Salmon and sea-trout in Denmark and impact of cormorant predation

DTU Aqua
National Institute of Aquatic Resources

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Stockholm- 2019
1. Introduction

2. The Danish salmon

3. A summary of 18 years of smolt studies

4. Change of cormorant foraging behaviour

5. The cormorant conflict

6. Cormorant population and management
The story - brief

- 80’ies – 90’ies – Traditional pound net fishing disappeared
- Then coastal fish (and fishing) was heavily reduced
- Relatively few, large colonies
- Large colonies started to collapse (2002-2008)
- More, but smaller colonies
- More birds overwintering (mostly from Sweden and Finland)
- 2009/10 change of behaviour, birds going inland, less shy
- Recent years – much more problems in rivers, brooks and lakes
- Grayling, resident trout and North Sea Houting are threatened
Documenting the impact of predation:

- Proving things that have happened
- Lack of fish to study
- High variation from year to year
- Effect of capture, handling and tagging
- Statistical confidence in estimates

Funding for studies ??
Methods

PIT- Tags (Passive Integrated Transponder)

Acoustic tags

Radio-tags
Status:

• We have documented severe damage from cormorants on several fish populations and fishery as well as economy

• After 15 years of increasingly tough (lethal) management we still have many conflicts

• Cormorants may start to move inland in Sweden and create problems like in DK.

• We cannot solve the problem alone, we need Nordic cooperation
Smolts

Salmon/trout, wild/hatchery

Pre-smolt/parr in-river predation

Predation on migrating smolts

Predation on post-smolts

Do they really have wild Atlantic salmon in Denmark?
River restoration, removal of barriers and stop for coastal fishing have increased the populations hundredfold

Yes we do!
Annual catches of Salmon in the estuary of River Skjern, 1900 - 1978

Pollution, dams, fishing
Genetic studies

4 indigenous populations left in 1999!

River Storå
River Skjern
River Varde
† River Kongeå
† Sneum
River Ribe Å
† River Brede
† River Vidå
† River Vidå
† River Gudenå
† River Brede
Annual run size app. 14,000, anglers catch 40 %, but keep only 10 %. High proportion of MSV, mean size 78 cm. Most are wild.
Danish salmon 141 cm, caught by a 23 year old angler in 2016
Why did the Danish salmon fare so well?

No salmon lice (no salmon farms)
No dams (wind energy, not HP)
No harvest on coast or in estuaries
No Gyrodactulus
**Good management?**

But we do have predation
Our hero catching smolts at a river mouth
Skjern River

North Sea

Surface area: 300 km$^2$

Depth: 0 - 10 m

Sluices

500 - 2000 nests
Old cormorant stories

Eels, salmon smolts and flounders were cw-tagged and released in Skjern River and the estuary 2003 and 2004.
Pellet collection
Predation of salmon smolts 2003

Recovery of cw tags from salmon smolts from cormorant pellets collected April through June 2003
Results from Ringkøbing Fjord 2000 – 2004

*Telemetry* (2000, 2002): Salmon *smolts* 40 – 50 % of tags were recovered from one colony.

*CW-tagging* (2003, 2004): 25 % of the available tagged salmon *smolts* were eaten during the 3-weeks smolt migration period. 40 – 50 % of tagged eel were eaten in one year. All (100%) of tagged flounders eaten in 15 days

*Pellet analyses*: 30,000 salmon *smolts*, 1.4 million flounders, 38,000 eel were eaten.
Skjern revisited 2016 - 18

Radio- and acoustic telemetry

Fewer birds than 10 years ago, harassing and shooting
Radio telemetry 2016

Of 74 tagged salmon, 8 were lost in the river (4 from pike, 4 from birds). Of the remaining we found 17 in cormorant colonies.

Predation from cormorants: 23 - 42%
Skjern Å, trap and hydrophones 1 – 6.
104 salmon smolt were tagged with acoustic tags in 2016

39 of these passed the sluice and entered the North Sea

Net: 38 % survival.

More about this study later
<table>
<thead>
<tr>
<th>Year</th>
<th>Number tagged</th>
<th>Species</th>
<th><strong>Eaten by cormorants (%)</strong></th>
<th>Method</th>
<th>Source</th>
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<td>Mean</td>
<td></td>
<td></td>
<td>48</td>
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</table>
Where are the smolts vulnerable?

- Transition from lotic to lentic water
- Impoundments (lakes, reservoir)
- Estuaries
- Coast
- Obstacles (dams, weirs, barrage)
Cormorants in our streams – a new phenomenon
Two cold winters
2009-10
2010-11
<table>
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<th>Grayling – Omme Å</th>
<th>Number pr. km</th>
<th>2009</th>
<th>2010</th>
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<tbody>
<tr>
<td>Fry</td>
<td></td>
<td>147</td>
<td>0</td>
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<tr>
<td>1+</td>
<td></td>
<td>250</td>
<td>5</td>
</tr>
<tr>
<td>Larger</td>
<td></td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>412</td>
<td>6</td>
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Catch of Grayling by electrofishing a 2 km stretch in Omme Å 2009 og 2010 (Iversen 2010).
Grayling
Grayling density in 1.5 km stream. Cormorants were first seen in 09/10.
25 grayling (32-36 cm) were radiotagged in October.

River with very few cormorants

Only two tagged grayling survived

A loss of 80% of total fish biomass was estimated

_Jepsen et al. 2018_
Predation in river on juvenile salmonids?

Effect of in-river predation?
Three - four times better survival in the covered area
Adult sea-trout
Predation on sea-trout throughout the whole life

Predation on post spawning sea-trout
Life-cycle impact

**Without** cormorants

1000 fry

↓

100 smolts

↓

90 post-smolts

↓

30 spawners

↓

**30 large sea trout**

**Predation in river/stream**  

**Predation during migration**

**Predation on the coast?**

**Predation after spawning**

---

**With** cormorants

1000 fry

↓

25 smolts

↓

13 post smolts

↓

4 spawners

↓

**2 large sea trout**
Conclusion:

Significant impact on fish populations in Rivers, Lakes and coast. Documentation that predation from cormorants is now the main regulating factor for many fish stocks, including salmon.

Effects include:

• Economic loss (commercial and recreational fishing)

• Cultural loss

• Biodiversity loss

• Problems in reaching WFD requirements

Is this only a problem in DK?
Conflicts

Population status

Management in DK

Management in EU

Nordic cooperation
How to use the site

1. To add your sighting, first select whether you are recording cormorants, mergansers or goosanders or a colony of birds. A colony is a group of birds that are living in one regular location.
2. Complete the other details of your sighting as accurately as possible.
3. When you have entered all your details, click on the ‘PLACE’ button.
4. Move your mouse cursor over to the map and drop it in the approximate area where your sighting took place.
5. Once the pin is dropped, you can zoom in by double clicking, scrolling your mouse wheel or by using the zoom slider. As you go, drag and drop your pin, to ensure that the position is as accurate as possible.
6. Zoom as close as you can to the position of your sighting. Sometimes switching the map to ‘Terrain’ will help you identify the exact spot.
7. When you are happy with your selected location, move your mouse cursor off the map and click ‘SUBMIT’ on the form.
8. That’s it! Your sighting will be added as soon as we approve it - this is usually within a few hours but might take a bit longer.

Don’t forget to bookmark this site, keep your eyes peeled and come back every time you want to report a sighting.

It’s really important to let other anglers know about the site so please use the links at the top to add this to your Facebook and Twitter then use the envelope icon to email a link to all your friends so they can do their bit too.

I SAW A CORMORANT

Step 1: Fill the form

- Species seen:
- Number of birds seen:
- Date recorded:
- Main behaviour:
- Type of watercourse seen near:
- Name of watercourse:
  (if known):
- First name:
- Surname:
- Email address:
- Confirm email address:
- Angling Trust member?: Yes  No

If you don’t want to be sent information about the Angling Trust, please untick the box

Please tick to receive information from selected fishing companies that we think you’ll like

Step 2: Place the marker

Step 3: Submit
Kormoran und Fischbestand—
eine unendliche Geschichte?

Oktober 2009
Mellemskarven
-en gigantisk miljøpolitiske skandale?

Ifølge den svenske debattør Christer Olburg er mellemskarven – som er den skarvart, der
yngler i Danmark – en invasiv kinesisk art, der truer den oprindelige europæiske storskarv
og som derfor burde udrødes på linie med andre invasive arter.....
se baggrunden og argumenterne her!

Aftenen Ulf Høgh

Intet dansk dyr har vakt mere debat i nyere tid end skarven, der bredte sig nærmest eksplosivt i
landet fra omkring 1970 og indtil for ganske få år siden, hvor bestanden stodte mod loftet før, hvor
mange skarver de danske kystler og søer kan brudsøde. I processen fik de sidste danske
budgarnsfiskere, der havde overlevet overgødskning og bundvendinger, det endelige dødsstød.
Konkurrencen mod skarven, der udnyttede fiskeredskaberne effektivt i sin egen fodes ogning, var en
ulige kamp.
Debatten delte befolkning i to lejre: Skarvelskerne og skarvhederne. Forståede gruppe omfattede
7 FISKEHAMN
1 NÄMPNÄS
Cormorants are eating nearly 20 million baby salmon a year on East Sand Island, a tiny man-made Oregon island. (Jamie Francis/The Oregonian)
Conflict: Conservation of a healthy cormorant population and conservation of harvestable fish stocks

Silkeborg center 2016
Colonies of Great Cormorants

- Ph. carbo *carbo* ⇒ stays within same regional range
- Ph. carbo *sinensis* ⇒ massive expansion between 1990 and 2008
The number of breeding colonies and the total number nests in 2012 in Europe

<table>
<thead>
<tr>
<th>Country</th>
<th>Colonies</th>
<th>Nests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>3</td>
<td>65</td>
</tr>
<tr>
<td>Belarus</td>
<td>20</td>
<td>3250</td>
</tr>
<tr>
<td>Belgium</td>
<td>28</td>
<td>1584</td>
</tr>
<tr>
<td>Bosnia and Herzegovina</td>
<td>2</td>
<td>154</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>15</td>
<td>2775</td>
</tr>
<tr>
<td>Croatia</td>
<td>2</td>
<td>1331</td>
</tr>
<tr>
<td>Denmark</td>
<td>64</td>
<td>27237</td>
</tr>
<tr>
<td>Estonia</td>
<td>18</td>
<td>13000</td>
</tr>
<tr>
<td>Finland</td>
<td>40</td>
<td>17208</td>
</tr>
<tr>
<td>Germany</td>
<td>150</td>
<td>22550</td>
</tr>
<tr>
<td>Greece</td>
<td>13</td>
<td>6978</td>
</tr>
<tr>
<td>Iceland</td>
<td>49</td>
<td>4772</td>
</tr>
<tr>
<td>Italy</td>
<td>48</td>
<td>3914</td>
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<tr>
<td>Latvia</td>
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<td>3106</td>
</tr>
<tr>
<td>Lithuania</td>
<td>6</td>
<td>3200</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Montenegro</td>
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<td>1156</td>
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<tr>
<td>Norway</td>
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<td>2500</td>
</tr>
<tr>
<td>Poland</td>
<td>54</td>
<td>26600</td>
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<td>Portugal</td>
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<td>0</td>
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<tr>
<td>Russian part of the Gulf of Finland</td>
<td>7</td>
<td>4605</td>
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<tr>
<td>Serbia</td>
<td>15</td>
<td>2000</td>
</tr>
<tr>
<td>Slovenia</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Spain</td>
<td>21</td>
<td>1605</td>
</tr>
<tr>
<td>Sweden</td>
<td>169</td>
<td>40598</td>
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<tr>
<td>Switzerland</td>
<td>13</td>
<td>1037</td>
</tr>
</tbody>
</table>

One nest equals app. 5 birds, so a total of almost one million birds

In 2006, there were 517 breeding colonies with 165,650 breeding pairs
Colonies 2016

Current max number of birds: 250,000

Current min number of birds: 15,000
Development in breeding stock (pairs) in Denmark 1975-2018
Management
Ministry of Environment

Cormorant-group: Stakeholders, managers, experts

National cormorant management-plan since 1997:

• Egg oiling

• Prevention of new settlements

• Protective Shooting (fishers and hunters)

• Regulation outside breeding season in rivers
The cormorant group meets regularly and consists of:

*Ministry of the environment (Naturstyrelsen)*
Anglers (DSF)
Commercial fishers
Recreative net fishers (Fritidsfiskere)
Animal protection (Dyrenes Beskyttelse)
Hunters (DJF)
Ornithologists (DOF)
Minstry of agriculture and fisheries
Bird expert (T. Bregnballe, ÅU)
Fish expert (N. Jepsen, DTU)
Management plan

From 1982, revised with 5 year intervals

A decent report, including historical info, scientific info and experience with management measures.
Adaptive management

• MP provides the framework

• Loss in poundnets – fishermen were permitted to shoot cormorants at nets (1000 m)

• Loss of smolts – anglers were permitted to shoot cormorants during smolt migration

• Cormorants foraging in the rivers – protective shooting was initiated

• Now it will also be possible to shoot at night roosting sites
Permissions are easy to get – online application – fast answer

Permissions granted to regulate (shoot) in rivers
Oiling off eggs
Rønland Sandø
Development of nest numbers – Rønland Sandø

The last 5 years: 400 nests
Ringkøbing Fjord
17 years after start, we have app. 2000 nests in 2018.
Management measures seems NOT to be the main cause of the recent decrease of Cormorant numbers in DK.

Cold winters and lack of food
No measures

Measures

Years after colony establishment

Proportion of colonies with chicks

However …
Skjern Å, Ringkøbing Fjord 2016-2018:

Coordinated hunting and scaring to keep birds from the river

Hunting/shooting at the river mouth and sluice

Monitoring of the predation on smolts using telemetry

Counting of cormorants in river and Fjord
Monitoring smolt predation in Skjern and Ringkøbing Fjord
Results

2016: No extraordinary regulation in the smolt period.

2017: Heavy regulation in river, fjord and sluice. A total of 600 hunters and 33 boats were involved in a special measure to reduce predation during April-June. More than 1800 nests were destroyed.

A large and costly action.
Effects of hard regulation/harassment of cormorants
EU- management

Parliament wants action – Commission not so much

Some MS are really trying to reduce numbers

Some MS are still very protective to Cormorants

Few MS seem not to care very much

Parliament wants to promote a pan-EU management plan

Birds directive – derogations. Enough?
Great cormorant

Applying derogations
under Article 9 of the Birds Directive
2009/147/EC

© European Union, 2013
BETWEEN FISHERIES AND BIRD CONSERVATION: THE CORMORANT CONFLICT

Ian Cowx, 2013
No conservation issue
No recreational value
No commercial value
Feelings

Conservation
Biodiversity
Recreational value
Commercial value
Cultural history
Feelings
Way forward:

International cooperation,

Nordic group

EEA

EIFAAC

Politics

Funding
If EU cannot agree on common management, Nordic cooperation is the only way DK can manage the conflicts.

Birds from Sweden and Finland visit DK during winter in increasing numbers.
Thank you