Understanding the impacts of seals and cormorants on fish stocks in the Baltic Sea - For starters

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Harbour seals

Map: HELCOM 2016

Number of seals

Harbour seals, Kalmarsund

Number of counted seals (60%)

Estimated population size (back-calculated, 8%)

Data: Swedish National Environmental Monitoring Program, Swedish Museum of Natural History
• Seasonal dynamics?
Interpolation derived from haul-out data during moult

Seasonal dynamics?
Cormorant population development

Development of the Cormorant population in the eastern and northern Baltic

Development of the Cormorant population in the western Baltic
Cormorant population development

A real problem for Baltic fishermen

- Damage to gear and catch ↑
- Number of fishermen ↓
- Damage/fisherman ↑↑

Photos: Swedish University of Agricultural Sciences
But...

- What is the ecological role of seals and cormorants in food webs?
- Impact on fish stocks?

Boström 2013. Aqua Licentiate Theses 2013:1

Hansson et al. 2007. Ambio 36:265-271
Information need

• Ecosystem dynamics
• Impact on fish stocks
• Competition with fisheries
• Management
  • Ecosystem-based management
• Fish stock assessments
• Effect of environmental changes
  • Food demand of the predator populations
  • Environmental monitoring programs
• Objective and sound facts to debates etc.
Feeding habits – What do we know?

- **Seals**: 3-5 kg fish per day, on average
  - Species
  - Age
  - Diet composition

- **Cormorants**: 0.5 kg fish per day, on average

- **Dietary variability**
  - Geographical
  - Annual
  - Seasonal
  - Age

- A general lack of interest in diet studies
Case studies

1. Cormorant impact on fish stocks
2. Quantifications of fish removal
3. Overlap in size preferences
4. Inclusion of predation in fish stock assessment models
5. No-take zones
#1. Cormorant impact on fish populations

- Meta analysis
  - 4000 titles and abstracts
  - n>500 articles identified
  - 22 articles where effect sizes could be extracted
    - (fish variables vs. cormorant abundance/predation)
  - Global scope: great cormorant; double-crested cormorant
#1. Cormorant impact on fish populations

**Method**

- Bird abundance (61)
- Refuges (27)
- Hazing (61)
- Bird presence (4)
- Shooting (9)
- Grand mean

**Environment**

- Baltic Sea coast (7)
- Lake (30)
- Farm (6)
- Estuary (48)
- Experimental (25)
- River (2)
- Grand mean

Negative effect on fish: Bird abundance, Refuges, Hazing, Bird presence, Shooting

Positive effect on fish: Grand mean

Negative effect: Baltic Sea coast, Lake, Farm, Estuary, Experimental, River

Positive effect: Grand mean

Ovegård 2017. PhD thesis
#1. Cormorant impact on fish populations

**Fish species**

- **Perch** (20)
- **Coho salmon** (43)
- **Walleye** (5)
- **Rainbow/Steelhead** (8)
- **Catfish** (4)
- **Brown trout** (5)
- **Cyprinidae** (21)
- **Miscellaneous** (12)

**Grand mean**

Effect size

Negative effect

Positive effect

Ovegård 2017. PhD thesis
#2. Quantification of fish removal

Annual fish removal, Baltic Sea

- **Cod**
- **Herring**
- **Sprat**
- **Flatfish**
- **Perch**
- **Pike**
- **Whitefish**
- **Other species**

Commercial fishery, recreational fishery, cormorants, seals.

Hansson et al. in prep.
Perch and pike are predatory fish with ecologically important functions.
#4. Inclusion of predation in stock assessment models

- Ringed seals and vendace in the Bothnian Bay
  - Overlap in size preference

- Seals consume 2-6 x fishery landings (Lundström et al. 2014)

- Inclusion of seal predation affects the stock assessment results

Figure: Length distribution of vendace in fishery and seal collections. (Lundström et al. 2014)
#4. Inclusion of predation in stock assessment models

- Inclusion of seal predation affects the stock assessment results

- More vendace in the ecosystem than previously believed
  - SSB: 5x higher
  - In line with hydroacoustic survey results

Limited material!
- Snapshot
- Representative?
- More available

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Lundström et al. In prep.
#5. No-take zones (MPA)

- Impact on threatened/protected local fish stocks
- No-take zones are feeding grounds of seals and cormorants
  - To an unknown extent
- Seals and cormorants were never considered
- Lack of information
- No lack of speculations...
- Lack of interest?
- Finally, some small-scale pilot studies were initiated
#5. No-take zones (MPA)

- Pilot study, some results
- Monitoring is possible
  - Diet
  - Numbers
- Concerned fish species are consumed
- Seals and cormorants have potential to remove large quantities of concerned species
- But, systematic information is lacking
- Fish removal is still going on, yet of an unknown magnitude

The 8 fjords area
- Cod
- Pollack
- Haddock
- Plaice

No signs of recovery after 5 years of protection

Frequency of occurrence

Similar results from other no-take zones
- Bothnian Sea
- Stockholm Archipelago
- Kattegat
Conclusions

• Seals and cormorants can affect fish populations
• Cannot and should not be neglected
• Information is limited, but needed
• Possible to improve our understanding
• Start recognizing and discussing this issue!
• What fish stocks are affected?
  • Where?
  • When?
  • How?
• Fisheries management + wildlife management
• One of the components to an ecosystem-based management
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