The interaction between northern shrimp (*Pandalus borealis*) and cod (*Gadus morhua*) in inshore and offshore areas off Iceland

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Outline

- Introduction

- Inshore
  - Area + survey
  - Shrimp stock
  - Cod
  - Prey

- Offshore
  - Area + survey
  - Shrimp stock
  - Cod
  - Prey

- Summary and comparison of areas
Introduction

- Northern shrimp is
  - targeted by commercial fisheries
  - of great importance as prey in the marine food web

- Predation of cod can have strong effects on the development of shrimp stocks

- The biological interaction between cod and shrimp are poorly understood

- The goal was to compare the feeding ecology of cod, with emphasis on northern shrimp, in two different areas, inshore and offshore shrimp grounds around Iceland
Inshore
Inshore: Ísafjarðardjúp

Graph: Guðrún Helgadóttir

Inshore
Research survey
Shrimp: biomass index, catch, TAC

Inshore
## Sample size

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>% of empty stomachs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>78</td>
<td>31</td>
</tr>
<tr>
<td>2000</td>
<td>163</td>
<td>34</td>
</tr>
<tr>
<td>2001</td>
<td>178</td>
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<tr>
<td>2002</td>
<td>150</td>
<td>19</td>
</tr>
<tr>
<td>2003</td>
<td>165</td>
<td>33</td>
</tr>
<tr>
<td>2004</td>
<td>247</td>
<td>25</td>
</tr>
<tr>
<td>2005</td>
<td>181</td>
<td>32</td>
</tr>
<tr>
<td>2006</td>
<td>108</td>
<td>25</td>
</tr>
<tr>
<td>2007</td>
<td>205</td>
<td>16</td>
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<tr>
<td>2008</td>
<td>231</td>
<td>16</td>
</tr>
<tr>
<td>2009</td>
<td>133</td>
<td>25</td>
</tr>
<tr>
<td>2010</td>
<td>134</td>
<td>22</td>
</tr>
</tbody>
</table>
Cod abundance

[Chart showing the abundance of cod from 1990 to 2010. The y-axis represents the number of cod per hour, ranging from 0 to 250. The peak in 1995 is notably higher than in other years.]
Length distribution

Number of cod

Length (cm)

Inshore
Proportion of cod consuming shrimp

Inshore
Proportion of shrimp

Proportion

Inshore
Prey groups

1999 2001 2003 2005 2007 2009

0
20
40
60
80
100

% Inshore

Other items
Other shrimps
Krill
Fishes
Northern shrimp
Capelin
Cod length vs shrimp consumption

Proportion with shrimp

Proportion of shrimp

Cod length (cm)
Offshore
Offshore
Biomass and catch
## Sample size

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>% of empty stomachs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>417</td>
<td>6</td>
</tr>
<tr>
<td>2000</td>
<td>335</td>
<td>13</td>
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<tr>
<td>2001</td>
<td>253</td>
<td>8</td>
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<tr>
<td>2002</td>
<td>348</td>
<td>8</td>
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<tr>
<td>2003</td>
<td>722</td>
<td>12</td>
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<tr>
<td>2004</td>
<td>550</td>
<td>13</td>
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<td>2005</td>
<td>514</td>
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<tr>
<td>2006</td>
<td>367</td>
<td>8</td>
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<tr>
<td>2007</td>
<td>304</td>
<td>15</td>
</tr>
<tr>
<td>2008</td>
<td>349</td>
<td>16</td>
</tr>
<tr>
<td>2009</td>
<td>339</td>
<td>17</td>
</tr>
<tr>
<td>2010</td>
<td>343</td>
<td>15</td>
</tr>
</tbody>
</table>
Cod abundance

All cod
Cod > 15 cm

Number of cod / hour


0 10 20 30 40


0 50 100 150 200 250

Offshore
Length distribution

Number of cod

Length (cm)

Offshore
Proportion of cod consuming shrimp
Proportion of shrimp

![Graph showing the proportion of shrimp over the years from 2000 to 2010. The x-axis represents the years, and the y-axis represents the proportion. The data points show an increase in the proportion of shrimp from 2000 to 2010.](image)
Prey groups

%
Cod length vs shrimp consumption

Proportion with shrimp

Proportion of shrimp

Cod length (cm)

Offshore
## Summary

<table>
<thead>
<tr>
<th></th>
<th>Inshore</th>
<th>Offshore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
<td>&lt; 155 m</td>
<td>&lt; 700m</td>
</tr>
<tr>
<td>Bottom temperature</td>
<td>4.2 – 10.6</td>
<td>-0.8 – 7.4</td>
</tr>
<tr>
<td>Mean cod length</td>
<td>23 cm</td>
<td>57 cm</td>
</tr>
<tr>
<td>Mean % of empty stomachs</td>
<td>25 %</td>
<td>12 %</td>
</tr>
<tr>
<td>Main prey of cod</td>
<td>Shrimp, fishes, krill</td>
<td>Capelin, fishes, Hymenodora, shrimp</td>
</tr>
</tbody>
</table>
Summary

- The proportion cod eating shrimp was higher in the offshore area but has been similar since 2007.

- The proportion of shrimp (of the total stomach content weight) was higher in the inshore area.
Summary

- Shrimp was of greater importance in the inshore area.

- The proportion of cod feeding on shrimp increased with length in the offshore area but not in the inshore area.

- The proportion of shrimp decreased with length in both areas.
Thank you for your attention.