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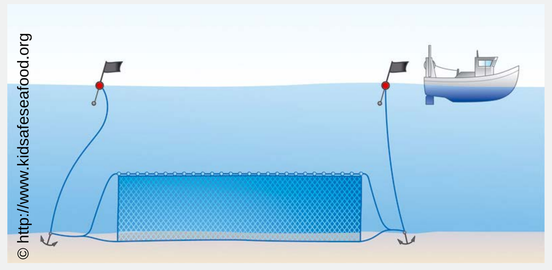
INTRODUCTION

CONTEXT AND CHALLENGES



- ✓ 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)

MATERIAL & METHODS

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)

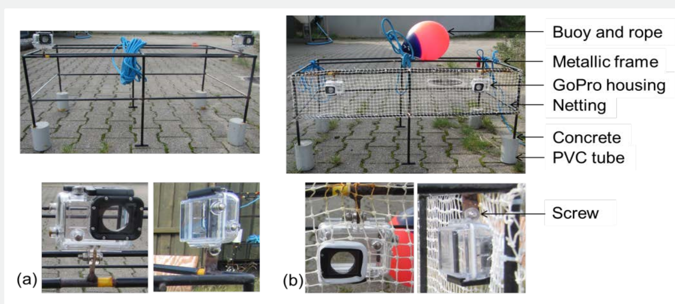


Fig. 1. Stereo imaging recording unit
Two set-ups were experimented:
(a) Type a: the cameras were mounted on top of the frame at a distance of 80 cm
(b) Type b: the cameras were mounted in the frame at a distance of 65 cm and protected by netting to avoid entanglement of the net in the frame

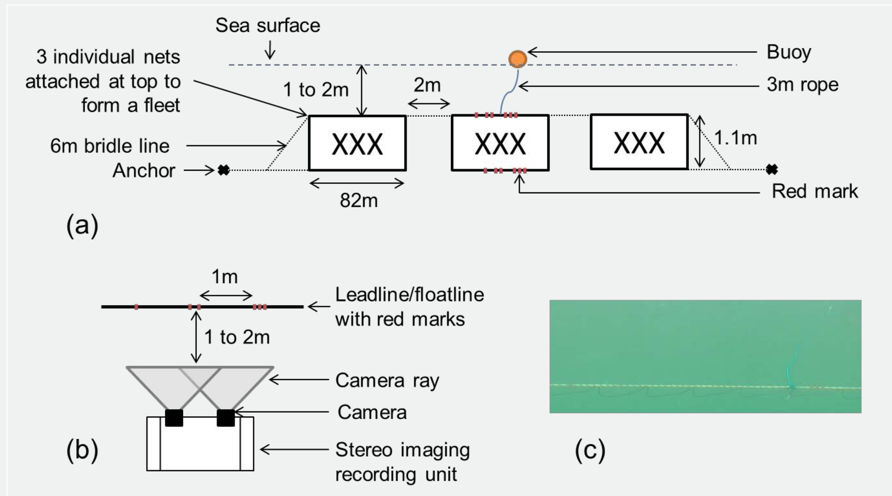


Fig 2. Experimental set-up for stereo imaging
(a) side view of a fleet, i.e., a ganged sequence of 3 individual gillnets, set on the bottom
(b) top view of the stereo imaging recording unit positioned in front of a net
(c) underwater view of the floatline with red marks and rope to buoy

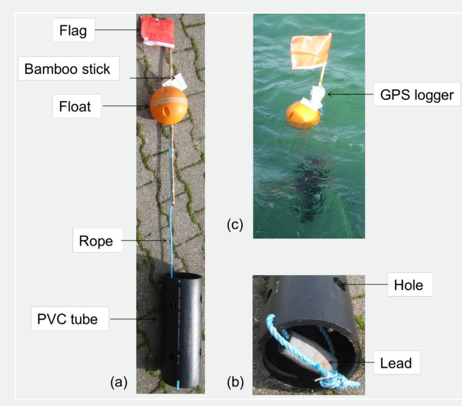


Fig. 3. Drifting device to measure current speed and direction
(a) full view of the device
(b) close-up view of the lower end of the PVC tube which allows to measure in the water column median net height in the water column
(c) view of the device at sea
Two similar devices were left drifting between the nets for short periods during soaking.

DATA ANALYSIS

- ✓ Processing of stereo clips (Fig. 4) VidSync www.vidsync.org/HomePage
- ✓ Statistical analysis (R Core Team, 2015)

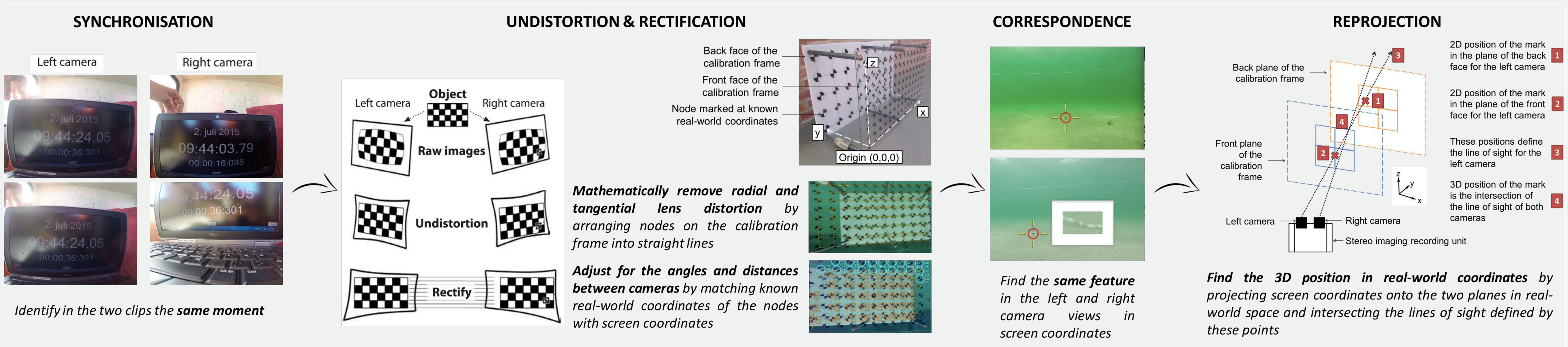


Fig 4. Steps to process stereo imaging clips, adapted from Bradski and Kaehler (2008) and Neuswanger (2014)

RESULTS

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 0.77m/s) (National Geospatial-Intelligence Agency, 2013)

Run	Date	Location	Current speed (m/s)	Net	Recording unit	Frame nr.	Cameras nr.	GoPro	Resolution	fps	FOV	Clip length
1b	02-07	Hirtshals	0.17 (±0.11)	light	a	7	8(L)/13(R)	3 Black	1080p S	30	UW	64min
1c	02-07	Hirtshals	0.17 (±0.11)	heavy	a	4	3(L)/4(R)	3 Black	4K	12	UW	15min
2a	10-09	Strandby	0.10 (±0.09)	heavy	b	8	1(L)/2(R)	3+ Black	1080p S	30	UW	191min
2b	10-09	Strandby	0.10 (±0.09)	light	b	3	3(L)/4(R)	3+ Black	1080p S	30	UW	50min
2c	10-09	Strandby	0.10 (±0.09)	heavy	b	6	9(L)/10(R)	3+ Black	1080p S	30	UW	152min
3b	10-09	Strandby	0.10 (±0.09)	light	b	3	3(L)/4(R)	3+ Black	1080p S	30	UW	136min
3c	10-09	Strandby	0.10 (±0.09)	heavy	b	6	1(L)/2(R)	3+ Black	1080p S	30	UW	170min

Table 1. Experimental runs at sea
'Recording unit' gives the type of set-up 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 Ultra Wide. Distorsion and calibration calculations were run in a tank with the same recording units and cameras as in the field, except for runs 1b and 1c where cameras 3(L)/4(R) and 11(L)/12(R), respectively, were used.

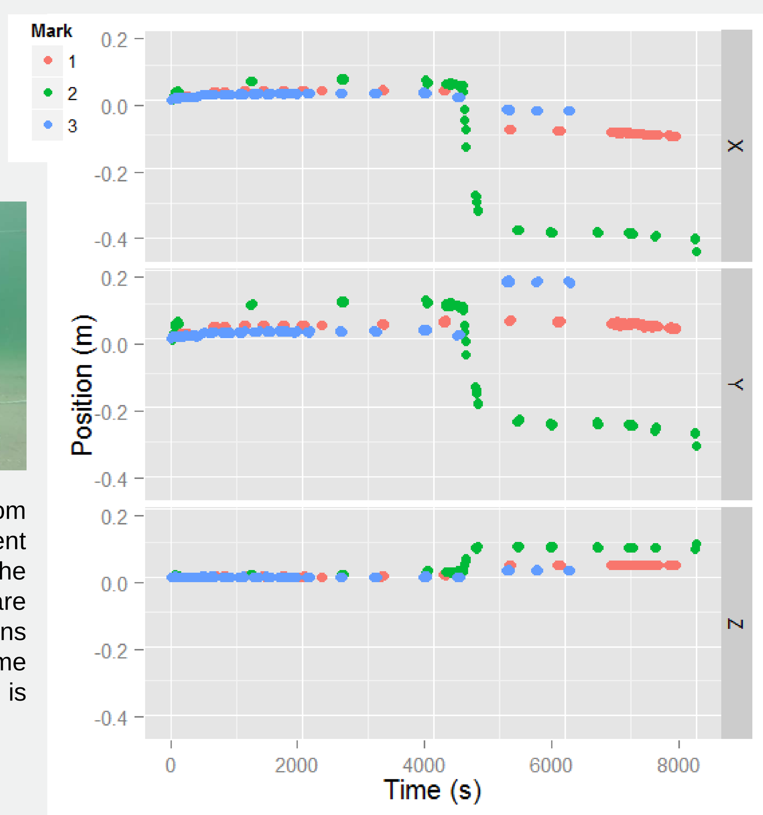


Fig 5. Example of output from run 2c. Positions of 3 different marks (1, 2 and 3) on the leadline of the same net are recorded in the 3 dimensions (X, Y and Z) at different time intervals. The initial position is set to 0.

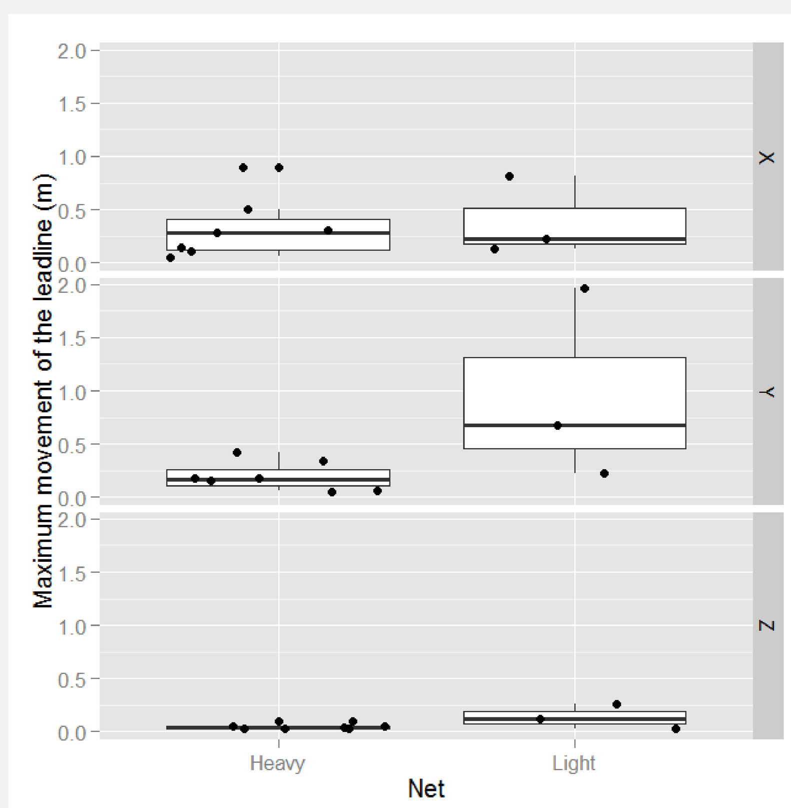


Fig 6. Boxplot of the maximum movement of the leadline for heavy and light nets in the 3 dimensions (X, Y and Z) calculated from all runs.

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

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