Where do the northern Atlantic salmon feed during their sea residence – in the Norwegian, Greenland or Barents Sea?

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Total capture (tons)

YEAR

Number of salmon captured

Greenland North-west North-east "other"

Tana, BZ Lista, Tuloma, Kola & Ponoi

YEAR

# salmon captured
River catches of Atlantic salmon

- Norway
- Russia
- Scotland
- Ireland
- Iceland
- Canada
- Others

River catches (%)

![Bar chart showing river catches of Atlantic salmon by various countries. Norway has the highest catch, followed by Russia, Scotland, Ireland, Iceland, Canada, and others.](image-url)
“Salmon in the North”: Phase I (2002-2006) and Phase II (2007-2010)

Project rivers:

- Mâlselv
- Tana
- Neiden
- B.Z. Litsa
- Tuloma
- Ura
- Kola

Temporal variation in abundance of the northernmost populations of Atlantic salmon with emphasis on the River Tana

Surveys, stable isotopes, satellites and salmon: exploring elements of the marine ecology of Barents Sea

Salmo salar (I) (II)

Norwegian institute for nature research (Co-ordinating institution)
- Polar Research Institute of Marine Fisheries and Oceanography (Russia)
- Finnish Game and Fisheries Research Institute
- University of Turku (Finland)
- Department of Fisheries and Oceans (Canada)
- University of Waterloo (Canada)
- University of Tromsø and Tromsø University Museum (Norway)
- University of Life Sciences (Norway)
- Department of Environmental Affairs, County of Finnmark (Norway)

- present some “relevant” results from the two projects, i.e.:
- give a brief overview of the Barents sea salmon populations
- emphasize their uniqueness compared to other populations
- suggest/discuss/speculate possible feeding areas
- describe some activated projects (2007-10) to describe marine feeding areas

University of Life Sciences (Norway)
Department of Environmental Affairs, County of Finnmark (Norway)
### Commercial fisheries – 60 %

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Catch (tonnes)</th>
<th>Estimated number of salmon in the catch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1985</td>
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<tr>
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<td></td>
<td></td>
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<tr>
<td>2000</td>
<td></td>
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</tbody>
</table>

### Angling – 40 %

- Tana: 1972-2006
  - (up to 20 % of catches in Europe)

![Graph showing salmon catches and estimated numbers over years](#)
Kola peninsula

- more than 65 rivers with Atlantic salmon
- fish traps in some rivers back to 1959
- rod and line fishery (catch and release) dominates
• fish trap in river Varzuga
• closing the river every second -> third day
• similar traps used in a few some Kola-rivers since 1959
• giving precise estimates of ascending salmon the last 45 years
• scale samples, SW, sizes, sea temperatures etc.

The kola peninsula rivers – reliable information about ascending salmon since 1959
June # of salmon
Utsjoki/Tana
Varzuga

June          July          August

# of salmon

MSW

1SW

Spawning next autumn !!
Utsjoki as an index river for Tana

RKTL (research station)

Tana river

Video monitoring of descending smolts and ascending adult salmon
Temporal and spatial migration patterns of Atlantic salmon in the sub-Arctic River Utsjoki – a large tributary to the Tana river
Number of smolts descending Utsjoki per year

- 2002: 12,852
- 2003: 13,800
- 2004: 27,113
- 2005: 40,000
- 2006: 26,000

Frequency (%)

- when entering the fjord/estuary?
- what about the other 30 tributaries?
Unique smolt behaviour for northern populations?

When?  Both day (60 %) and night (40 %)

Where?

Less than 5 % of the smolts migrated in the upper 30 cm

85%
Ascendence and capture of adult salmon in Utsjoki

By use of the video cameras we may estimate the "marine" survival rate of the Utsjoki salmon (annually)
Mortality for Atlantic salmon during the sea residence is probably density independent.

Survival = 8% (1976–1990)
Survival ≤ 3% (after 1995)

Revised after Jonsson et al. 1998 (based on data from River Imsa)
Survival rate, Utsjoki (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>12,852</td>
<td>13,800</td>
<td>27,113</td>
<td>40,000</td>
<td>25,000</td>
</tr>
</tbody>
</table>

No of adults returning:
- 1SW
- Multi SW

No of smolts descending (Utsjoki)
- 2002: 12,852
- 2003: 13,800
- 2004: 27,113
- 2005: 40,000
- 2006: 25,000

Survival rate in Utsjoki/Tana probably above 20%.
Survival rate; Yokonga (Kola) = 16%.

Higher "marine" survival in northern populations?

Survival rate in southern populations (last 10 yr)
Influence of ocean climate on Atlantic salmon:

- Positively correlated to NAO-index

River Teno

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Catch (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>20</td>
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<tr>
<td>1980</td>
<td>40</td>
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<td>1985</td>
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<tr>
<td>1995</td>
<td>100</td>
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<tr>
<td>2000</td>
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River Näätämöjoki

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<tr>
<th>Year</th>
<th>Total Catch (tonnes)</th>
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<tbody>
<tr>
<td>1975</td>
<td>5</td>
</tr>
<tr>
<td>1980</td>
<td>10</td>
</tr>
<tr>
<td>1985</td>
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<td>1995</td>
<td>25</td>
</tr>
<tr>
<td>2000</td>
<td>30</td>
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</table>

River Kola

<table>
<thead>
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<th>Year</th>
<th>Total Catch (tonnes)</th>
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<tbody>
<tr>
<td>1975</td>
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<td>1995</td>
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<tr>
<td>2000</td>
<td>130</td>
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</tbody>
</table>

Barents Sea

<table>
<thead>
<tr>
<th>Year</th>
<th>Temperature (°C)</th>
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</thead>
<tbody>
<tr>
<td>1975</td>
<td>4</td>
</tr>
<tr>
<td>1980</td>
<td>5</td>
</tr>
<tr>
<td>1985</td>
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<td>1990</td>
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<td>1995</td>
<td>6.5</td>
</tr>
<tr>
<td>2000</td>
<td>7</td>
</tr>
</tbody>
</table>

• Correlated to the Kola section temperature
• Not correlated to NAO-index
Different parasite burden suggest different marine feeding areas between summer and autumn salmon.
The low smolt age of postsmolt and adult salmon captured in the Norwegian Sea (2 yr) and inner "southern" fjords (3 yr), strongly indicates that the Tana and Kola salmon are feeding elsewhere – in the Barents Sea?
Recaptures of wild salmon tagged and released by the Faroes in the **autumn** and in **winter** in the period 1992-95 (From Hansen & Jacobsen 2000)
Pink salmon is very frequent along the Spitsbergen coast (even in lakes).

Adult Atlantic salmon captured annually in inner Isfjorden (LYR)

Salmon smolt captured west of Novaya Zemblya (Sept/Oct)

Commerciaal sea fishery for salmon in the Neidenfjord up to 1974

Postsmolt trawling 1990-2001 (IMR)
Salmon in the north (2007-2010)

Surveys, stable isotopes, satellites and salmon: exploring elements of the marine ecology of Barents Sea *Salmo salar*
Assess long-term changes in the marine trophic ecology of salmon by analysis of stable isotope signatures of carbon and nitrogen (δ^{13}C and δ^{15}N) in salmon scales sampled 1972-2007

• isotope signatures will be linked with salmon abundance, growth and also in relation to variation in marine climate conditions in the Barents Sea region
• analyses may provide an additional means to understand, in whole or in part, observed variability in abundance of various stocks of Atlantic salmon
• we hypothesize that nitrogen signatures would be higher during the second or third sea years owing to salmon feeding more piscivorously

Preliminary analyses of δ^{13}C carbon and δ^{15}N nitrogen isotope signatures of River Tana salmon, using scales sampled in the period 1992-2002

We have also found a positive correlation between the size of adult salmon entering the Karasjokka river (a large tributary of river Tana) and the estimated density of capelin in the Barents Sea
Determine marine distribution patterns and ocean forage areas across seasons by the combined use of archival ‘pop-up’ satellite tags and DST archival tags (tagging kelts)

- first time pop-up (satellite) tags have been used on salmon
- 25 Atlantic salmon kelts were tagged when descending Tana river (Jun 2007)
- tags are programmed to pop-up after 3 (Sep), 5, 7 and 9 months
- recording depth, temperature and “light” (dusk and dawn)
- also tagged with DST-tags in four rivers (measuring water temperatures)
Develop a time series of "marine survival" of a northern European (Barents) Atlantic salmon stock (Utsjoki)

- continue the video monitoring in the Utsjoki river
- develop a time series of "marine survival" of a "Barents" salmon stock
- correlate survival rate with prey abundance, climate conditions etc.

Utsjoki as an index river for a northern European (Barents) salmon stock
Apply molecular **genetic methods** to identify individual stock components in a mixed-stock fishery

• obtain more representative estimates of numbers of salmon that survive to return to home waters adjusting or correcting survival estimates to account for in-river, and possibly coastal, fisheries
• i.e. to correct survival estimates obtained from video monitoring operations

Examine **co-variation** in abundance and survival of salmon stocks in different Barents Sea rivers

• influence of climate and climate variability on annual variation in survival and abundance of Barents Sea salmon stocks (including Målselv river)
• co-variation in abundance and changes in sea-age at maturity

Develop **management plans** for northern Atlantic salmon rivers by integrating biological and local knowledge of the resource
Thanks for your attention!