Inter-calibration of micronekton sampling gears during the 2005 MIE-II cruise

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• MIE-I: off Hawaii
  – High diversity and Low density mesopelagic fauna
  – Gears compared
    • Tucker trawl
    • IKMT
    • FMT (HUFT)
    • Cobb trawl
MIE-II

- **September 23 - October 3, 2005**
- R/V Hokko-maru (HNFRI, 904t)
- Doto area (off SE Hokkaido Island)
- Participants
  - HNFRI, TNFRI, HU
- Gears tested:
  - MOCNESS-10
  - MOCHT
  - FMT (3mm and 9mm mesh)
  - Otter Trawl + Multisampler (opening/closing codend)
  - Acoustic backscattering --> Yasuma et al.
MIE-II

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- Gears compared:
  - MOCNESS-10
  - MOHT
  - FMT: fine (3mm) and coarse (9mm) mesh sizes
  - Otter Trawl + Multisampler (codend with opening/closing device)
  - Acoustic backscattering: EK-60 (4 freqs.) → Yasuma et al.
MOHT: Matsuda-Oozeki-Hu Trawl (Oozeki et al., 2004)

- Towing vector
- Net resistance
- Balance
- Downward vector

- 5 m² mouth opening
- 4 mm mesh
- V-shaped concave depresser
- Wing area: 0.99 m²
- Rising angle: 20°
MIE-II

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<table>
<thead>
<tr>
<th>Parameter</th>
<th>MOCNESS FMT-Coarse</th>
<th>FMT-Fine</th>
<th>MOHT</th>
<th>Otter Trawl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouth opening</td>
<td>14 m²</td>
<td>4 m²</td>
<td>4 m²</td>
<td>c. 900 m²</td>
</tr>
<tr>
<td>Mesh size</td>
<td>4 mm</td>
<td>3 mm</td>
<td>9 mm</td>
<td>4 mm</td>
</tr>
<tr>
<td>Towing speed</td>
<td>3.0-5.0</td>
<td>1.6-3.0</td>
<td>1.0-3.0</td>
<td>1.3-2.0</td>
</tr>
<tr>
<td>Towing angle</td>
<td>41-47°</td>
<td>N/A</td>
<td>N/A</td>
<td>8°</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>
Comparison procedure

- D/N sampling at 4 stns.
- At shelf edges (BD: 385-480m, x = 444m)
- Otter trawl: daytime only (n = 2)
- Oblique tows aiming at 300 m (MOHT, FMT)
- Discrete sampling from 300 to 0 m (MOC, MT)
- Samples were roughly sorted immediate after towing, then fixed
- Identified, counted, weighted & measured in the laboratory
- Catchability was assessed based on N and W of micronekton per water volume filtered
Consequence of towing operations

<table>
<thead>
<tr>
<th>Stn 1</th>
<th>Stn 2</th>
<th>Stn 3</th>
<th>Stn 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 25</td>
<td>Sep. 26</td>
<td>Sep. 27</td>
<td>Sep. 28</td>
</tr>
</tbody>
</table>

- MOC
- MOHT
- FMT
- MT
Catch composition

- Myctophids, especially *Diaphus theta* dominated the overall catch (82% in N and 71% in W),
- reflecting the depth sampled (0-300m)
- Gears were compared using the catches of *D. theta*
Catch composition
Body length frequency distribution of *D. theta*

**Stn. 1**

- **Day**
  - Small-sized

**Stn. 2-4**

- **Night**
  - Large-sized
Catchability for small-sized fish (≤40 mm, Stn. 1)

- N of fish per vol of water filtered at Stn. 1
- Relative measure with MOC (D) = 1.0
- MOC ≈ FMT << MOHT
- No or slight day/night difference

![Graph showing relative catchability for different conditions.](image-url)
Catchability for large-sized fish (41-80 mm)

- based on N of fish caught at Stn. 2-4
- Relative measure with MOC (D) = 1.0
- MOC ≈ FMT(3mm) < FMT(9mm) < (MOHT)
- No D/N difference, except for 3mm FMT
- MT: low efficiency

<table>
<thead>
<tr>
<th></th>
<th>Relative Catchability</th>
</tr>
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<tbody>
<tr>
<td>MOC</td>
<td>1.0</td>
</tr>
<tr>
<td>FMT-3mm</td>
<td>0.6</td>
</tr>
<tr>
<td>FMT-9mm</td>
<td>1.7</td>
</tr>
<tr>
<td>MOHT</td>
<td>3.8</td>
</tr>
<tr>
<td>MT</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>10.2</td>
</tr>
<tr>
<td></td>
<td>10.5</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
</tr>
</tbody>
</table>

Night: N/A
Catchability of large-sized fish (cont’d)

- No or slight D/N difference, except for 3mm FMT
  - suggesting limited visual avoidance

- MT
  - Low catchability due to large mesh size in the wing and belly, but caught largest quantity of micronekton
  - Poor condition of specimens due to turbulence in the codend
  - not recommended for sampling <80mm micronekton, but effective for sampling more evasive larger micronekton and nekton
Catchability of large-sized fish (cont’d)

- **FMT - 3mm**
  - Lowest efficiency during daytime
  - Perhaps due to visual avoidance, due lowest towing speed and the presence of bridle ahead
  - Inadequate for micronekton sampling

- **FMT - 9mm**
  - Limited catchability, but sample micronekton more effectively than MOC-10

- **MOHT**
  - Sample micronekton most effectively
  - Excellent sample condition (often alive!)
  - Highly recommended for micronekton sampling

![Relative Catchability Chart]

<table>
<thead>
<tr>
<th></th>
<th>MOC</th>
<th>FMT-3mm</th>
<th>FMT-9mm</th>
<th>MOHT</th>
<th>MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Night</td>
<td>N/A</td>
<td>1.0</td>
<td>1.7</td>
<td>10.2</td>
<td>10.5</td>
</tr>
<tr>
<td></td>
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Summary

• Catchability of 4 sampling gears were tested for micronekton sampling: MOC, FMT, MOHT and MT
• MOHT showed the highest efficiency for micronekton sampling
• MOHT is strongly recommended for the sampling of micronekton
• However, MOCNESS is still essential for discrete sampling
Further analysis

• Incorporating results from MIE-I (using data of FMT)
• Analyze and compare MOC-1 samples
  – Size selectivity and catchability of Euphausia pacifica
• Other gears to be tested:
  – 4m² MOCNESS
  – IKMT (MIE-I)
• Size selectivity analysis (ongoing)
• Comparison with EK-60 backscattering data (ongoing)