

Comparing multi-net sampling with optical measurements: how efficient is LOKI (Lightframe On-sight Key species Investigations) in analysing zooplankton communities in the Fram Strait?

Rationale: Optical measurements are increasingly important in zooplankton studies as they allow for covering wide spatial ranges and study the spatial distribution of the dominant taxa in greater detail than classical net tows. Yet, however, studies comparing results from net catches and optical methods are rare.

Aims: Calibrate data obtained by LOKI (stands for Lightframe On-sight Key species Investigations) with depth stratified net tows and relate spatial distribution to hydrography.

Multi-net sampling

(Hydro-Bios, type Midi, Fig. 1A)

- Vertical tows down to >1000 m depth / bottom
- 5 depth strata
- 150 µm mesh size
- Samples preserved in formalin (Fig. 1B)

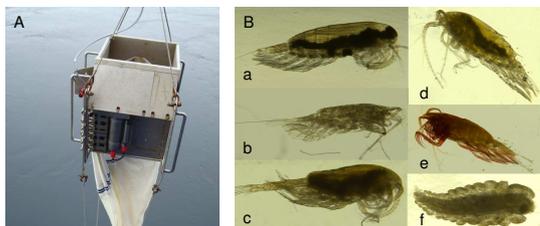


Fig. 1A: The multi-net deployed in Fram Strait
Fig. 1B: preserved specimens; (a) *Calanus glacialis* female, (b) *Heterorhabdus* sp., (c) *Metridia longa* female, (d) *Aetideopsis* sp., (e) *Paraeuchaeta* sp., (f) *Tomopteris* sp.

LOKI sampling

- Vertical tows down to 1000 m depth (Fig. 2A)
- Takes up to 27 high resolution pictures sec⁻¹ (Fig. 2B)
- One cm mesh on top that no large zooplankton clog the cuvette
- Equipped with net of 150 µm mesh size
- Depth, Sal, T, O₂, and fluorescence recorded simultaneously



Fig. 2A: LOKI, deployed in the Fram Strait

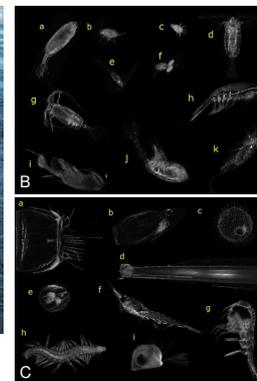


Fig. 2B: Examples of copepods; (a) *Aetideopsis* sp., (b) *Microcalanus* sp., (c) nauplius, (d) *Calanus* sp. stage CV, (e) *Oithona* sp., (f) *Oncaea* sp. female with egg sacks, (g) *Gaetanus* sp. female, (h) *Calanus* sp. stage CIV, (i) *Paraeuchaeta* sp. female with egg sack, (j) *Metridia longa* female, (k) *Heterorhabdus norvegicus*

Fig. 2C: Examples of non-copepod zooplankton; (a) *Aglantha digitale*, (b) Siphonophora, (c) Radiolaria, (d) Chaetognatha, (e) Ctenophora, (f) Euphausiacea, (g) Amphipoda, (h) Polychaeta, (i) Ostracoda

Sampling onboard RV Polarstern in the eastern Fram Strait (N 79° 56.33', E 3° 11.45') in July 2015 during PS 93.2

- Abundances higher with multi-net (MN) than LOKI (Table 1)
- Copepods always dominant
- Higher taxonomical resolution in MN samples
- Multi-net suitable for biodiversity studies
- *Oithona* spp. (Cyclopoida), *Pseudocalanus*/*Microcalanus* spp. and nauplii frequent in MN samples but not in LOKI images (Fig. 3)
- *Oithona* spp. are undersampled with LOKI due to optical properties
- LOKI analysis directly links abundance with hydrography (Figs. 4 and 5)

Table 1: Abundances in multi-net and LOKI analyses.

Depth interval	Total zooplankton (n m ⁻³)		Copepods (n m ⁻³)		Copepods (n m ⁻³) without <i>Oithona</i> spp.
	MN	LOKI	MN	LOKI	MN
50-0 m	6127	340	5913	334	3129
200-50	462	32	446	30	343
500-200	237	74	219	66	172
1000-500	232	84	208	75	195

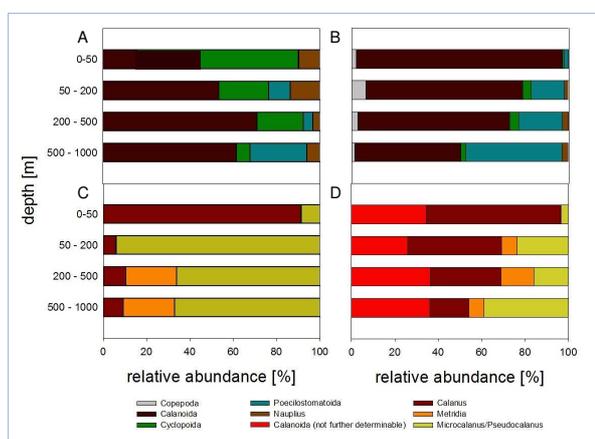


Fig. 3: Abundance of copepod orders (A, B) and calanoid genera (C, D) in multi-net samples (left panel) and LOKI (right panel). Individuals that could not be identified beyond the level of order were summarised as "Copepoda" and those that could not be identified to genus level were summarised as "Calanoida". Orders and genera with a contribution >5% are not included.

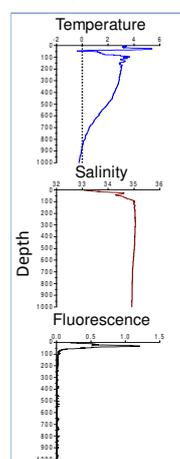


Fig. 4: Temperature, salinity and fluorescence profiles at sampling site

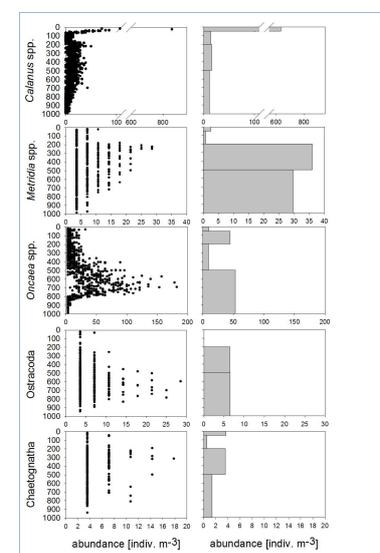


Fig. 5: Distribution patterns of different taxa as determined by LOKI (left panel) and multi-net sampling (right panel).