Impacts of harvesting forage species

- Fishing through marine food webs
- Ecological and economic importance of forage species
- Potential trade-offs and conflicts from the simultaneous harvest of predators and prey populations
Global Cephalopod Landings

FAO Landings Data

Global landings (X 1000t)

Year

Global Cephalopod Landings

Global landings (X 1000t)

Year

N Pacific landings (x 1000t)

FAO Landings Data
Trade-offs in cephalopod fisheries?
Valuation of cephalopods

Landings (MT)  Landed value ($)

Commodity  Supportive  Commodity  Supportive
Commodity contribution
Summed tonnage (MT) and monetary value ($USD) of all cephalopods landed in an ecosystem
Supportive contribution
Portion of landings and landed value of other species that rely on cephalopods for their production
Objectives

- What are the commodity and supportive contributions of cephalopods to fisheries landings and landed values?
- Change in contributions between historical (1960-1970) and contemporary (1990-2004) periods?
- Biophysical factors that dictate the magnitude of their contributions?
Large Marine Ecosystems

LME landings and market values estimated by Reg Watson and Rashid Sumaila
## Point Estimates of Supportive Contribution (MT)

<table>
<thead>
<tr>
<th>Species list</th>
<th>Average Landings (MT)</th>
<th>Cephalopod in diet (%)</th>
<th>Supportive contribution (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuna</td>
<td>6,000</td>
<td>10</td>
<td>600</td>
</tr>
<tr>
<td>Hake</td>
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<tr>
<td>Squid</td>
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<tr>
<td>Pollock</td>
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</tr>
<tr>
<td>Dogfish</td>
<td>Total landings (MT)</td>
<td></td>
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</tr>
<tr>
<td>Mackerel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species list</td>
<td>Average Landed Value</td>
<td>Cephalopod in diet</td>
<td>Supportive contribution</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Tuna</td>
<td>$ 2 million</td>
<td>10 %</td>
<td>$ 200,000</td>
</tr>
<tr>
<td>Hake</td>
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<td>Squid</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total landings ($USD)**

**Total supportive contribution ($USD)**
Data

- Food habits data for each taxonomic group (% M or V)
- Diet data for taxonomic groups in the specified ecosystem
- Multiple estimates of the predators’ diet composition
- Applied the same diet data for contemporary and historical periods
Results

• What are the commodity and supportive contributions of cephalopods to fisheries landings and landed values?

• Change between historical (1960-1970) and contemporary (1990-2004) periods?

• Biophysical factors that dictate the magnitude of their contributions?
Contribution to Global Landed Value (%)
North Pacific Ocean Landings

- East Bering Sea
- West Bering Sea
- Gulf of Alaska
- *Sea of Okhotsk
- *Oyashio Current
- California Current
- *Kuroshio Current
- Sea of Japan
- Central North Pacific

* Not included in publication

Total contribution to landings (%)

- Commodity
- Supportive
North Pacific Ocean Landed Value

- East Bering Sea
- West Bering Sea
- Gulf of Alaska
- *Sea of Okhotsk
- *Oyashio Current
- California Current
- *Kuroshio Current
- Sea of Japan
- Central North Pacific

* Not included in publication

Total contribution to landed values (%)
Objectives

- What are the commodity and supportive contributions of cephalopods to fisheries landings and landed values?

- Change between historical (1960-1970) and contemporary (1990-2004) periods?

- Biophysical factors that dictate the magnitude of their contributions?
Historical vs. Contemporary Global Landings (MT)
Objectives

- What are the commodity and supportive contributions of cephalopods to fisheries landings and landed values?
- Change between historical (1960-1970) and contemporary (1990-2004) periods?
- **Biophysical factors that dictate the magnitude of their contributions?**
  - Mean TL of ecosystem, Mean TL of catches, Primary production
Fishery mean TL is important driver
Summary

- Total contribution: as much as 55% of landings and 70% of landed values
- Supportive: highest in open ocean systems
  Commodity: highest in coastal systems
- North Pacific ecosystems among the highest in terms contribution to MT and $USD
- In most ecosystems contributions have increased over time, exceptions are seen in the North Pacific systems
- Magnitude of contribution influenced by the nature of the fishery (i.e. mean TL)
Conservation Value
Impact as predator
Concluding Remarks

- In general, current demands have no historical precedent.
- Ecosystems where cephalopods are highly exploited as target resource and ecological support service warrant further attention.
- Considering the value of cephalopods, in addition to other forage, is important for ecosystem-based management.