Gillnet modifications to reduce harbor porpoise bycatch

Isabella Kratzer, Daniel Stepputtis, Lotte Kindt-Larsen, Finn Larsen and many other colleagues
Holistic approach

WP1: Characterization of fishery & improve effort data
WP2: Gillnet modifications
WP3: Alternative gears
WP4: Sustainable practices in gillnet fisheries
Gillnet modifications

Goal

A Designguide, that allows construction of *acoustically reflective*, catch-efficient gillnets

Method

1) Simulation study to identify ideal reflective object
2) Experimental verification of acoustic characteristics of reflector
3) Behavioral experiment to analyze porpoise behavior around nets
4) Trials in commercial fishery
Goal

A Designguide, that allows construction of acoustically reflective, catch-efficient gillnets

Method

1) Simulation study to identify ideal reflective object
2) Experimental verification of acoustic characteristics of reflector
   - Same characteristics in all directions
   - Small (<1.5cm diameter)
   - Right combination of material properties and size
   → Search for small sphere resonating at 130kHz
Target Strength

- material properties
- sizes
- frequencies
Simulation Results

Target Strength of sphere at 50kHz

Target Strength of sphere at 70kHz

Target Strength of sphere at 90kHz

Target Strength of sphere at 110kHz

Target Strength of sphere at 130kHz

Target Strength of sphere at 150kHz
Experiment vs simulation

Acrylic glass 9.6mm sphere

Acrylic glass 6.4mm sphere
TS measurements

Results

All Measurements

<table>
<thead>
<tr>
<th>Material</th>
<th>Frequency [kHz]</th>
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<tbody>
<tr>
<td>steel 25.5mm</td>
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<tr>
<td>TT Ball</td>
<td></td>
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<tr>
<td>Acrylic glass 6.4mm</td>
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<tr>
<td>Acrylic glass 9.6mm</td>
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</tbody>
</table>
Echograms
No resonance effect at 38kHz

→ No visible difference
Echograms

120kHz

- Resonance of pearls → highly visible rows

Standard gillnet

Modified gillnet
Echograms

- Systematic trials in tank
- Whole frequency range
- Three angles
- Several gillnet modifications

<table>
<thead>
<tr>
<th></th>
<th>Angle</th>
<th>0°</th>
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<th>20°</th>
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<td>Transducer</td>
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<td>Turbot Reference</td>
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</tbody>
</table>
Echograms

- Systematic trials in tank
- Whole frequency range
- Three angles
- Several gillnet modifications
Behavioral Experiment

No Net vs. Standard net
Behavioral Experiment

No Net

vs.

Standard net

vs.

Pearl net
Commercial trials

- Black Sea turbot fishery
- Higher bycatch rates than in the Baltic
- 2 km standard vs 2 km modified
Commercial trials

- Black Sea turbot fishery
- Higher bycatch rates than in the Baltic
- 2 km standard vs 2 km modified
- 10 hauls
Commercial trials

- Black Sea turbot fishery
- Higher bycatch rates than in the Baltic
- 2 km standard vs 2 km modified
- 10 hauls

<table>
<thead>
<tr>
<th>standard gillnet</th>
<th>Total: 5</th>
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<tbody>
<tr>
<td>1</td>
<td>2</td>
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<tr>
<td>modified gillnet</td>
<td>Total: 2</td>
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</tbody>
</table>

- Fewer porpoises in modified net, however no statistical significance
- Reasons: no echolocation? Echolocation in wrong direction? Noise?
Next steps

- Repeat behavioral experiment to observe porpoises around gillnets
- Further trials in other commercial fisheries?
- Development of automated process of „pearl net“ production

Collaborations are more than welcome, we are happy to provide any information needed for trials with the nets

Please reach out:

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Resonance – acoustic field

d=1mm

d=6.4mm