Feeding ecology of herring and mackerel in Icelandic waters
and other aspects of relevance for this workshop

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Why focusing on pelagic fish considering the workshop’s title?

• Large consumers on the zooplankton of interest
• Important components of the pelagic ecosystem that needs to account for when considering “fishery” on zooplankton.
<table>
<thead>
<tr>
<th>Stock</th>
<th>Feeding period in Icel. waters</th>
<th>Traditional fishing season</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Icelandic summer-spawning herring</td>
<td>April-June and August-Sept.</td>
<td>Oct.-Jan.</td>
<td>Some bycatch in mackerel fishery (~10% of TAC)</td>
</tr>
<tr>
<td>NE-Atlantic mackerel</td>
<td>June-Sept.</td>
<td>July-Sept.</td>
<td>--</td>
</tr>
</tbody>
</table>
Icelandic summer-spawning herring

The feeding grounds of Icelandic summer-spawning herring
Norwegian spring-spawning herring (*Clupea harengus*)

Based on results of International research surveys (e.g. IESNS and IESSNS)
Norwegian spring-spawning herring (*Clupea harengus*)

Based on results of International research surveys (e.g. IESNS and IESSNS)
NE Atlantic mackerel (*Scomber scombrus*)

Based on results of surveys (IESSNS) and Olafsdottir et al. (2015).
NE Atlantic mackerel (*Scomber scombrus*)

Based on results of surveys (IESSNS) and Olafsdottir et al. (2015).
Stock size and catches

Icelandic catches since 1988

ICES 2017
Stock size and catches

Icelandic catches since 1988

ICES 2017
Diet composition these three stocks in Icelandic waters

Sampling locations in July 2010 and 2011

* Mackerel
o Icelandic summer-sp. Herring
Δ Norwegian sp.-sp. herring

Óskarsson et al. 2015
Diet composition these three stocks in Icelandic waters

**Mackerel**

- 2010:
  - Diet weight (%): Other Pisces, Gadidae, Capelin, Other, Other Crustacea (mix.), Hyperiidea, Euphausiacea, Copepoda, Mollusca

**Herring**

- 2010:
  - W: 94, SW: 25, SE: 8, E: 69, N: 66
  - Diet weight (%): Other Pisces, Gadidae, Capelin, Other, Other Crustacea (mix.), Hyperiidea, Euphausiacea, Copepoda, Mollusca

**Notes:**
- *Óskarsson et al. 2015*
Comparison to diet composition of blue whiting

Va (Iceland)  Ila (Norwegian Sea)  XIVa (E. Greenland / N. Iceland)

VIII (Biscay)  VIIe-j (Celtic Sea)  VIIa (Irish Sea)

- Amphipod
- Euphausiid
- Copepod
- Ul Crustacean
- Teleost
- Pteropod
- Shrimp
- Shrimp
- Other

Pinneagar et al. 2014
Stomach content weight (mean ± 2 SE)

(a) 2009

(b) 2010

(c) 2011

● Mackerel
○ Herring

Óskarsson et al. 2015
Total consumption of mackerel in Icelandic waters

Derived from estimates of weight gain:

Óskarsson et al. 2015
Total consumption of mackerel in Icelandic waters in 2010

\[
\text{Consumption}_{\text{Total},Y} = \left( \sum_A \left( N_{A,Y} \times W_{\text{Gain},A,Y} \right) \right) \times (CE)^{-1}
\]

Where:

- \( N \) = stock number (in Icelandic EEZ on basis of IESSNS),
- \( W_{\text{Gain}} \) = weight gain, \( A \) = age, \( Y \) = year, \( CE \) = conversion efficiency

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total mackerel biomass in Icel. EEZ (thous. T)</td>
<td>1100</td>
<td>1100</td>
</tr>
<tr>
<td>Total weight gain (thous. T)</td>
<td>324</td>
<td>336</td>
</tr>
<tr>
<td>Food consumption (thous. T) (CE=10%)</td>
<td>3200</td>
<td>3400</td>
</tr>
</tbody>
</table>

The estimates depends on assumptions of conversion efficiency (%)

Óskarsson et al. 2015
Summary

• Three pelagic fish stocks that are major consumers of *Calanus* in Icelandic waters.
• Two of them are fished during their feeding season when occupying Icelandic waters, while the local stock during its overwintering (i.e. not feeding).
• Their stock size, geographical distribution and thereby fishing opportunities in Icelandic waters varies.
• Mackerel is apparently more effective *Calanus* feeder than herring – more extensive feeding studies are in process.
Thanks for your attention