Developing a computer vision method to quantify impact on seabed of bottom gillnets

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Developing a computer vision method to quantify impact on seabed of bottom gillnets

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INTRODUCTION

- Habitat damage is of high interest in an Ecosystem Approach to Fisheries
- Seabed integrity is defined by the Marine Strategy Framework Directive as one of the descriptors to ensure Good Ecological Status
- Effects of bottom set gillnets on habitat may be well below those associated with natural disturbance, but if located in areas of high biological importance, the effects on ecosystem functions could be larger

OBJECTIVES OF THE STUDY

- Develop an appropriate methodology for assessing the seabed impact of bottom gillnets
- Assess the movement of the leadline of gillnet during soaking in 3-dimensions (x, y and z)

DATA COLLECTION AT SEA

- Light and heavy commercial bottom set gillnets
- Sandy bottoms, shallow waters
- Stereo imaging recording unit (Fig. 1 and 2): cameras take synchronized images from slightly different perspectives and allow to estimate the distance to an object as in human vision
- Simultaneous sea current measurement (Fig. 3)

DATA ANALYSIS

- Processing of stereo clips (Fig. 4)
- Statistical analysis

PRELIMINARY RESULTS

- 7 runs (Table 1) (Fig. 5 and 6)
- Current during the experiment lower than the average range in coastal Danish waters (0.26 to 0.77 m/s) (National Geospatial-Intelligence Agency of the United States Government, 2013)

EXPECTED OUTPUTS & NEXT STEPS

- Test for significant differences between heavy and light nets, and correlate with current measurements
- Look at seabed penetration of the leadline

MATERIAL & METHODS

Look at seabed penetration of the leadline
Test for significant differences between heavy and light nets, and correlate with current measurements

FINANCIAL SUPPORT

Ministry of Food, Agriculture and Fisheries of Denmark

REFERENCES


DEMaT’15 Aberdeen, UK October 27-29, 2015

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Table 1. Experimental runs at sea: acronyms give the type of setup with ‘a’ for the type a (Fig. 1a) and ‘b’ for the type b (Fig. 1b). Frame nr. gives the recording unit identification number. ‘Cameras’ gives the cameras identification numbers and their location in the recording pair with (L) for left and (R) for right. ‘Resolution’ gives the video resolution with ‘S’ standing for SuperView (the sides of the video are stretched out for greater viewing), ‘fps’ gives the frame per second and ‘FOV’ the field of view with ‘UW’ standing for underwater images. Distance is given in 3 dimensions (x, y and z) as different distances. The median position is set to 0.

<table>
<thead>
<tr>
<th>Run</th>
<th>Data</th>
<th>Location</th>
<th>Current speed (m/s)</th>
<th>Net</th>
<th>Recording unit</th>
<th>Frames</th>
<th>Cameras</th>
<th>Resolution</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>32/3</td>
<td>H/M/Rss</td>
<td>0.07/0.10/0.09</td>
<td>a</td>
<td>1+2</td>
<td>4</td>
<td>Black 3</td>
<td>1080p S</td>
<td>30 VV/14mm</td>
</tr>
<tr>
<td>1b</td>
<td>32/3</td>
<td>H/M/Rss</td>
<td>0.07/0.10/0.09</td>
<td>b</td>
<td>1+2</td>
<td>4</td>
<td>Black 3</td>
<td>1080p S</td>
<td>30 VV/14mm</td>
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<tr>
<td>2a</td>
<td>10/1</td>
<td>Strandby</td>
<td>0.10/0.03/0.05</td>
<td>a</td>
<td>1+2</td>
<td>3</td>
<td>Black 3</td>
<td>1080p S</td>
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</tr>
</tbody>
</table>

Fig. 1. Stereo imaging recording unit on top of the frame at a distance of 80 cm. (a) Type a: the cameras were mounted in the frame at a distance of 65 cm and protected by netting to avoid entanglement of the net in the frame. (b) Type b: the cameras were mounted in the frame at a distance of 65 cm and protected by netting to avoid entanglement of the net in the frame.

Fig. 2. Stereo imaging recording unit positioned in front of a net (a) side view of the imaging recording unit with red marks and rope to buoy (b) type b: view from the left camera to the right camera (c) view from the left camera to the right camera (d) view from the left camera to the right camera (e) view from the left camera to the right camera (f) view from the left camera to the right camera (g) view from the left camera to the right camera (h) view from the left camera to the right camera (i) view from the left camera to the right camera (j) view from the left camera to the right camera (k) view from the left camera to the right camera (l) view from the left camera to the right camera (m) view from the left camera to the right camera (n) view from the left camera to the right camera (o) view from the left camera to the right camera (p) view from the left camera to the right camera (q) view from the left camera to the right camera (r) view from the left camera to the right camera (s) view from the left camera to the right camera (t) view from the left camera to the right camera (u) view from the left camera to the right camera (v) view from the left camera to the right camera (w) view from the left camera to the right camera (x) view from the left camera to the right camera (y) view from the left camera to the right camera (z) view from the left camera to the right camera

Fig. 3. Drifting device to measure current (b) close-up view of the lower end of the PVC tube which allows to measure at the median net height in the water column (c) view of the device at sea (a) full view of the device 

Fig. 4. Steps to process stereo imaging clips, adapted from Brodin and Kallander (2006) and Hauknesveger (2014)

Fig. 5. Example of output from run 2c. Positions of 3 different leadlines of the same net are recorded in the 3 dimensions (x, y and z) as different distances. The median position is set to 0.

Fig. 6. Example of output from run 2c. Positions of 3 different marks (1, 2 and 3) on the leadline of the same net are recorded in the 3 dimensions (x, y and z) as different distances. The median position is set to 0.