU expert on Ecosystem based modeling / Baltic sea
14. **Karl Lundström** – SLU
15. **Henrik Lund** – Danmarks fiskeriforening / The Danish Fishermen PO

Absent:

Anne Mette Bæk - Marine Ingredients Denmark & European Fishmeal (EFFOP)

Alan Baudron – Marine Scotland

Guðjón Már Sigurðsson – expert on marine mammals, bycatch and discards at MFRI

Tønnes "Kaka" Berthelsen - ~~KNAPK~~

The Nordic Seals project

Jonas R. Viðarsson - Matís

The Nordic Seals project

- **Research & Networking project funded by Nordic Counsel of Ministers Working Group for Fisheries (AG-Fisk)**

- **Project objective:** To identify, discuss and analyse the challenges associated with the moratorium on seal hunting, and explore alternatives for how to address seal management in the future.

- **The specific objectives of the project are:**
    - gather facts about seal populations and distribution in the N-Atlantic,
    - analyse the effects of the seal populations on the Nordic seafood industry,
    - identify means of controlling the seal populations, including sustainable harvesting,
    - identify and analyse potential products and markets, whilst considering barriers such as animal welfare, policy & political correctness, food safety & toxins ...
- Duration: 1.1.2021 -31.12.2021

The Nordic Seals project

Project partners:

- Matís (IS) –Jónas R. Viðarsson, Gunnar Þórðarson & Elvar Traustason
- Sjokovin (FO) – Unn Laksá
- Fisheries and Marine Institute of Memorial University of Newfoundland (CA) – Heather Burke
- FF Skagen, Scandic Pelagic & EFFOP (DK) –Jóhannes Pálsson
- Marine Ingredients Denmark & EFFOP – Søren Anker Pedersen and Anne Mette Bæk

Associated partner:

- NAMMCO (NO) – Geneviéve Desportes

The Nordic Seals project

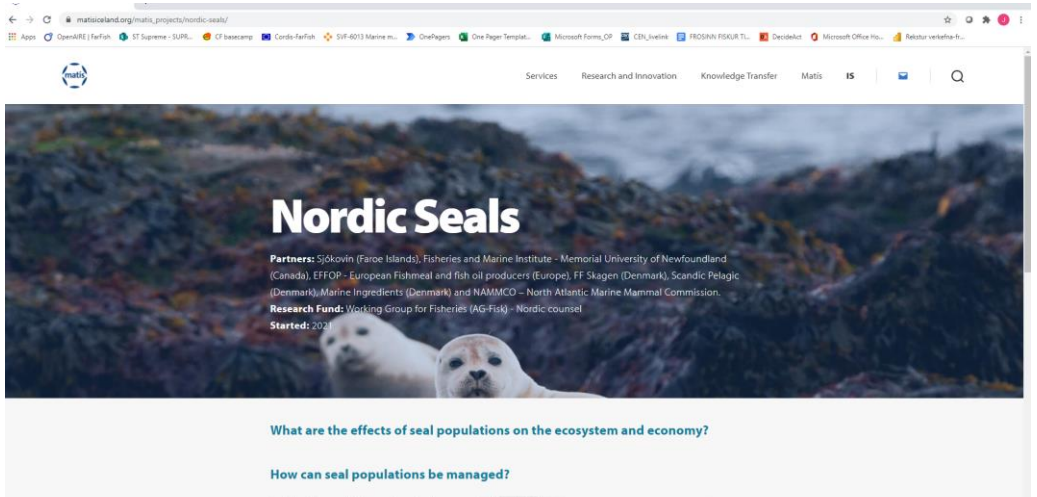
The project has the following milestones:

• Kick-off meeting	2.12.2020
• Project meeting (status check - webpage - preparation for workshop)	16.2.2021
• Workshop	29.4.2021
• Preliminary agenda for conference published	15.5.2021
• Status report to AG fisk	15.5.2021
• Report published	15.10.2021
• Conference	11.11.2021
• Conference proceedings published	1.12.2021
• Final reporting to AG fisk	31.12.2021

The Nordic Seals project

Progress

1. Launch web page https://matisiceland.org/matis_projects/nordic-seals/
2. Gather data on seal populations and distribution in the N-Atlantic on TEAMS
3. Gather data on the effects of seal populations on the seafood industry on TEAMS
4. Gather data on possible use of seals in food or feed on TEAMS
5. Spot at Icelandic Fisheries conference secured - session 2*90 min
6. Workshop and first draft of report presented



Next steps

1. **Continue collecting data**
   - Matís leading – See TEAMS folder
2. **Continue drafting report**
   - Matís leading with contribution from others
3. **Conference preparations**
   - Speaker list and agenda to be published 15.5.2021
4. **Interim reporting to AG fisk**
   - Matís leading – to be submitted 15.5.2021

Ministry of Environment and Food of Denmark
Danish Veterinary and Food Administration

UNIVERSITY OF COPENHAGEN

The MSE-project and seals

2020-2022

www.mseproject.org

European Union
European Maritime and Fisheries Fund

Henrik Sparholt

Project description

Development of Management Strategy Evaluations (MSEs) based on the Fmsy values obtained from the Fmsy-project for six high profile fish stocks.

“The MSE-project“

a) Mackerel,
b) Baltic sprat,
c) Blue whiting,
d) North Sea plaice,
e) North Sea cod,
f) Norwegian Spring Spawning herring.

WorkPackage 7

Sea mammals and their population increases in the Northeast Atlantic - its effects on the population dynamics relevant for the MSE methods applied.

Mega-trend in the stock biomass of sea mammals in the Northeast Atlantic

- sea mammals are now eating about 12 million t per year of fish in this sea area and compared to the commercial catch of 10 million t
- this could potentially be important for fisheries management, meaning that Fmsy should be reduced.
- data on sea mammal stock development by species and food items consumed, are sparse so only rough estimates will be possible.
- A comparison will be made to the Northwestern Pacific where there are indications that the reason for the large annual catches there of 20-30 million t are due to fishing down large fish and thus reducing predation on small forage fish, boosting the catches of these. However, it could be speculated that maybe changes in sea mammal biomass might also contribute. This will be considered on a macro-ecological scale.
- We will especially consider the effect on the selected six stocks in the current project.

Case: North Sea cod

Pressures that have increased in recent years:

1. Climate changes
2. Grey gurnards
3. Grey seals
4. Harbour porpoise
5. Mackerel and herring predation on 0-groups
6. Mackerel and herring food competition with 0-groups
7. Zooplankton
8. *Calanus finmarchicus*
9. Plaice
10. Hake
11. Saithe, haddock and whiting
12. Tuna

3. Grey seals

Great increase since late 1990s.

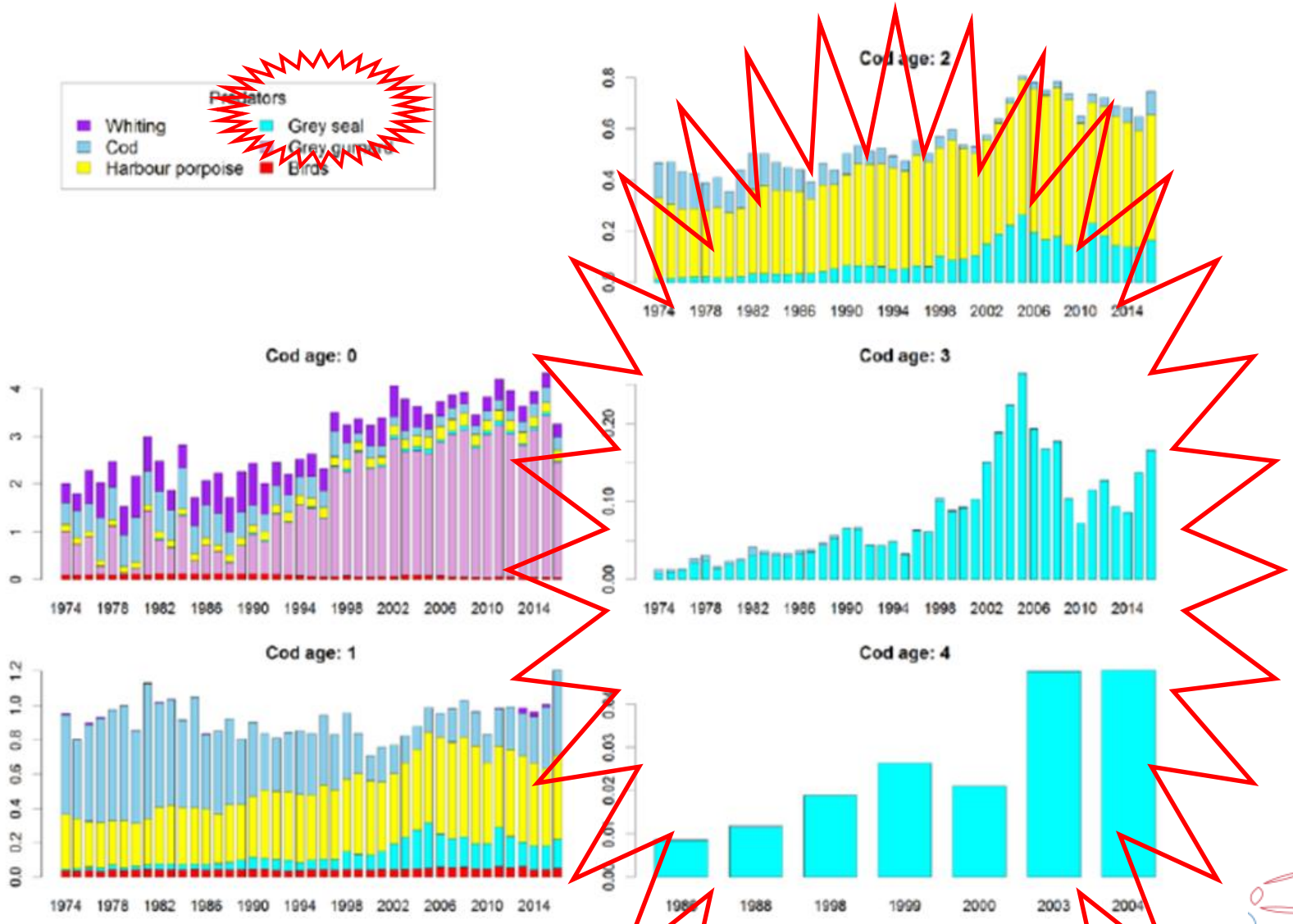


Figure 5.1.22. Annual predation mortality (M2) by prey species and age inflicted by predator species.

Based on ICES multispecies work

- ICES. 2019. Working Group on Multispecies Assessment Methods (WGSAM). ICES Scientific Reports. 1:91. 320 pp. http://doi.org/10.17895/ices.pub.5758

The big picture – for North Sea cod

The analysis showed:

a. **Grey gurnards reduce recruitment of cod in the North Sea by increased predation by a factor of exp(1.0) since the late-1990s;**
b. **Grey seal increased natural mortality M, by 0.3 for ages 1-3 combined. This means a further reduction of productivity of cod available to fishing of a factor of exp(0.3);**
c. **The reduction of the southern cod stock further reduced the total North Sea cod productivity by about 20%.**

In total this reduces the total North Sea cod productivity since the late-1990s by a factor of about exp(1.4)=
4. In addition to this but not quantified:

1. **Increased food competition for cod larvae from herring and mackerel;**
2. **Probably (but not well documented) increased predation by herring and mackerel on cod larvae.**

The environmental data above are in line with the SPM and S-R analyses and offer a plausible explanation of the observed reduction in productivity of North Sea cod in recent years.

What we are interested in -

- **Trends in seal numbers by area**
- **Seal predation/stomachs by food item, food size and geographical area**

We can deliver –

- **Implication for the fishery by each of the six stocks**
- **A method for assessing the impact on other stocks**

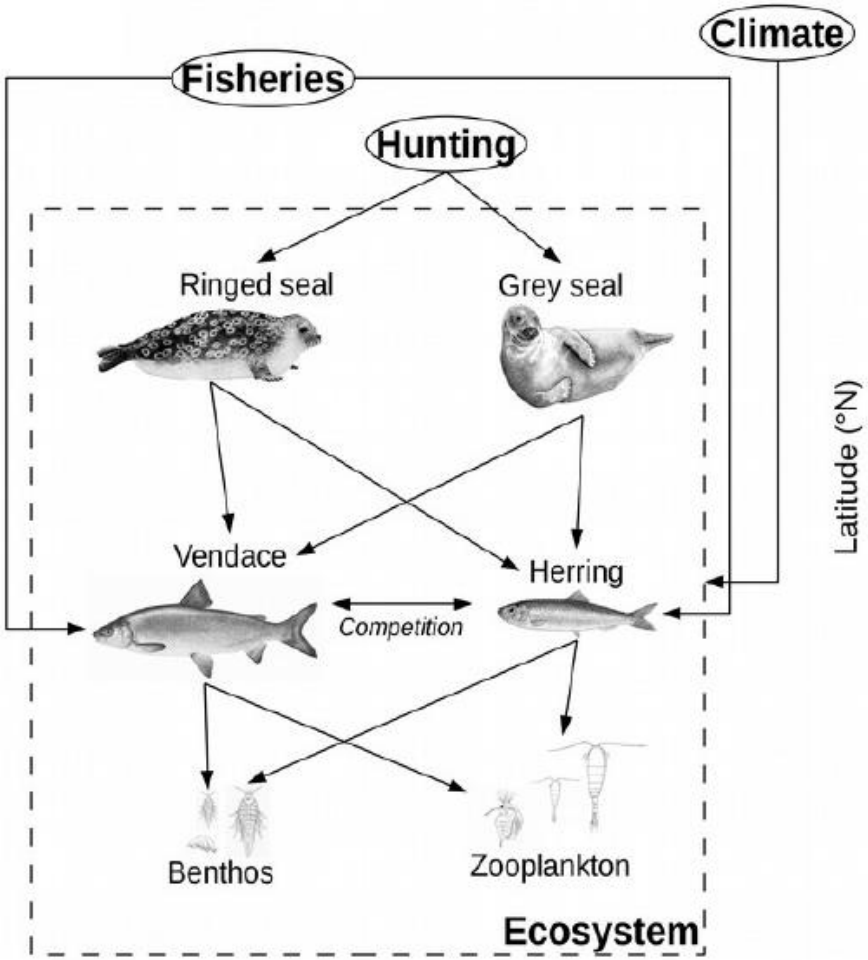
Thanks for listening!

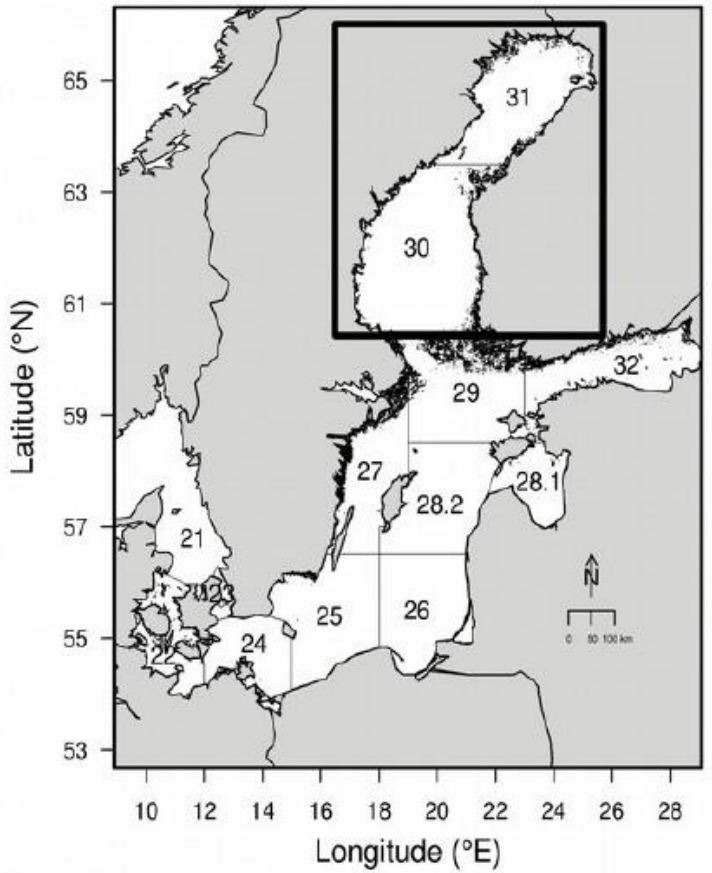
A multispecies model with marine mammals for the Northern Baltic Sea

Valerio Bartolino & Karl Lundström
Dept Aquatic Resources, SLU
valerio.bartolino@slu.se

Background

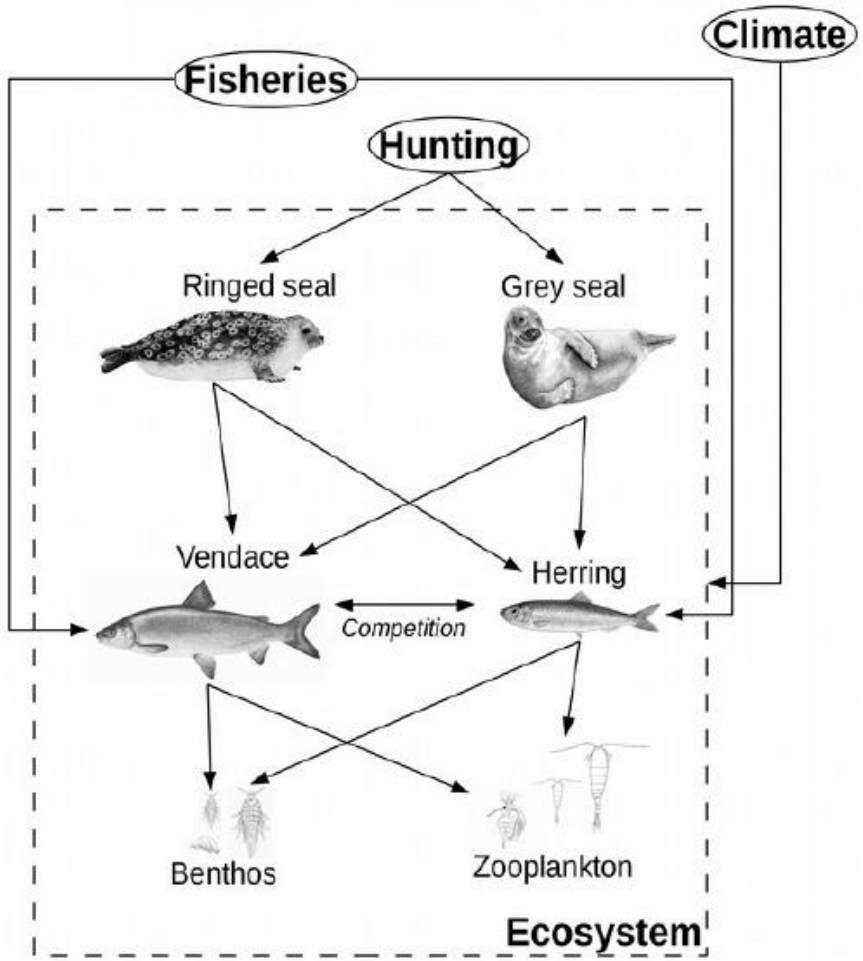
Brackish environment
Marine species at their physiological limits
Low eutrophication and limited anthropogenic pressures
Economically relevant pelagic fisheries

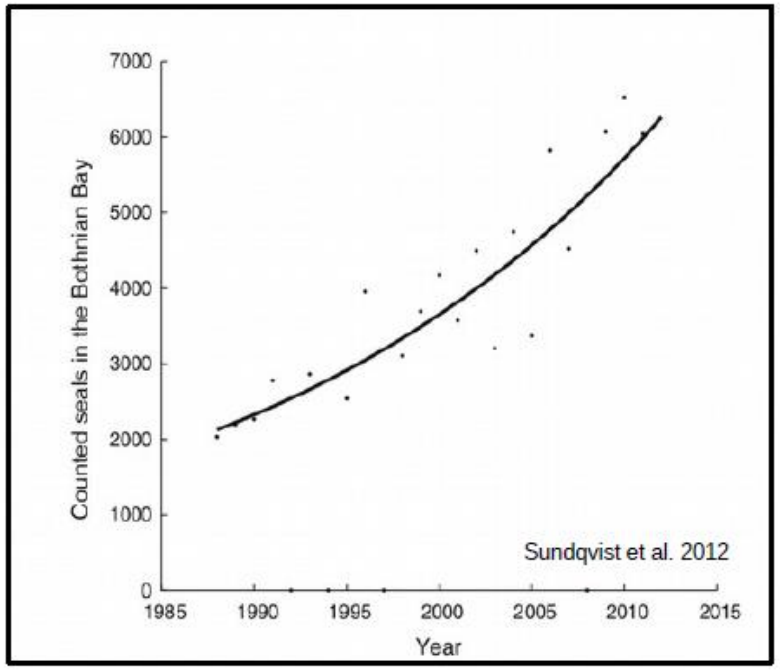


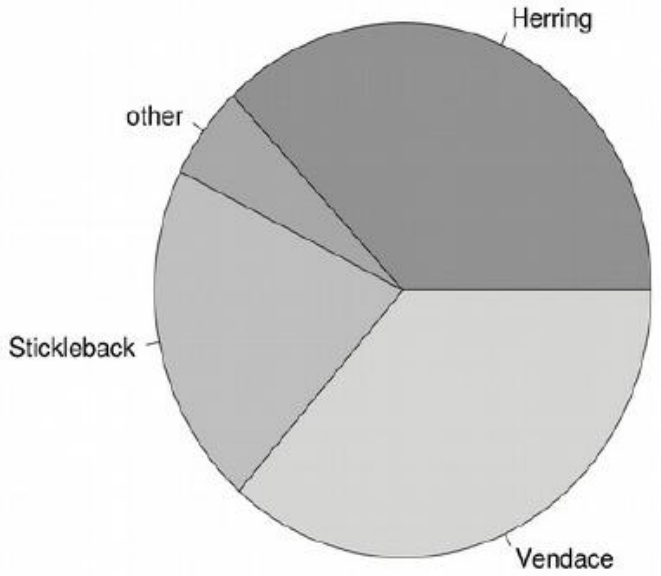


Background

Resident populations of seals
Steady increase seal populations
Strong seal-fishery competition







Ringed seal (Lundström, pers. comm.)

Motivation for the study

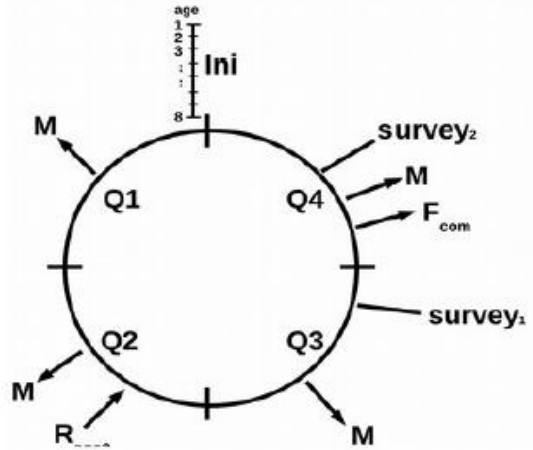
Strong need for tools to investigate trade-offs between the management of fisheries and marine mammals throughout the Baltic, also under the uncertain effects of climate change on predators and preys

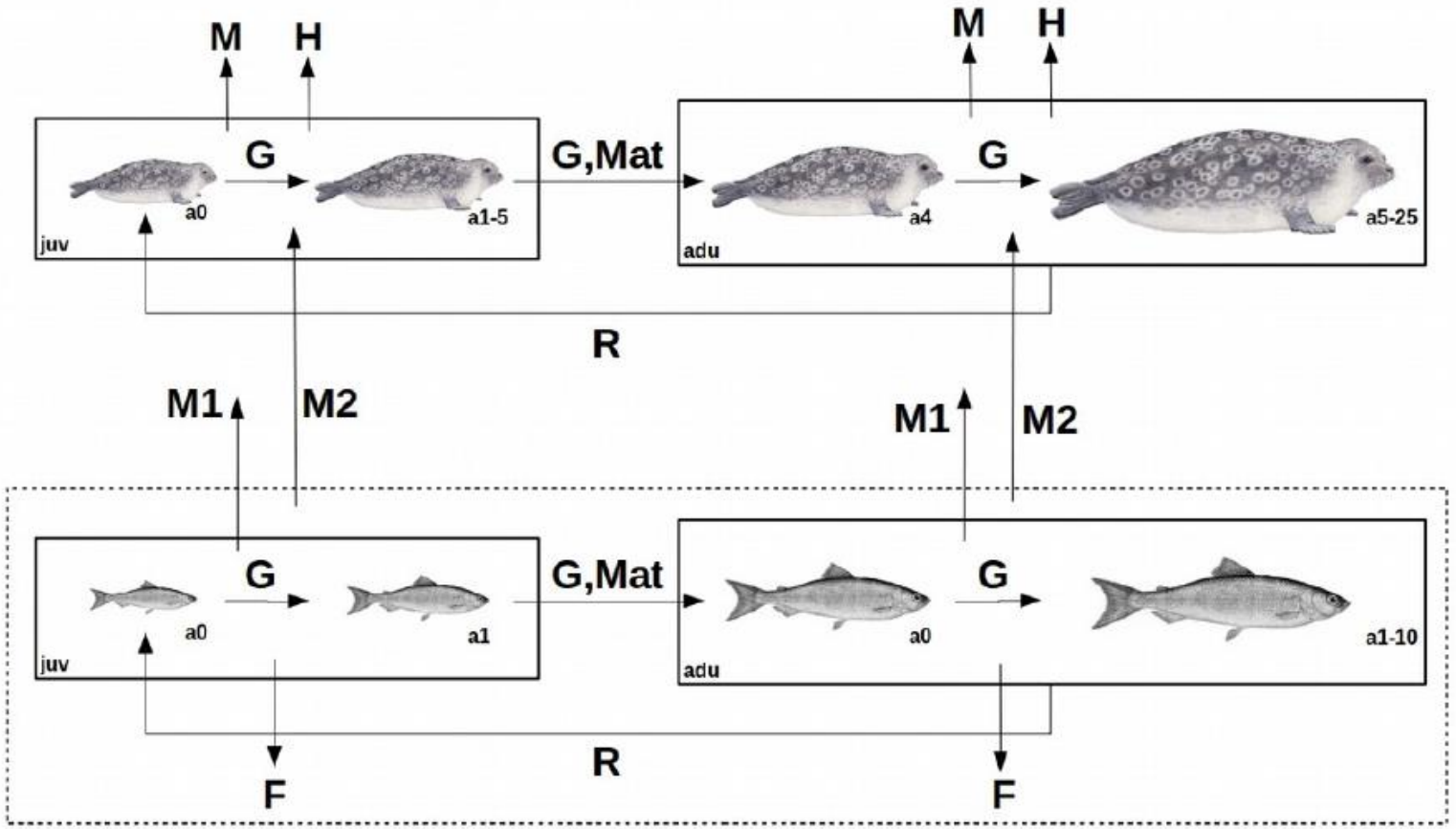
Bothnian ecosystem is an ideal case study:

- low biodiversity and strong trophic interactions in the upper part of the food web
- emerging pressing issues related to the management of seals which requires decision making within an EBFM context
- simplest form of an international dimension

Model

Age-length model
1991-2018, quarterly
1 area
1 fleet
vendace and ringed seal dynamic
gadget2 framework





Implement predation

1. prey species composition
   - functional response
   - non-dynamics preys & otherfood

2. predator-prey size selection (S_p)

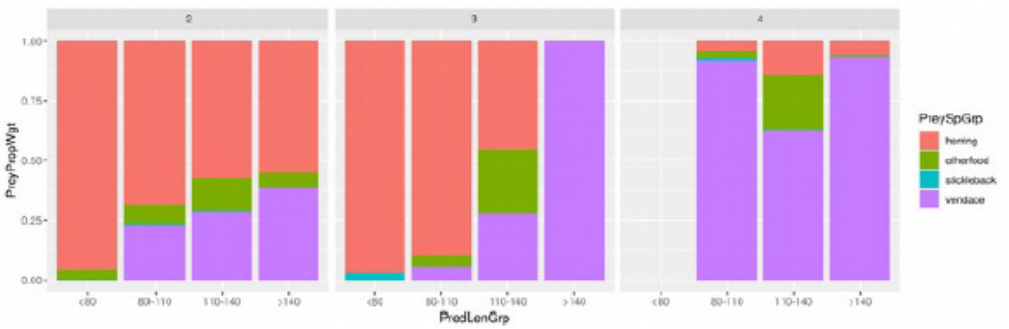
3. consumption (M_L, Ψ_L)
   - feeding level
   - bioenergetic models & experiments
   - energy or biomass

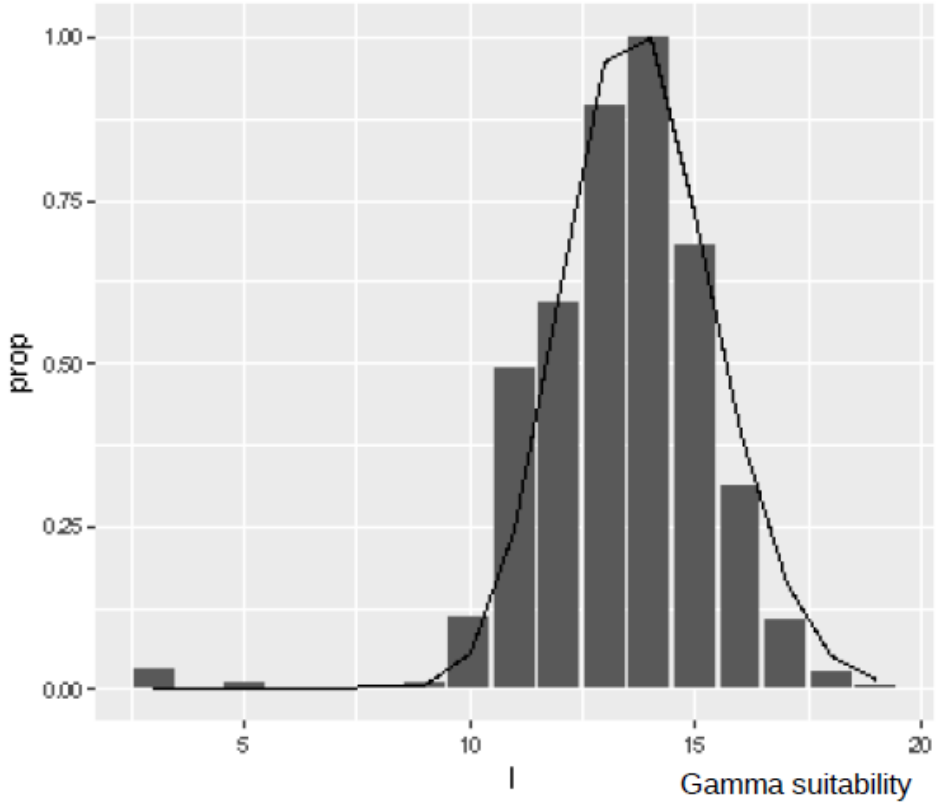
$$C_p(l,L) = \frac{N_L M_L \psi_L F_p(l,L)}{\sum_{preys} F_p(l,L)}$$

$$F_p(l,L) = \left(S_p(l,L) E_p N_l W_l\right)^{d_p}$$

$$M_L = m_0 \Delta t e^{(m_1 T - m_2 T^3)} L^{m_3}$$

$$\psi_L = \frac{\sum_{preys} F_p(l,L)}{H\Delta t + \sum_{preys} F_p(l,L)}$$



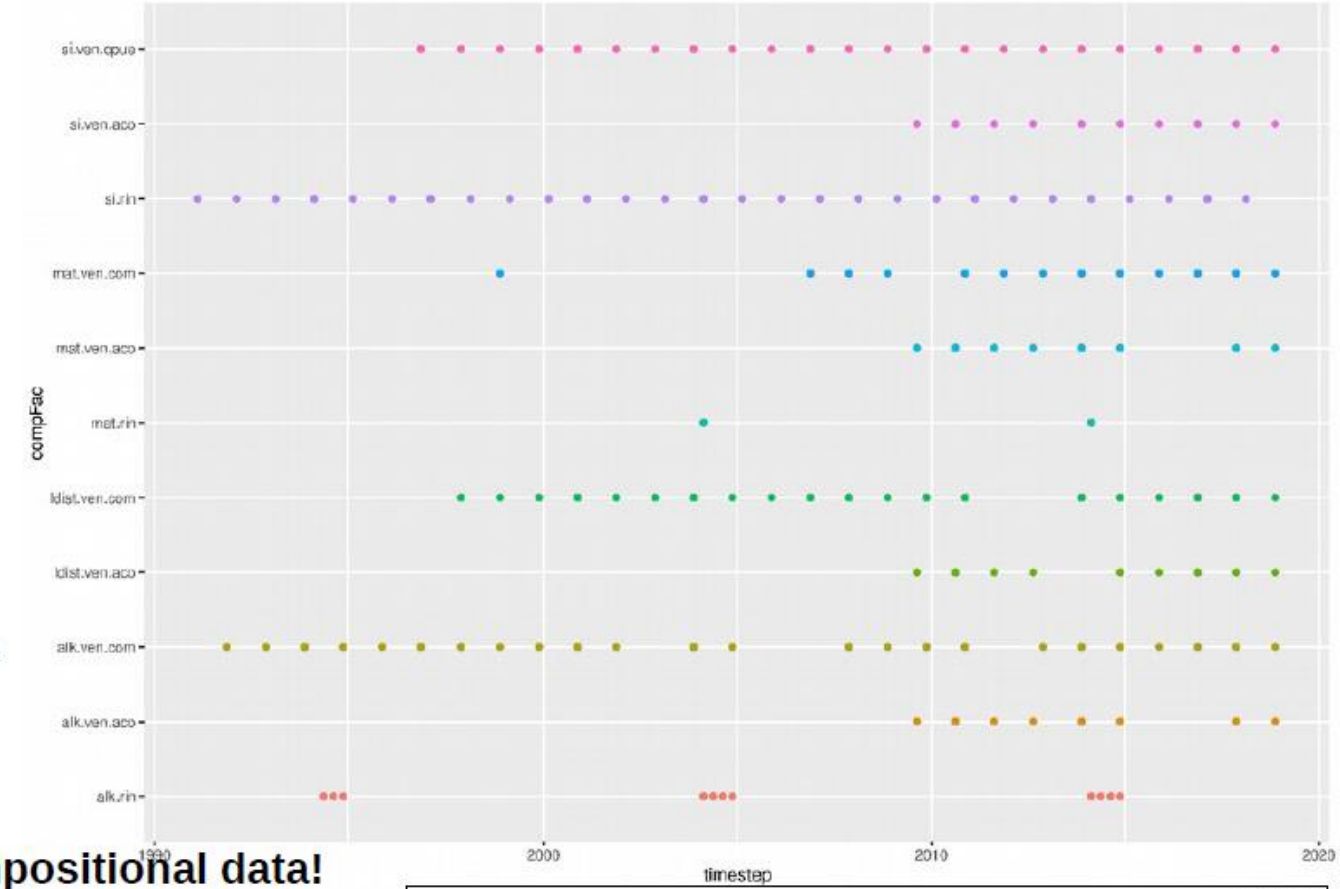


Data

13 (8+5) fitted dataset

vendace

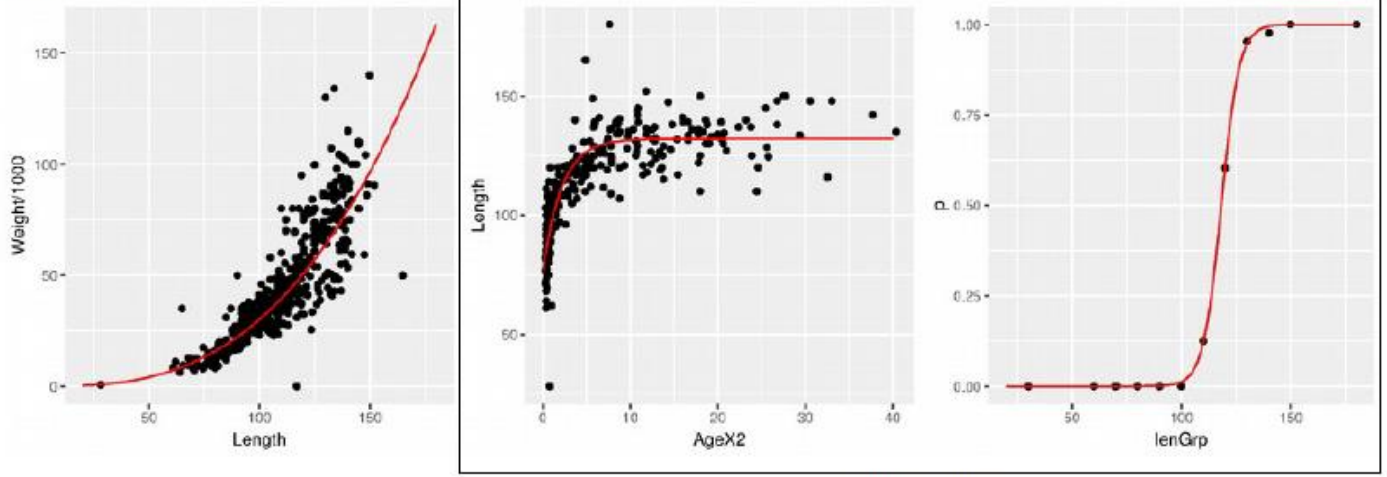
- len.dist.com
- len.dist.aco
- alk.dist.com
- alk.dist.aco
- si.ref
- si.aco
- mat.com
- mat.aco



No compositional data!

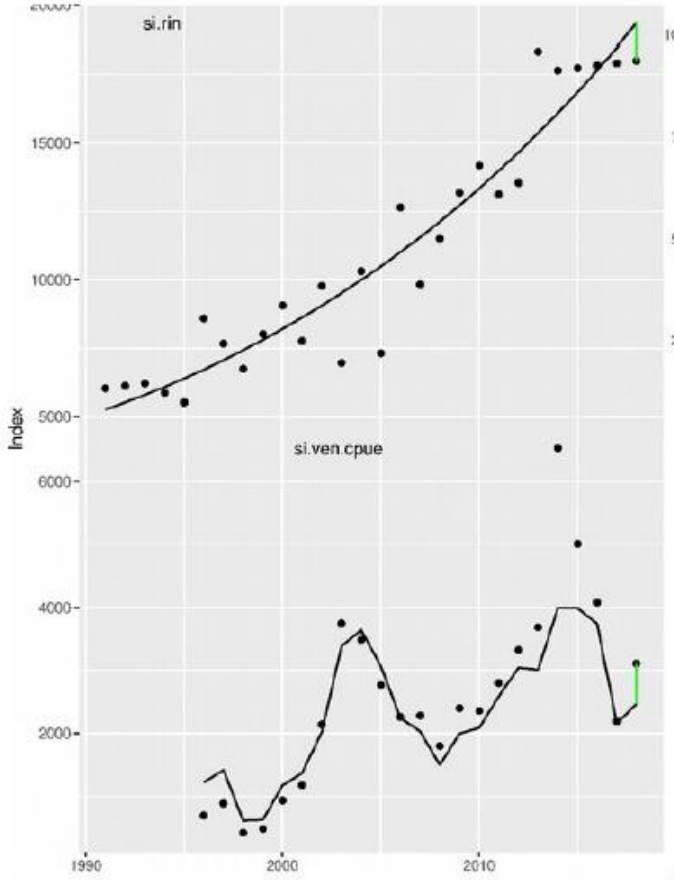
seal

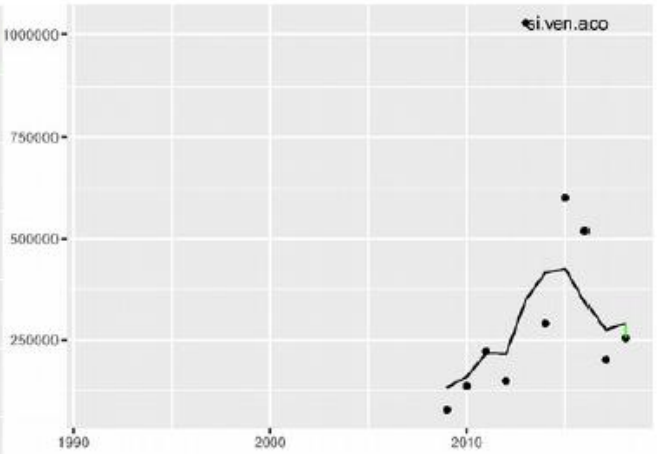
- alk.rin
- si.rin
- mat.rin
- stom1
- stom2

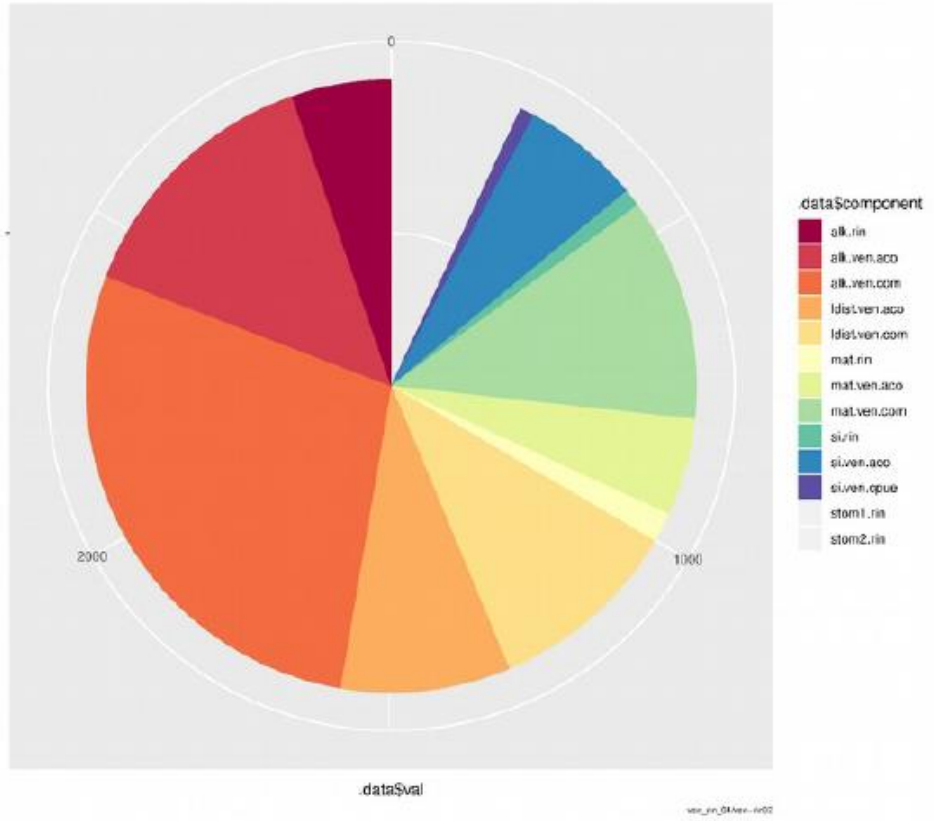


Initial params

Model fitting 1 – indices

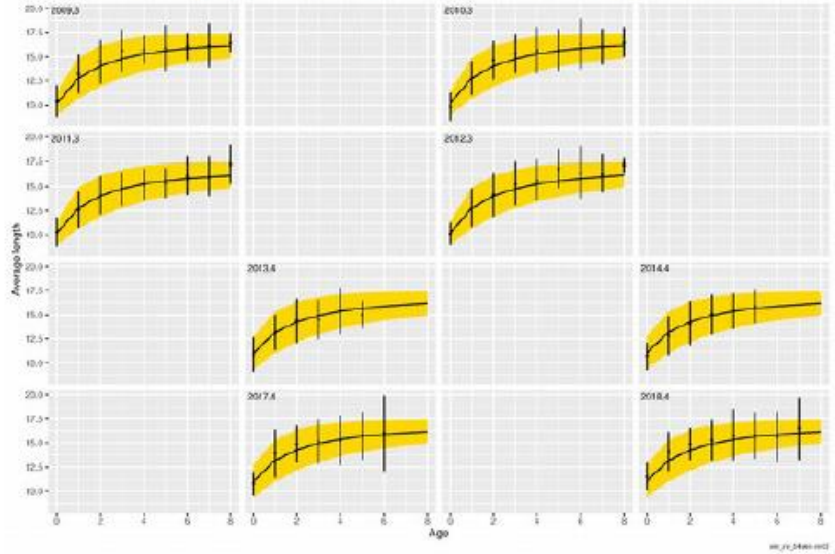


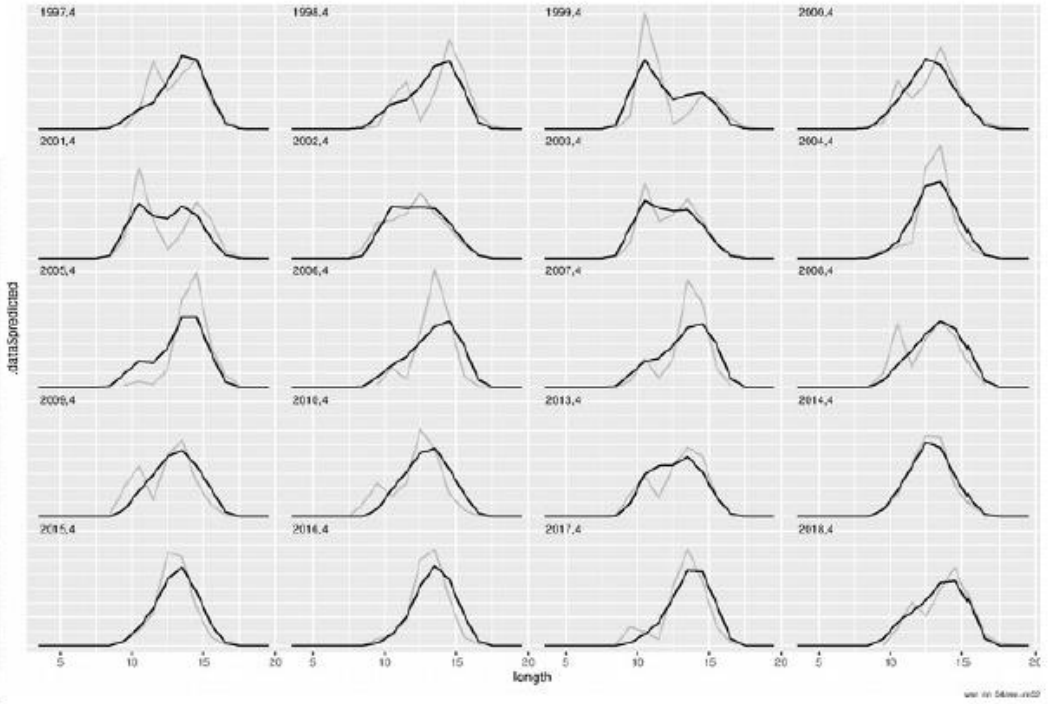


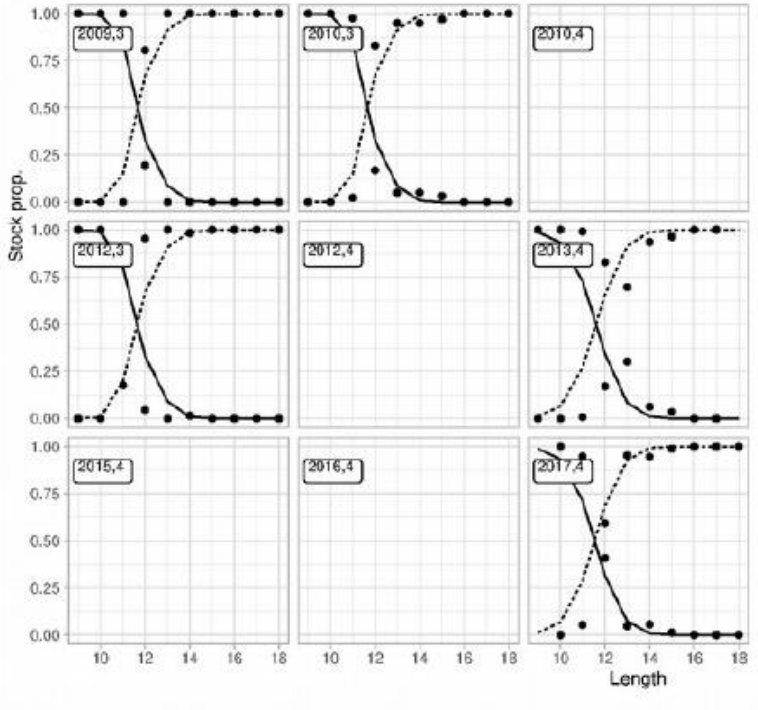


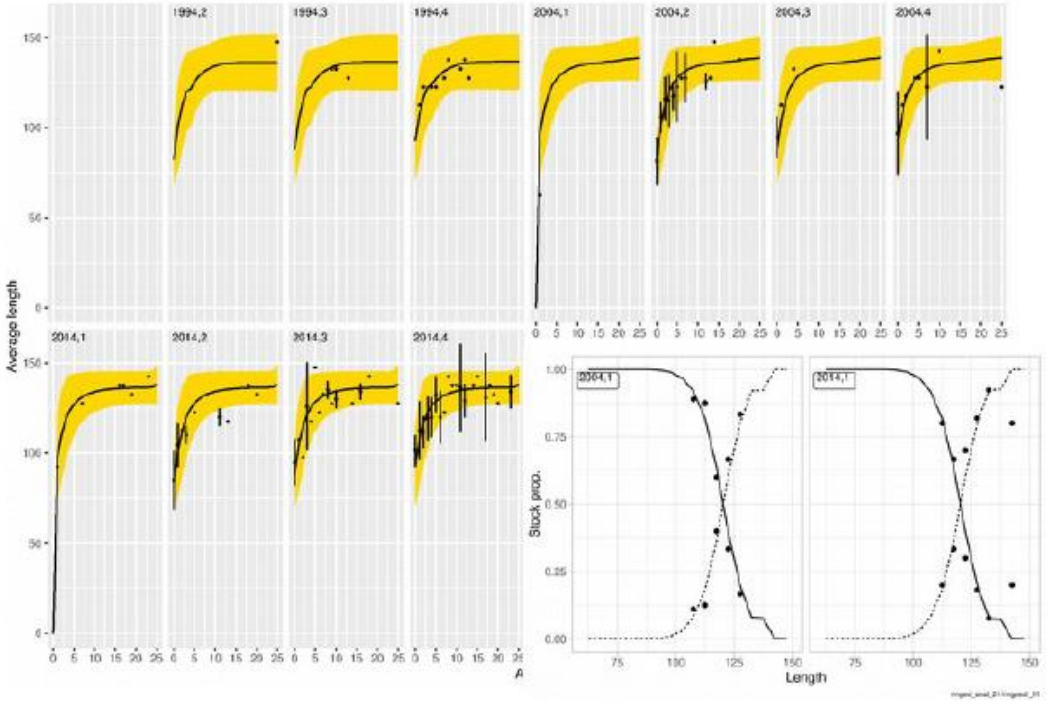
Based on iterative re-weighting (Taylor et al. 2007)

Model fitting 2 - composition and biology

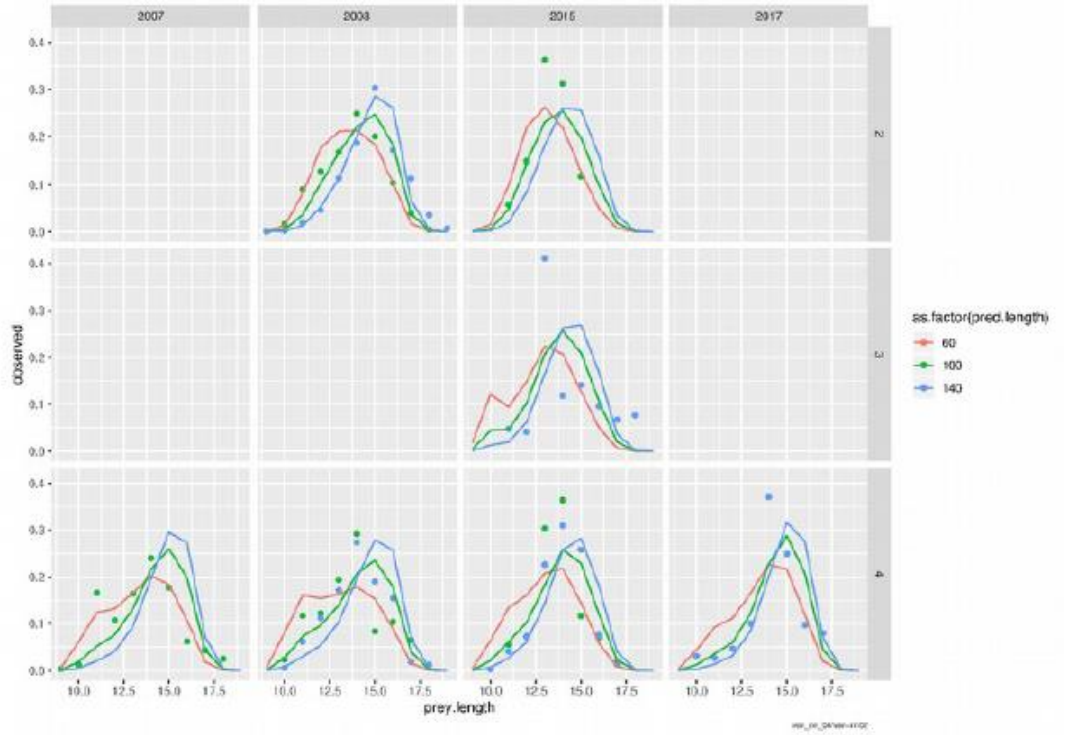


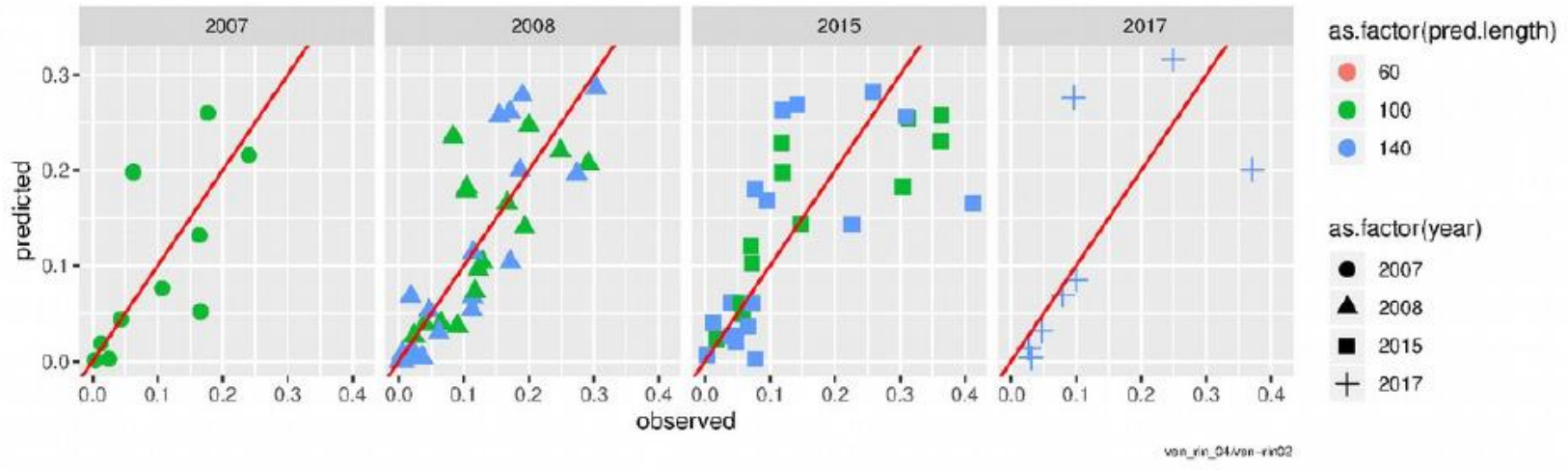




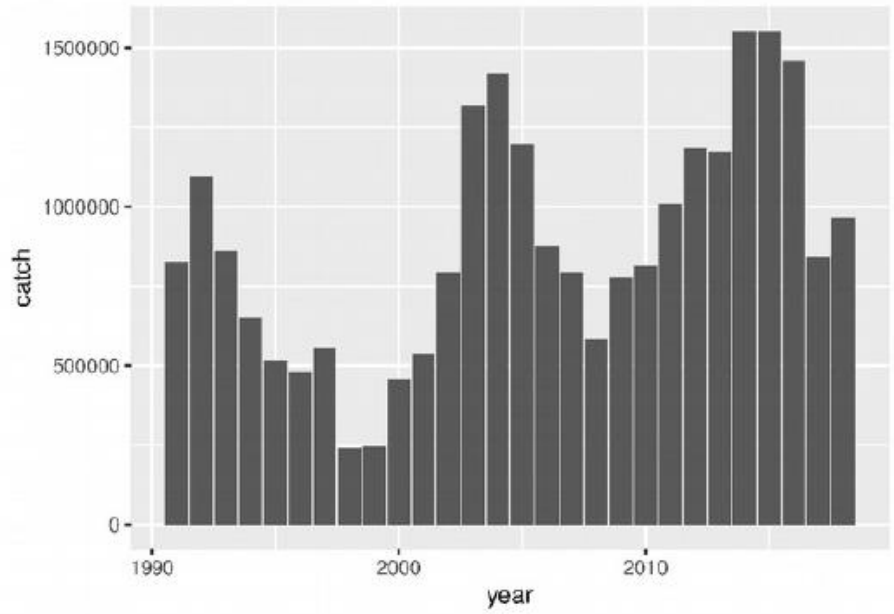


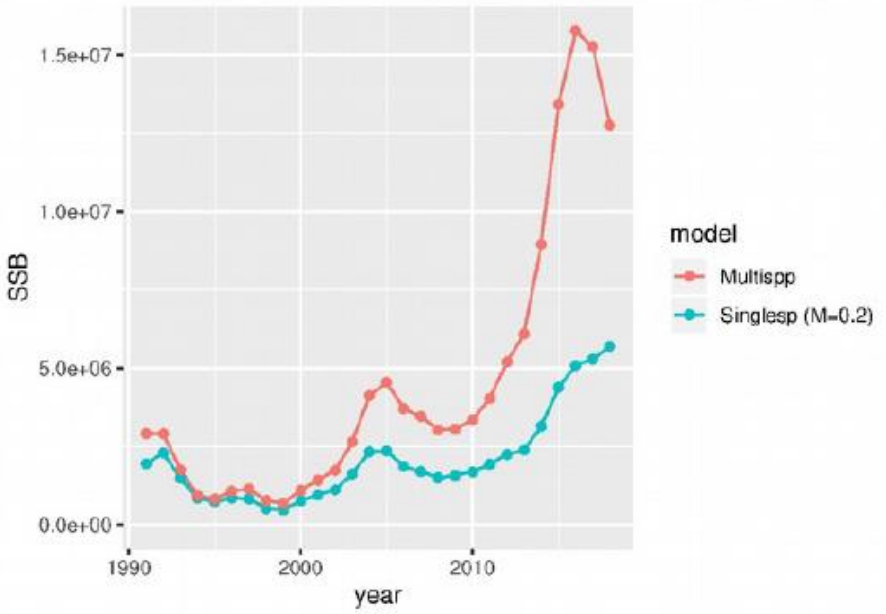
Model fitting 3 – stomachs

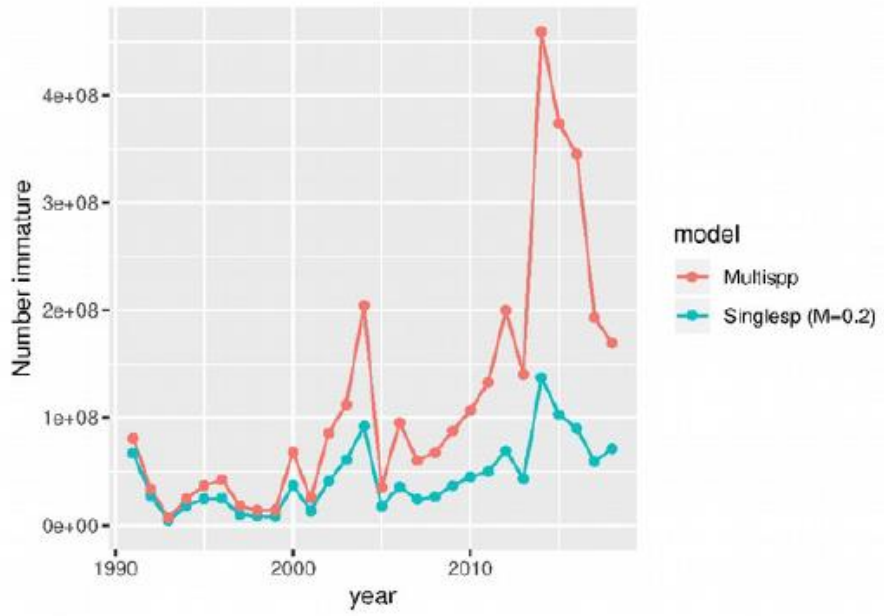


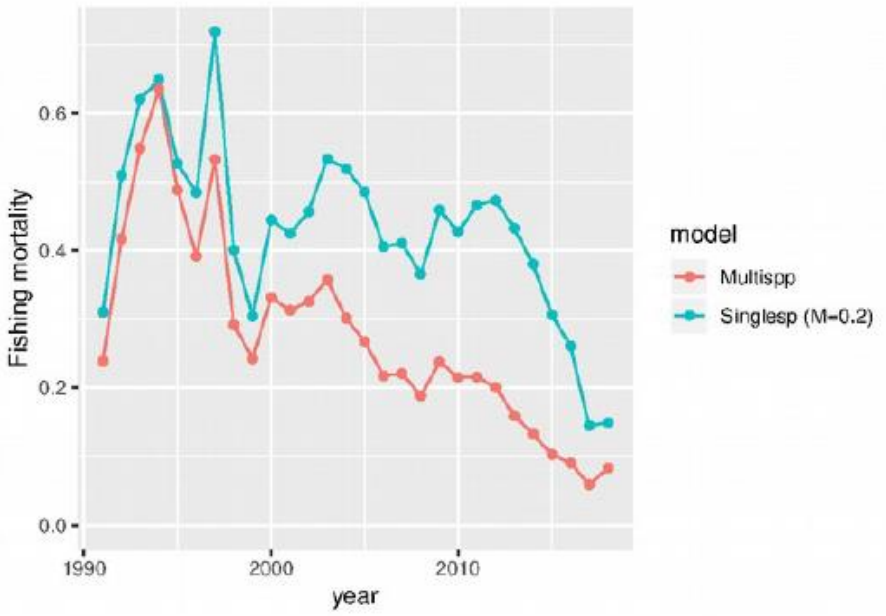


Model output









Possible developments - a framework to cultivate

Integrate incoming new data on fish and seal (monitoring, biological, stomachs, ...)

Fine tuning of the basic model

Extend herring as a dynamic species in the model

Calculate multispecies Fmsy

Evaluate the effect of including seal predation on stock dynamics and refPoi

Add effect of ice cover on ringed seal reproduction

Try more appropriate reproduction models for marine mammals (Pella-Tomlinson)

Implement other biological processes, ie predator-prey overlap, food-dependent growth, seasonality, ...

Test alternative scenarios of fisheries and seal management, and evaluate trade-offs

Use the vendace-ringed seal model as test for gadget3

… most of all get this funded!

Nordic Co-operation

HAFRANNSÓKNASTOFNUN
Rannsókna- og ráðgjafarstofnun hafs og vatns
MARINE & FRESHWATER RESEARCH INSTITUTE

Seal research in Iceland:

Population ecology, fluctuations in the seal populations and anthropogenic interactions

SELASETUR ÍSLANDS
HVAMMSTANGA

SANDRA M. GRANQUIST

Hafrannsóknastofnun **Selasetur Íslands**


This presentation
• Overview of seal research in Iceland and obligations of MFRI
• Status and abundance of Icelandic seal populations
• Seal hunting and by-catch
• Other anthropogenic interactions
– Interactions with fishing industry and angling assocations
– Other interactions with humans

Marine and Freshwater Research Institute (MFRI)

- Seal research and obligations includes for example to:
  - Carry out regular seal population estimates
  - Monitor important factors regarding population ecology
  - Research seal ecology and genetics, for example anthropogenic interactions (fishing, disturbance etc)
  - Give advice to the ministry about seal management based on our monitoring and research (sustainable hunting management etc)
  - Participations in international organzations such as NAMMCO, ICES and Ospar

The Icelandic Seal Center

- Seal museum and information centre.
- Seal research department, research station MFRI
- Tourism research department, in cooperation with Hólar university
- Nature research department, in cooperation with Náttúrustofa Norðvesturlands

Species in Iceland






Population estimates
How are they conducted?

- Aerial surveys
- Started 1980/1982
- Population counts everyother year

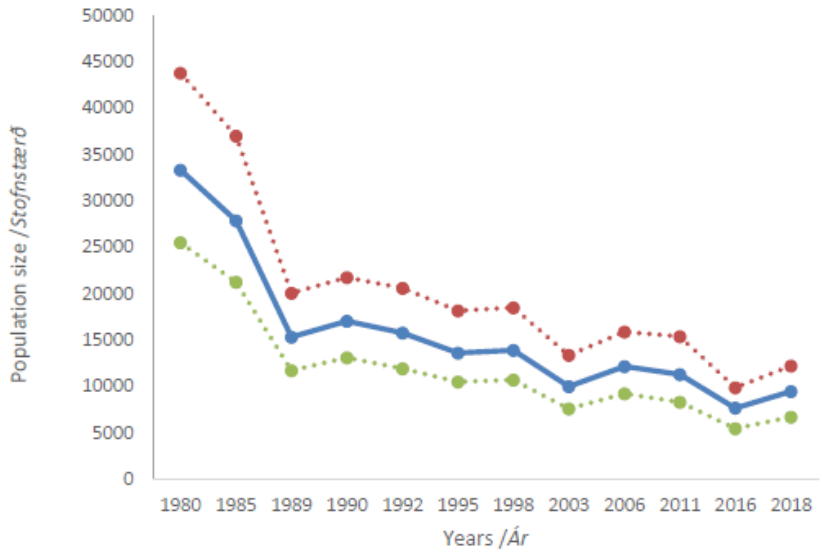
- Harbour seal census carried out durig moult in July/August
  - All animals counted
  - Correction factor for submerged and missed animals
- Grey seal census during pupping period in October
  - Only pups counted
  - Total pup production estimated
  - Population size estimated based on pup production

Populatin estimate
Harbour seals- aerial survey

Status of the Icelandic seal populations

Harbour seals

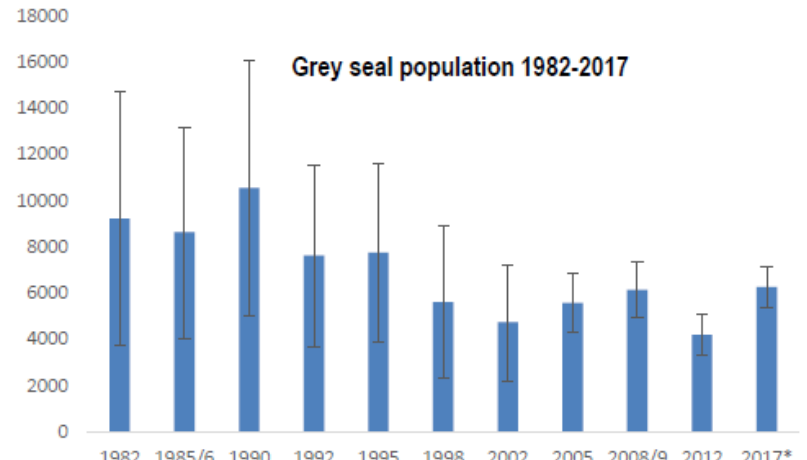
- 33.000 animals 1980
- 9.400 animals 2018
- Management objective 12.000 animals



Status of the Icelandic seal populations

Grey seals

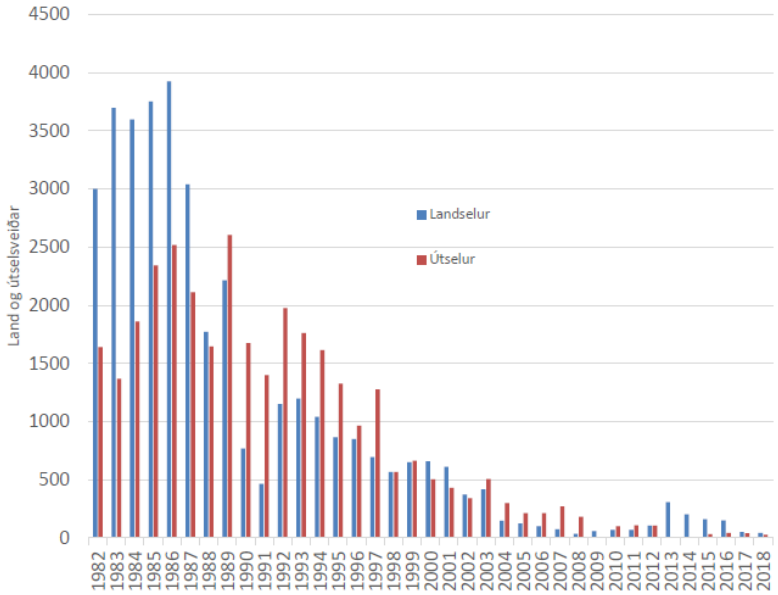
- Around 10.000 animals in 1990
- 6.300 animals in 2017
- Management objective 4.100 animals



National red list for Icelandic mammal populations

- Published first in 2018
  - Harbour seals: Critically endangered
  - Grey seals: Vulnerable

Hunting statistics



Different types of hunting:

- Traditional hunt (vorkópar og haustkópar)
- Bounty system (hunters payed to hunt)
- Culling around salmon river moths

- Until 2019, there was no obligation to report hunting statistics and very minimal management of seal hunting

Seal hunting in Iceland

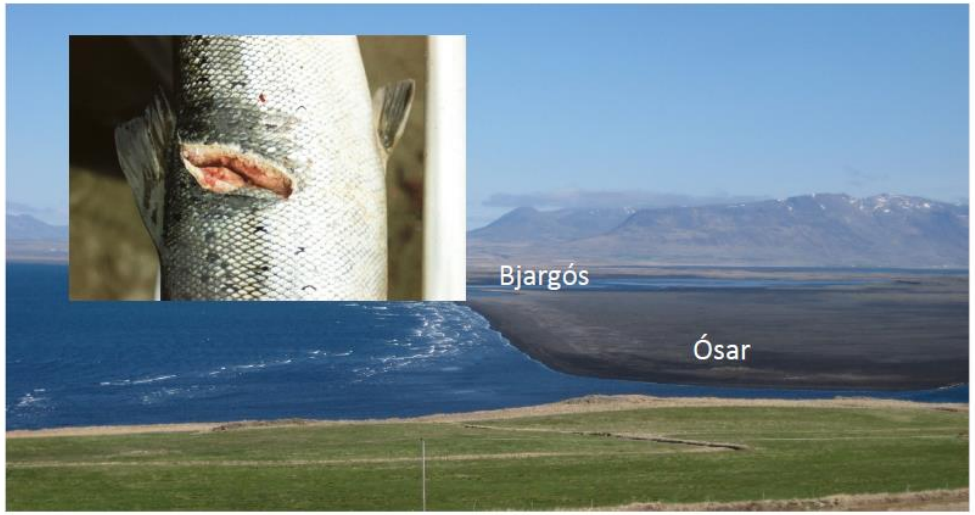
- New legislation in 2019
  - Seal hunting banned
  - Permission to hunt for traditional utilization

By catch

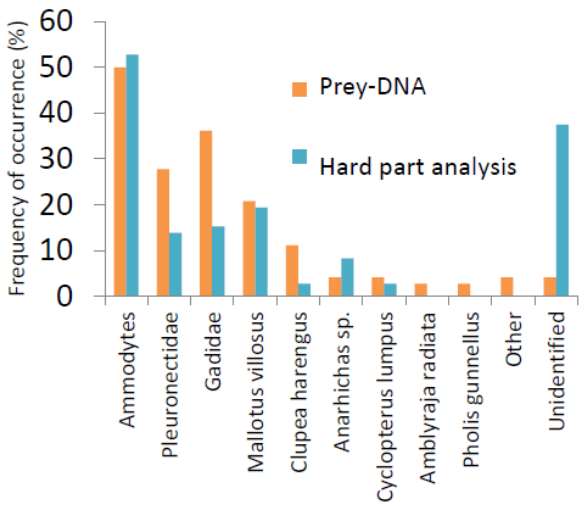
- Today, by-catch is the largest threath to both seal populations
- Grey seal: Average the last 5 years
  - 990 animals in lumpsucker fisheries anually
  - (Also some in other types of gear)
- Harbour seal: Average the last 5 years
  - 1390 animals in lumpsucker fisheries annually
  - 32 in other fishing gears annually

Seal diet;
Effects on salmonids

- Fecal samples May- September 2009-2011.
  - Otholits and bones
  - Prey DNA metabarcoding analysis
  - Stable isotopes (hair and muscle)



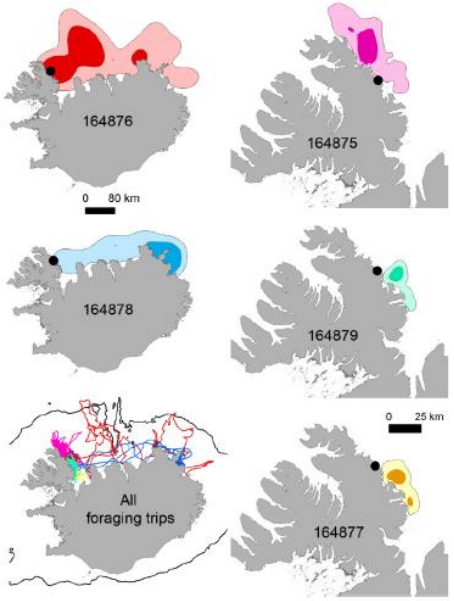
Seal diet- some results



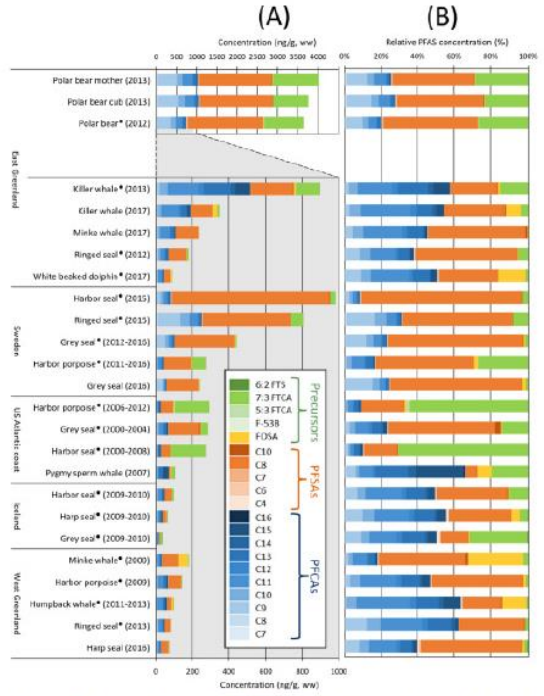
- No evidence that salmon, charr or trout are important prey.
- Most important species were sandeel, flatfishes, cod fishes, herring etc

Granquist, S. M., Esparza-Salas, R., Hauksson, E., Karlsson, O., & Angerbjörn, A. 2018. Fish consumption of harbour seals (Phoca vitulina) in north western Iceland assessed by DNA metabarcoding and morphological analysis. *Polar Biology*, 1-12.

Spatial use and co-use of marine areas



Environmental toxins and seals



1. (A) Sum of targeted PFASs (note the separate concentration axis for polar bears) and (B) normalized concentrations for marine als sorted according to their sampling location. • = pooled samples (n = 2–10). Detailed sample information is available in Table S1.


Environmental Science & Technology

Fluorine Mass Balance and Suspect Screening in Marine Mammals from the Northern Hemisphere

Kyra M. Spaan,* Carmen van Noordenburg, Merle M. Plassmann, Lara Schultes, Susan Shaw, Michelle Berger, Mads Peter Heide-Jørgensen, Aqqalu Rosing-Asvid, Sandra M. Granquist, Rune Dietz, Christian Sonne, Frank Rigét, Anna Roos, and Jonathan P. Benskin*

Peer review papers:

- Aquino, J.F., Burns, G.L and Granquist, S.M. (2021). A Responsible Framework for Managing Wildlife Watching Tourism. *Ocean and coastal management*. In press.
- Rößler, H., Tougaard, J., Sabinsky, P. F., Rasmussen, M. H., Granquist, S. M., & Wahlberg, M. (2021). Are Icelandic harbor seals acoustically cryptic to avoid predation?. *JASA Express Letters*, *1*(3), 031201.
- Magnússon, B., Guðmundsson, G.A., Metúsalemsson, S. and Granquist, S.M. (2020). Seabirds and seals as drivers of plant succession on Surtsey. *Surtsey Research* 14: 115-130.
- Spaan, K. M., van Noordenburg, C., Plassmann, M. M., Schultes, L., Shaw, S., Berger, M., Heide-Jørgensen, M.P., Rosing-Asvid, A., Granquist, S.M., Dietz, R., Sonne, C., Roos, A., Benskin, J.P. (2020). Fluorine mass balance and suspect screening in marine mammals from the Northern Hemisphere. *Environmental Science & Technology*, *54*(7), 4046-4058.
- Punt, A. E., Siple, M., Sigurðsson, G. M., Víkingsson, G., Francis, T. B., Granquist, S. M., ... & Zerbini, A. N. (2020). Evaluating management strategies for marine mammal populations: an example for multiple species and multiple fishing sectors in Iceland. *Canadian Journal of Fisheries and Aquatic Sciences*, *77*(8), 1316-1331.
- Baylis, A. M., Þorbjörnsson, J. G., dos Santos, E., & Granquist, S. M. (2019). At-sea spatial usage of recently weaned grey seal pups in Iceland. *Polar Biology*, 42(11); 2165–2170. DOI:10.1007/s00300-019-02574-5
- Granquist, S.M., Nilsson, P.Å., and Angerbjörn, A. 2019. From Eco-Tourism to Ego-Tourism: Fluctuations in human view on nature over time. *Athens Journal of Tourism*. 6(3), 195-210. DOI: 10.30958/ajt.6-3-4
- Granquist, S. M., Esparza-Salas, R., Hauksson, E., Karlsson, O., & Angerbjörn, A. (2018). Fish consumption of harbour seals (Phoca vitulina) in north western Iceland assessed by DNA metabarcoding and morphological analysis. *Polar Biology*, 1-12.
- Burns, G.L., Öqvist, E.L., Angerbjörn, A., and Granquist, S. 2018. When the wildlife you watch becomes the food you eat: Exploring moral and ethical dilemmas when consumptive and non-consumptive tourism merge. In Kline, C (ed), Animals, food, and tourism pp. 22-35. Routledge Ethics of tourism: New York.
- Öqvist, E.L., Granquist, S.M., Burns, G.L. and Angerbjörn, A. 2017. Sealwatching: an evaluation of codes of conduct. *Tourism in marine environments* 13(1); 1-15. https://doi.org/10.3727/154427317X14964473293699
- Marschall, S., Graquist, S.M. and Burns, G.L. 2016. Interpretation in Wildlife Tourism: Assessing the effectiveness of signage to modify visitor behaviour at a seal watching site in Iceland. *Journal for outdoor recreation 17*, 11-19.
- Granquist, S. and Hauksson, E. 2016. Diet of harbour seals in a salmon estuary in North-West Iceland. *Icelandic Agricultural Sciences* 29, 7-19, doi: 10.16886/IAS.2016.02
- Granquist, S. and Hauksson, E. 2016. Seasonal, meterological, tidal and diurnal effects on haul-out patterns of harbour seals (*Phoca vitulina*) in Iceland. *Polar Biology*, *39*(12), 2347-2359.
- Granquist, S. M., & Nilsson, P. Å. 2016. Who's watching whom?–an interdisciplinary approach to the study of seal-watching tourism in Iceland. *Journal of Cleaner Production*, *111*, 471-478. doi:10.1016/j.jclepro.2014.11.060
- Granquist, S.M. and Sigurjónsdóttir, H. 2014. The effect of land based seal watching tourism on the haul-out behaviour of harbour seals (*Phoca vitulina*) in Iceland. Applied Animal Behaviour Science 156; 85-93.
- Granquist.S. and Nilsson, P.Å. 2013. The Wild North: Network Cooperation for Sustainable Tourism in a fragile Marine Environment in the Arctic Region. In Müller, D., Lundmark, L. and Lemelin, R. (Eds.), *New Issues in Polar Tourism* pp. 123-132. Heidelberg: Springer

Research reports:

- Granquist, S.M. and Hauksson, E. 2019. Population estimate, trends and current status of the Icelandic harbour seal (Phoca vitulina) population in 2018 [Landselstalning 2018: Stofnstærðarmat, sveiflur og ástand stofns]. Marine and Freshwater Research Institution, HV 2019-36. Reykjavík 2019. 22pp.
- Granquist, S.M. and Hauksson, E. 2019. Aerial census of the Icelandic grey seal (*Halichoerus grypus*) population in 2017: Pup production, population estimate, trends and current status [Útselstalning 2017: Stofnstærðarmat, sveiflur og ástand stofns]. Marine and Freshwater Research Institution, HV 2019-02. Reykjavík 2019. 19 pp.
- Víkingsson GA, Gunnlaugsson T, Halldórsson SD, Granquist, SM (2019) Iceland – Progress report on Marine Mammals in 2018. NAMMCO SC/24/NPR-I. 9 pp.
- Víkingsson GA, Gunnlaugsson T, Halldórsson SD, Granquist, SM (2018) Iceland – Progress report on Marine Mammals in 2017. NAMMCO SC/24/NPR-I. 9 pp.
- Jóhann Garðar Þorbjörnsson, Erlingur Hauksson, Guðjón Már Sigurðsson & Sandra Magdalena Granquist. 2017. Aerial census of the Icelandic harbour seal (*Phoca vitulina*) population in 2016: Population estimate, trends and current status / *Landselstalning 2016: Stofnstærðarmat, sveiflur og ástand stofns.* Marine and Freshwater Research Institution, HV 2017-009. Reykjavík 2017. 22 s.
- Víkingsson GA, Gunnlaugsson T, Halldórsson SD, Granquist, SM (2017) Iceland – Progress report on Marine Mammals in 2016. NAMMCO SC/24/NPR-I. 9 pp.
- Víkingsson GA, Gunnlaugsson T, Halldórsson SD, Granquist, SM (2015) Iceland – Progress report on Marine Mammals in 2014. NAMMCO SC/24/NPR-I. 9 pp.
- Sandra M. Granquist and Erlingur Hauksson. 2016. Management and status of harbour seal population in Iceland 2016: Catches, population assessments and current knowledge. Skýrsla til Veiðimálastofnunnar VMST/15002. 17p.
- Sandra M. Granquist and Erlingur Hauksson. 2016. Status of the Icelandic harbor seal population in Iceland. NAMMCO. SC/23/CSWG/13. 10p.
- Sandra M. Granquist and Erlingur Hauksson. 2016. Status of the grey seal population in Iceland. NAMMCO. SC/24/CSWG/13. 8p.
- Sandra M. Granquist, Erlingur Hauksson og Tryggvi Stefánsson. 2015. Landselatalning árið 2014 -Notkun Cessna yfirþekju flugvélar, þyrilvængju og ómannaðs loftfars (flygildi) við talningu landsela úr lofti. Skýrsla til Veiðimálastofnunnar VMST/15002
- Sandra M. Granquist. 2014. Hvítanes selaskoðunarstaður: Úttekt á hugsanleg áhrif á hegðun og útbreiðslu sela vegna uppbyggingar selskoðunarstaðs. Nóvember 2014. Unnið fyrir verkefnið Hvítanes á Skötufirði.
- Erlingur Hauksson, Halldór Gunnar Ólafsson og Sandra Granquist. 2014. Talning útselskópa úr lofti haustið 2012. [An aerial survey of the Icelandic grey seal population in 2012] Skýrsla til Veiðimálastofnunnar. Október 2014 VMST/14050
- Granquist, S. 2014. Ummerki eftir sel á veiddum laxfiskum í völdum laxveiðiám í Húnaþingi vestra og Austur-Húnavatnssýslu [Injuries from seal on caught salmonids in selected rivers in Húnaþingi vestra og Austur-Húnavatnssýslu, Iceland]. Institute of freshwater fisheries. February 2014,VMST/14019
- Granquist, S. & Hauksson, E 2013. Selatalningin mikla. Niðurstöður 2007-2012 [The great seal count. Results 2007-2012]. Institute of freshwater fisheries January 2013. VMST/13001
- Granquist, S., Hauksson, E., Árnadóttir, A., B. and Kasper, J. 2011. Landselstalning úr lofti árið 2011. Framvinda og niðurstöður [Aerial survey of the Icelandic harbour seal population]. Institute of freshwater fisheries November 2011. VMST/11051
- Granquist, S. 2009. The Wild North: The behaviour and abundance of harbour seals (*Phoca vitulina*); How do tourists affect the seals? *Annual Report for The Wild North*, December 2009.
- Granquist, S. 2008. *Hegðun og útbreiðsla landsela (Phoca vitulina) í návist ferðamanna; Hafa ferðamenn áhrif á seli?* [*Behaviour and abundance of harbour seals (Phoca vitulina) in presence of tourists: Do tourists affect the seals?*] In: Áhrif ferðamanna á atferli villtra dýra [The effect of tourists on the behaviour of wild animals]. A project in three parts, sponsored by the Icelandic innovation fund for students, September 2008.

Seal populations and climate change

Jonas R. Viðarsson - Matís

Seals and Climate Change

- Alan Baudron was unfortunately not able to be with us, due to ICES WG meeting
- He has been working on single- and multi-species models in the waters around UK.
- These include ecosystem models where seals are part of the pray-predator relationships
- He did work on CC forcing for the West of Scotland in the ClimeFish project
- His input on seals and CC are:

Seals and Climate Change

- Alan referenced Serpetti er al. 2017 https://doi.org/10.1038/s41598-017-13220-7 but emphasized that model designed around seals would be appropriate to make CC projections.
- From his modeling, using multi-species and ecosystem models, it seams that CC will have negative effect on seal populations. But more research is needed.
- Seals have quite a low thermal preference in Alan's models and are not doing really well under future warming.
- Seals are endotherms, so the impact of temperature may not be as 'direct' as for ectotherms like fish.
- The effects of CC on seals are likely to be indirect when CC affect the biomass of fish they eat.

The Nordic Seals report

Elvar Traustason - Matís

Agenda and purpose of presentation

Present draft and start discussions on next steps

1. Review of objectives
2. Main chapters
3. Sub chapters and main results
4. Discussions, are we on the right track?
5. Delegation of tasks (next steps)

Review of objectives

Scope of the report

- From project meeting 16.02.21
- Gather facts about seal populations and distribution in the N-Atlantic,
- analyze the effects of the seal populations on the Nordic seafood industry
- identify means of controlling the seal populations, including sustainable harvesting
- identify and analyze potential products and markets, whilst considering barriers such as animal welfare, policy & political correctness, food safety & toxins ...

Review of objectives

Scope of the report - Main goals

- A short, concise report that is based on the scientific literature and knowledge of the project partners
- Written in a way that can be understood and used by the public (laymen terms)
- Ideal length 20-25 pages

Main chapters

- Introduction
- Seal Populations in the North-Atlantic
- Damage to Fisheries
- Population Control / Fishery stock protection
- Seals as a Food Source
- Conclusions

Introduction

- Still needs work. Can mostly be adjusted from project proposal

Seal Populations in the North-Atlantic

- Sub chapters
  - Distribution and Population
  - Role in ecosystems
  - Conservation efforts

- Main findings
  - Overview of habitat and basic informations, e.g population no., conservation status height, weight and lifespan
  - 6 main species
  - Most recovering from heavy hunting pressure in the 19th and early 20th century

Damage to Fisheries

- Sub-Chapters
  - Predation – Direct competition
- Seals are opportunistic predators
  - Known to eat large quantities (Grey seals estimated to consume roughly 5500kcal a day)
  - Estimated prey quantaties for Grey seals in ICES areas IV and VIa (Scotland) were around 17000t in 2010 for cod alone
    - Hard to quantify numbers for larger areas. Only limited data available for specific regions

Damage to Fisheries

- Sub Chapters
- Theft from fishing equipment
- Damage to equipment

- Main results so far
  - Two culprits are most referred to in the literature
    - Grey seal and Harbor Seal
      - Spatial alignment with commercial fisheries?
  - Measurable damage to fisheries mostly in small scale fisheries
    - Gill nets, long lines, traps etc.
  - Theft from equipment is probably underrated
    - Specialized "problem seals"

Damage to Fisheries

- Sub Chapters
- Theft from fishing equipment
  - Seal proof fishing gear has in some cases limited damage to equipment
  - and catch losses
  - Distance of fishing equipment from haul outs a big factor
  - Specialized „Problem animals" often the culprit
  - Specialized culling efforts of these individuals suggested as an effective means of catch protection
- Damage to equipment
  - Hard to quantify financial losses for larger areas or industries.

- // Fish evasion from known fishing grounds due to seal presence?
  - Not much research found on this issue

Nematodes – Seal worms/ring worms

- Sub Chapters
  - Health Risks
    - Nematodes from the family Anisakidae.
      - Can affect humans if raw or undercooked contaminated fish is consumed
        - Anisakiasis
      - Dead Anisikidae can also have allergenic effects and cause sever reactions in humans.
  - Downgraded products
      - Known problem, hard to quantify large scale.
        - One study found 80% of cod fillets were affected
      - Candling ineffective against mackerel, does the same apply for whitefish?

Population control / Fishery stock protection

- Current Methods
  - Culling large quantities of seal seen as inhumane and unnecessary
  - Financial aid to fishermen and special culling licenses both unpopular and not sustainable.
  - Hunting a non-factor today
  - Strict moratoriums in place in most areas

- Viable alternatives
  - Culling of specific "problem animals" suggested to be effective in certain situations
  - Seal proofing equipment has shown reduced losses
  - Spatial segregation from haul outs
  - **STILL NEEDS WORK, RESULTS OF WORKSHOP/CONFERENCE?**

Seals as a Food Source

- History of seals as a food source
  - Historically important food source for Inuit's in Canada and Greenland
  - Opportunistic food source for coastal Scandina and the UK
    - Examples of more interest in seal meat during times of hardship
- Laws and regulations
- Potential products/values and markets – Heather Burke / Geneviéve Desportes
- Harvesting techniques - Heather Burke / Geneviéve Desportes
- Challenges in marketing seal products

Conclusions

- In collaboration with project partners after report chapters are finalized.

Discussions and delegations of tasks

Focus on more effects of fishermen on seal. – Unn Laksá
Focus on markets and is there an interest.

Focus on seals and how they impact ecosystems positively
e.g eat large amounts of invasive species(flaunder) also tourists new industry perhaps? – Sandra

Genevíeve: careful of language and to have trends in population in the report? Not going up everywhere

- **[2:14 PM] Karl Lundström**
- **Yes, very important to show the conditions in different regions, and not to generalize.**

Henrik: what we need is how many seals do we need how many seals are sustainable

The conference

Jonas R. Viðarsson - Matís

Nordic Seals session at the Icelandic fisheries conference

- **Annual conference with around 800 attendees**
- **Two-day event with around 20 sessions**
- **Most sessions are running parallel in three lecture halls**
- **We have two approximately 90 min slots on Thursday November 11 starting at 13:00**
- **It will be possible to have presentations pre-recorded if necessary and the organizers are looking into the possibility of enabling remote access for answering questions & panel**

Nordic Seals session at the Icelandic fisheries conference

Suggested agenda

13:00 - 13:05	Welcome and introduction	Chair of the session TBD
13:05 - 13:25	Overview of the Nordic seals report	Elvar Traustason – Matís
13:25 - 13:45	NAMMCO and its role in seal managment	Genevieve Desportes – NAMMCO
13:45 - 14:05	Seals around Iceland	Sandra Granquist – MFRI
14:05 - 14:25	Seals in Canada	Heather Burke – MUN
14:25 - 14:45	Seals in the Baltic	Valerio Bartolino – SLU
14:50 - 15:15	***Coffee break***	
15:15 - 15:35	Seals and ecosystem modelling	Henrik Sparholt – University of Copenhagen
15:35 - 15:55	Efferct of seal populations on fisheries	Henrik Lund - DKfisk
15:55 - 16:15	Are seals a wasted resource?	Unn Laksá – Blue Resource
16:15 - 16:45	Panel discussions	