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Gelatinous lifeforms sampled on the Faroe Bank demersal summer survey September 2024:

Image record of specimens preserved for DNA sequencing as part of the GLoBECC project

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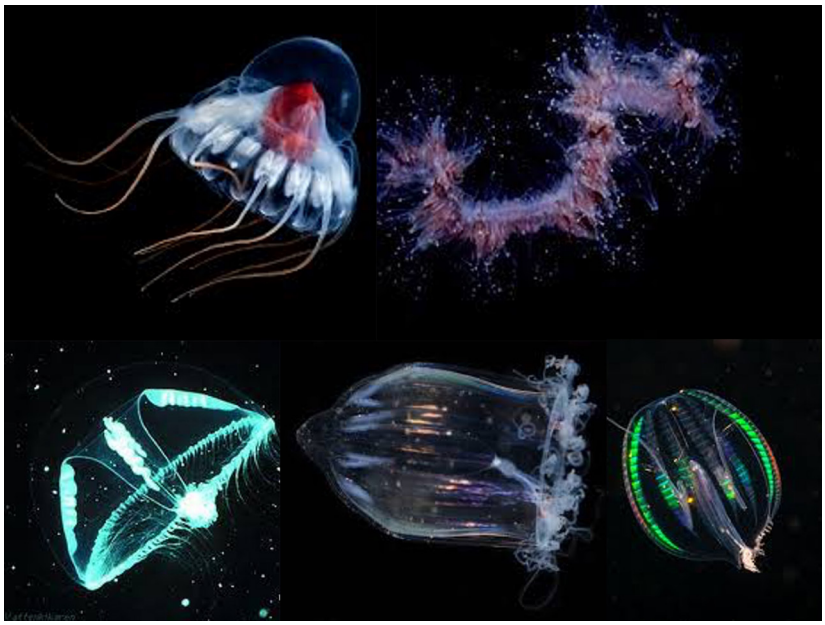

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TECHNICAL REPORT

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Helmet jellyfish
https://www.biographic.com/prince-of-darkness/
Apolemia uvaria:
https://en.wikipedia.org/wiki/Apolemia_uvaria
Leptomedusa:
https://taxateca.com/ordenleptomedusae.html
Aglantha digitales: https://www.invertebase.org/portal/taxa/index.php?tid=33664&taxauthid=1&clid=0
Pleurobrachia
http://www.seawater.no/fauna/ctenophora/pileus.html

Gelatinous lifeforms sampled on the Faroe Bank demersal summer survey September 2024: Image record of specimens preserved for DNA sequencing as part of the GLoBECC project.

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Summary

Gelatinous zooplankton, including jellyfish, play a crucial role in marine ecosystems. They are important predators, consuming a wide range of prey from small plankton to juvenile fish, and also serve as a valuable food source for larger marine organisms. Additionally, certain hydrozoan taxa can pose significant challenges to finfish aquaculture, sometimes leading to substantial mortality. Despite their importance, there have been no systematic studies of gelatinous zooplankton in Faroese waters, leaving us with a limited understanding of their role, particularly concerning fisheries. Most global climate models predict an increase in the occurrence and biomass of jellyfish under future climate scenarios. Therefore, establishing an effective monitoring approach for Faroese waters is a critical endeavor. This technical report contributes to the newly funded project GLoBECC (Gelatinous Lifeforms in Faroese Waters: Biodiversity, Regional Connectivity, and Capacity Building; Granskingar ráðið; 2024-2026). As part of the standardized demersal trawl survey on the Faroe Bank, WP2 net samples were collected using a modified retrieval technique designed to preserve the morphological integrity of gelatinous organisms. The specimens were imaged and preserved in ethanol for DNA barcoding to confirm their taxonomic identity. This effort aims to establish a local reference database for future monitoring, including eDNA metabarcoding. A total of 49 images were collected, with 25 specimens preserved for sequencing. Notable preliminary findings include specimens of *Aglanta digitales*, *Leptomedusa* spp., *Pleurobrachia* spp., Actinula larvae, and the siphonophore (string jellyfish) *Apolemia* spp. The presence of *Pleurobrachia* spp. is particularly noteworthy, as its occurrence on the Faroe Bank aligns with its apparent dominance in Faroese Shelf and fjord environments in 2024. The observation of *Apolemia* spp. is also significant, as it represents the first recorded instance of a string jellyfish in Faroese waters in 2024; this genus caused serious salmon mortality in Norwegian aquaculture in 2023. Additionally, we retrieved three large specimens of the mesopelagic helmet jellyfish (*Periphylla periphylla*) from the demersal trawl samples, documenting it's presence on the shallow Faroe Bank for the first time. A subset of gelatinous material from fish stomachs was collected to investigate their role as prey items in demersal fisheries. This report serves to provide documentation of the images and samples that were collected for DNA sequencing and the first documented records and images of gelatinous species on the Faroe Bank.

1. Objectives

The primary objective of this work was to carry out the first systematic sampling of gelatinous zooplankton on the Faroe Bank as a component of the existing standardised demersal trawl survey. The main objectives are:

1. document and describe the main gelatinous zooplankton forms occuring on the Faroe Bank
2. generate images of non-damaged live samples for improving taxonomic identification expertise

3. archive a subset of gelatinous zooplankton specimens in ethanol for DNA-based identification and contribution to regional metabarcoding reference databases

In addition to these main objectives, large jellyfish specimens recovered in the demersal trawl were also imaged and archived for sequencing. A subset of gelatinous material identified from stomach content analysis was transferred to 99% ethanol for sequencing.

2. Methods

Sampling was conducted between 4th and 10th September 2024 aboard the research vessel *Jákup Sverri* on the Faroe Bank, as part of the annual summer demersal fish bottom survey (Table 1.1). This survey included 29 trawl stations and 20 hydrographic stations, with WP2 net tows conducted at select locations to survey crustacean zooplankton. The stations are listed in Table 1.2. The WP2 net used has a diameter of 57 cm, corresponding to an area of 0.255 m^2, and a mesh size of 200 µm. A 200 µm square mesh is secured at the plastic cod end with a metal clip. WP2 tows involved vertical hauls to a standard depth of 50 m, resulting in an estimated sample volume of approximately 12.5 m^3. This volume is an approximation, as the standard operating procedure for WP2 nets does not involve a flow meter or account for the wire angle, which can be influenced by wind and current conditions.

The standard procedure for processing WP2 net samples involves thoroughly rinsing the sides of the net upon recovery, prior to bringing it back on deck. The net is then allowed to drain completely through the 200 µm mesh at the cod end before the sample is recovered. However, this filtering method can damage the morphological features of gelatinous zooplankton, sometimes making taxonomic identification difficult or impossible. To mitigate this issue and collect more intact specimens, I modified the recovery procedure. Upon recovery, the net was still rinsed over the side of the ship to wash specimens down to the cod end, but this was done more gently, using a lower water flow from the hose and targeting the exterior of the net rather than the interior. Once the net was back on deck, instead of allowing all the water to filter through the mesh at the cod end, a large plastic container was placed underneath, and the mesh was removed while the cod end was still filled with water. This approach helped recover less damaged gelatinous zooplankton.

Once the sample was safely in the plastic container, gelatinous zooplankton specimens were carefully removed using a metal spoon, metal tweezers, or a plastic pipette, depending on their size, shape, and morphology. These specimens were transferred to a 100 mL plastic container filled with surface seawater for imaging. The remainder of the sample was processed according to standard operating procedures. The contents were washed into a 200 µm sieve and gently rinsed with tap water to remove excess salt. The sieved material was then transferred into a 100 mL plastic container with approximately 80 mL of freshwater, to which 16 mL of 24% formaldehyde was added to achieve a final concentration of 4% for preservation. Samples for a particular station were split across 100mL containers depending on what was removed for DNA sequencing (Table 1.3).

The gelatinous specimens that were removed were imaged using the onboard Leica microscope, and a subset of interesting specimens was preserved for DNA analysis by transferring them into 50 mL sterile Falcon tubes with 99% ethanol. Specific details regarding the treatment of samples at different stations are provided in the results section below.

Occasionally, large jellyfish specimens were recovered during the demersal trawl survey. These specimens were photographed, and in some cases, sub-sampled for DNA sequencing. Detailed descriptions of the trawl design and operations are provided in the standard operating procedures of Havstovan. The most pertinent details to note here are that the net has a mesh size of 40 mm, and the tow duration is standardized at one hour. The trawl height is 5 meters; however, it is likely that jellyfish are primarily captured during the recovery phase, as the trawl is hauled from the bottom to the surface. It is important to note that the specific depth at which jellyfish are sampled cannot be determined. As part of the standardized trawl survey, certain fish specimens were selected for gut content analysis. Gelatinous remains found in the gut were occasionally transferred into ethanol for DNA sequencing when time permitted, in an opportunistic manner. Details of samples retrieved from demersal trawls are summarized in Table 1.4.

Table 1.1 Weather conditions on the Faroe bank during the demersal trawl survey.

Date	**Min. wind (m/s)**	**Max wind (m/s)**	**Prevailing direction**
05/09/2024	9	10	S
06/09/2024	5	6	S
07/09/2024	1	5	W / NW
08/09/2024	8	11	SW / W
09/10/2024	7	9	W / NW
10/10/2024	12	14	N

Table 1.2 A summary of the stations where WP2 nets were carried out for gelatinous zooplankton. All vertical net tows were executed over a standard depth of 50m.

Station number	**Date (dd/mm/yyyy)**	**Time (hh:mm)**	**Latitude (decimal)**	**Longitude (decimal)**	**Bottom depth (m)**
24380009	06/09/2024	07:15	61.024	-8.497	105
24380015	06/09/2024	13:22	61.116	-8.524	104
24380028	08/09/2024	05:23	60.720	-8.996	128
24380032	08/09/2024	11:04	60.845	-8.648	144
24380039	09/09/2024	08:24	60.921	-8.159	176

Table 2.3 A summary of the formalin preserved samples following the removal of gelatinous zooplankton for imaging and sequencing.

Station	Corresponding samples	Comments
24380009	24380009 WP2 50m 1/1 (-Jellies) + Formalin	Most gelatinous organisms removed
	24380009 WP2 50m 1/1 (Jellies) + Formalin	Remaining gelatinous organisms not removed for sequencing.
24380015	24380015 WP2 50m 1/1 (-Jellies) + Formalin	Most gelatinous organisms removed
	24380015 WP2 50m 1/1 (Jellies) + Formalin	Remaining gelatinous organisms not removed for sequencing.
24380028	24380028 WP2 50m 1/1 (-Jellies) + Formalin	Most gelatinous organisms removed
	24380028 WP2 50m 1/1 (Jellies) + Formalin	Remaining gelatinous organisms not removed for sequencing.
24380032	24380032 WP2 50m (1/1) (-Jellies) + Formalin	Most gelatinous organisms removed
	24380032 WP2 50m (1/1) (Jellies – Siphon) + Formalin	Siphonophores returned to formalin
	24380032 WP2 50m (1/1) (Jellies – Lepto) + Formalin	Leptomedusa retuned to formalin
24380039	24380039 WP2 50m 1/1 (-Jellies) + Formalin	Most gelatinous organisms removed
24380039	24380039 WP2 50m 1/1 (Jellies) + Formalin	Remaining gelatinous organisms not removed for sequencing.

Table 1.4 A summary of the trawl stations which procured gelatinous material for sequencing, either through direct sampling of large jellyfish (Type = Direct), or retrieval of gelatinous material from stomach contents (Type = Gut)

Station number	Date (dd/mm/yyyy)	Time (hh:mm)	Lat. (St |En) (decimal)	Lon. (St |En) (decimal)	Bottom depth (m)	Type
24380008	06/09/2024	05:48	61.022|61.019	-8.642 |-8.523	108	Gut
24380012	06/09/2024	09:12	61.020 |61.017	-8.297 |-8.169	126	Gut
24380042	09/09/2024	10:42	61.016 |61.075	-7.981 |-7.980	192	Gut
24380049	10/09/2024	05:40	61.252 |61.260	-8.969 |-8.860	288	Direct

3.Results

3.1 WP2 50m vertical hauls

3.1.1 Station 24380009

Gelatinous zooplankton were hand-picked from the total net sample and transferred to a clear petri-dish containing seawater. The remainder of the sample was passed through a 200um mesh and transferred in seawater to a 60mL plastic container and fixed with formalin which was labelled as 24380009 WP2 50m 1/1 (-Jellies) + Formalin. A selection of the hand-picked gelatinous zooplankton was imaged under the microscope (see figures 3.1 to 3.7) and transferred to sterile 50mL falcon tubes and preserved in 99% Ethanol. The remaining gelatinous zooplankton specimens were preserved in formalin and labelled as 24380009 WP2 50m 1/1 (Jellies) + Formalin. Details of the specimens imaged and preserved in ethanol for DNA sequencing are summarized in Table 3.1.

Table 3.1 Summary of the gelatinous zooplankton specimens imaged and removed for DNA sequencing. *Two *Leptomedusa* individuals were included in the tube for DNA. **Four Pleurobrachia specimens were included in the tube for DNA.

Station	**Image code**	**Magnification**	**Identity**	**Rec No.**
24380009	a	None	*Leptomedusa* spp.	24380009-1
24380009	b	None	*Leptomedusa* spp.	24380009-2
24380009	c	None	*Leptomedusa* spp.	24380009-3*
24380009	d	0.75	*Aglanta digitales*	24380009-4
24380009	e	0.75	*Pleurobrachia* spp.	24380009-5**
24380009	f	0.75	Actinula larva	24380009-6
24380009	g	0.75	Actinula larva	n/a
24380009	h	0.75	Actinula larva	n/a
24380009	i	0.75	Actinula larva	24380009-7

Figure 3.1 Image identifier 24380009-a. Unknown *Leptomedusa* spp. archived for biobanking (Rec No. 24380009). Image taken without magnification. Diameter of the specimen is approximately 15mm.

Figure 3.2 Image identifier 24380009-b. Unknown *Leptomedusa* spp archived for biobanking (Rec No. 24380009-#2). Image taken without magnification. Diameter of the specimen is approximately 15mm.

Figure 3.3 Image identifier 24380009-c. Unknown *Leptomedusa* spp archived for biobanking (Rec No. 24380009-#3). Image taken without magnification. Diameter of the specimen is approximately 15 mm. Two similar specimens, not imaged, were also included in the same tube for biobanking as a check for potential issues with DNA yield from one specimen.

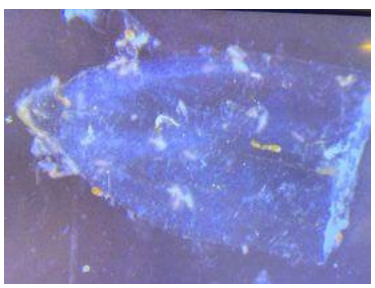

Figure 3.4 Image identifier 24380009-d. *Aglanta digitales* spp. archived for biobanking (Rec No. 24380009-#4). Image taken with a magnification of 0.75.

Figure 3.5 Image identifier 24380009-e. *Pleurobrachia* spp archived for biobanking (Rec No. 24380009-#5). Six similar specimens, not imaged, were also included in the same tube for biobanking as a check for potential issues with DNA yield from one specimen.

Figure 3.6 Image identifier 24380009-f (panel a), 24380009-g (panel b), 24380009-h (panel c), Actinula larva archived for biobanking (Rec No. 24380009-#6) was that displayed in image 24380009-f. White box in panel b delineates the boundary of the magnified image of tentacles in panel C. Six similar specimens, not imaged, were also included in the same tube (Rec No. 24380009-#6) for biobanking as a check for potential issues with DNA yield from one specimen.

Figure 3.7 Image identifier 24380009-i. Actinula larva spp archived for biobanking (Rec No. 24380009-#7). This particular specimen exhibited morphological differences from those specimens in **Figure 3.6** and were thus archived separately.

3.1.2. Station 24380015

Gelatinous zooplankton were hand-picked from the total net sample and transferred to a clear petri-dish containing seawater. The remainder of the sample was passed through a 200um mesh and transferred in seawater to a 60mL plastic container and fixed with formalin which was labelled as 24380015 WP2 50m 1/1 (-Jellies) + Formalin. A selection of the hand-picked gelatinous

zooplankton were imaged under the microscope (Figures 3.8 to 3.15) and transferred to sterile 50mL falcon tubes and preserved in 99% Ethanol. The remaining gelatinous zooplankton specimens were preserved in formalin and labelled as 24380015 WP2 50m 1/1 Jellies + Formalin. Details of the specimens imaged and preserved in ethanol for DNA sequencing are summarized in Table 3.2

Table 3.2 Summary of the gelatinous zooplankton specimens imaged and removed for DNA sequencing from station 24380015.

Station	Image code	Magnification	Identity	Rec No.
24380015	a	0.75	*Pleurobrachia* spp.	24380015-1
24380015	b	1.25	*Aglanta digitales*	24380015-2
24380015	c	0.75	Unknown	24380015-3
24380015	d	1.25	Unknown	24380015-4
24380015	e	1.0	Unknown	24380015-5
24380015	f	1.6	Actinula larva	24380015-6
24380015	g	1.25	Unknown	24380015-7
24380015	h	0.75	*Aglanta digitales*	24380015-8

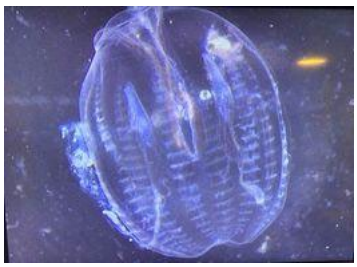

Figure 3.8 Image identifier 24380015-a. *Pleurobrachia* spp archived for biobanking (Rec No. 24380015-#1).

Figure 3.9 Image identifier 24380015-b. *Aglanta digitales* spp archived for biobanking (Rec No. 24380015-#2).

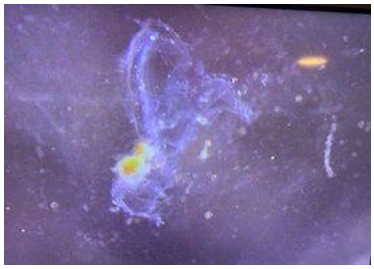

Figure 3.10 Image identifier 24380015-c. Unknown gelatinous zooplankton (potentially sea star larva) archived for biobanking (Rec No. 24380015-#3).

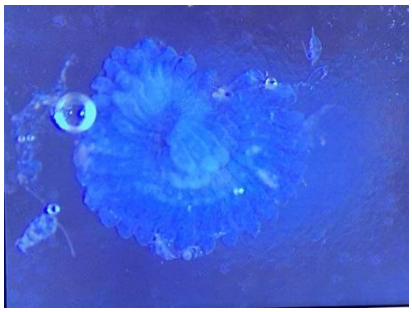

Figure 3.11 Image identifier 24380015-d. Unknown gelatinous zooplankton (potentially salp blastazooid) archived for biobanking (Rec No. 24380015-#4).

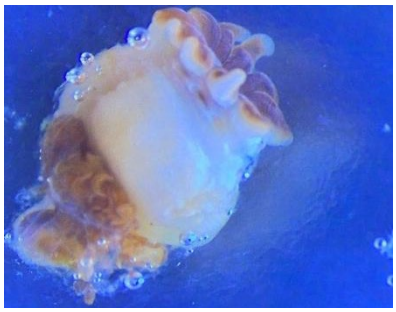

Figure 3.12 Image identifier 24380015-e. Unknown gelatinous zooplankton (potentially actinula larva) archived for biobanking (Rec No. 24380015-#5).

Figure 3.13 Image identifier 24380015-f. Actinula larva archived for biobanking (Rec No. 24380015-#6).

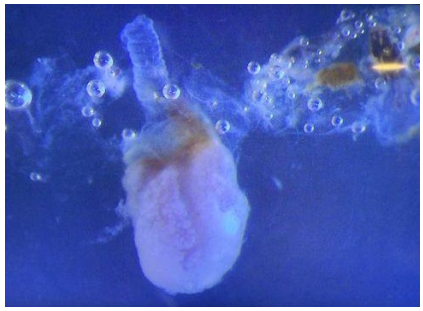

Figure 3.14 Image identifier 24380015-g. Unknown gelatinous zooplankton archived for biobanking (Rec No. 24380015-#7).

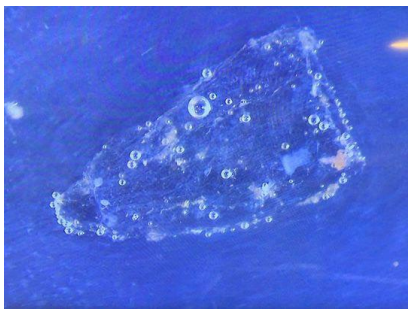

Figure 3.15 Image identifier 24380015-h. *Aglanta digitales* archived for biobanking (Rec No. 24380015-#8).

3.1.3 Station 24380028

Gelatinous zooplankton were hand-picked from the total net sample and transferred to a clear petri-dish containing seawater. The remainder of the sample was passed through a 200um mesh and transferred in seawater to a 60mL plastic container and fixed with formalin which was labelled as 24380028 WP2 50m 1/1 (-Jellies) + Formalin. A selection of the hand-picked gelatinous zooplankton were imaged under the microscope (Figures 3.16 to 3.19) and transferred to sterile 50mL falcon tubes and preserved in 99% Ethanol. The remaining gelatinous zooplankton specimens were preserved in formalin and labelled as 24380028 WP2 50m 1/1 Jellies + Formalin. Details of the specimens imaged and preserved in ethanol for DNA sequencing are summarized in Table 3.3

Table 3.3 Summary of the gelatinous zooplankton specimens imaged and removed for DNA sequencing from station 24380028. *The colonial radiolarians were transferred into a single tube for DNA archiving.

Station	Image code	Magnification	Identity	Rec No.
24380028	a	0.75	*Aglanta digitales*	n/a
24380028	b	0.75	Colonial radiolarian	24380028-1*
24380028	c	0.75	Colonial radiolarian	24380028-1*
24380028	d	1.25	Colonial radiolarian	24380028-1*
24380028	e	1.0	Colonial radiolarian	24380028-1*
24380028	f	1.0	Colonial radiolarian	24380028-1*
24380028	g	0.75	*Aglanta digitales*	n/a
24380028	h	1.25	*Aglanta digitales*	n/a
24380028	i	1.25	*Aglanta digitales*	n/a
24380028	j	1.25	*Aglanta digitales.*	n/a
24380028	k	1.25	*Aglanta digitales*	n/a

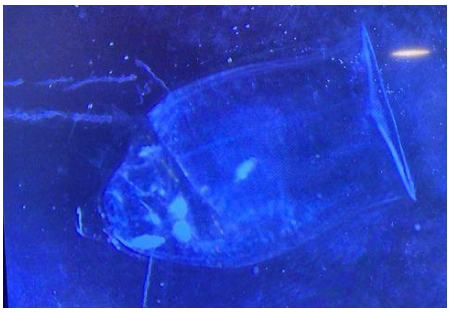

Figure 3.16 Image identifier 24380028-a. *Aglanta digitales* archived for biobanking (Rec No. 24380028-#1).

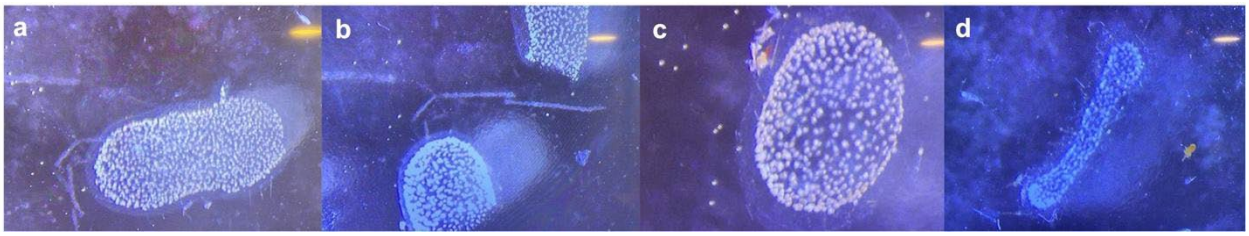

Figure 3.17 Image identifier 24380028-b (panel a), Image identifier 24380028-c (panel b), Image identifier 24380028-d (panel c), Image identifier 24380028-e (panel d). Colonial radiolarians combined into one tube and archived for biobanking (Rec No. 24380028-#1).

Figure 3.18 Image identifier 24380028-f. Colonial radiolarian, showing an example of how easily the specimen fragmented upon handling.

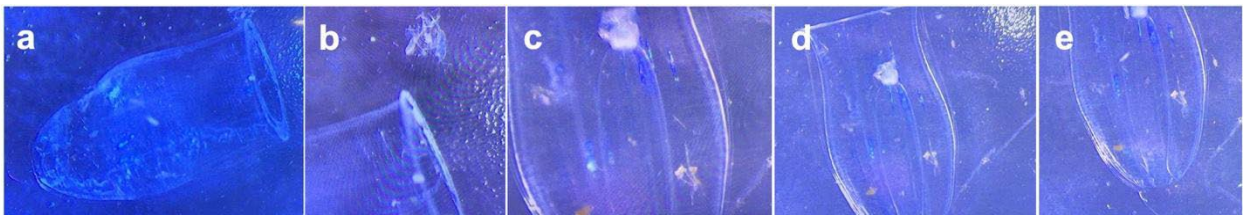

Figure 3.19 Image identifier 24380028-g (panel a), Image identifier 24380028-h (panel b), Image identifier 24380028-i (panel c), Image identifier 24380028-j (panel d), 24380028-j (panel k). Shows several images of *Aglanta digitales* specimens. Panel b shows three copepods ensnared in a tentacle close to the bell margin. Panels c and d show a close up of the tubular gastric peduncle, extending from the tip of the bell and terminating in the manubrium (mouth and lips). Panel e shows the tapered tip of the transparent bell, which appears like a small "hat".

3.1.4 Station 24380032

The WP2 net sample retrieved from 24380032 was characterized by a large number of chained siphonophores that aggregated and fragmented easily. A small sub-sample of these siphonophores, along with other gelatinous zooplankton were hand-picked from the total net sample and transferred to a clear petri-dish containing seawater. The remainder of the sample was passed through a 200um mesh and transferred in seawater to a 60mL plastic container and fixed with formalin which was labelled as 24380032 WP2 50m 1/1 (-Jellies) + Formalin. A selection of the hand-picked gelatinous zooplankton were imaged under the microscope (Figures 3.20 to 3.22) and transferred to sterile 50mL falcon tubes and preserved in 99% Ethanol. The remaining siphonophores and leptomedusa specimens were preserved in formalin and separately labelled as 24380015 WP2 50m 1/1 Jellies (Siphon + Formalin) and 24380015 WP2 50m 1/1 Jellies (Lepto + Formalin). Details of the specimens imaged and preserved in ethanol for DNA sequencing are summarized in Table 3.4

Table 3.4 Summary of the gelatinous zooplankton specimens imaged and removed for DNA sequencing from station 24380032. *The Apolemia specimens were transferred into a single tube for DNA archiving.

Station	Image code	Magnification	Identity	Rec No.
24380032	a	None	Whole sample*: Apolemia* spp.	n/a
24380032	b	None	Whole sample*: Apolemia* spp.	n/a
24380032	c	None	Whole sample*: Apolemia* spp.	n/a
24380032	d	0.75	*Leptomedusa* spp.	n/a
24380032	e	1.6	*Leptomedusa* spp.	n/a
24380032	f	0.75	*Apolemia* spp.	24380032-1*
24380032	g	0.75	*Apolemia* spp.	24380032-1*
24380032	h	0.75	*Apolemia* spp.	24380032-1*
24380032	i	0.75	*Apolemia* spp.	24380032-1*

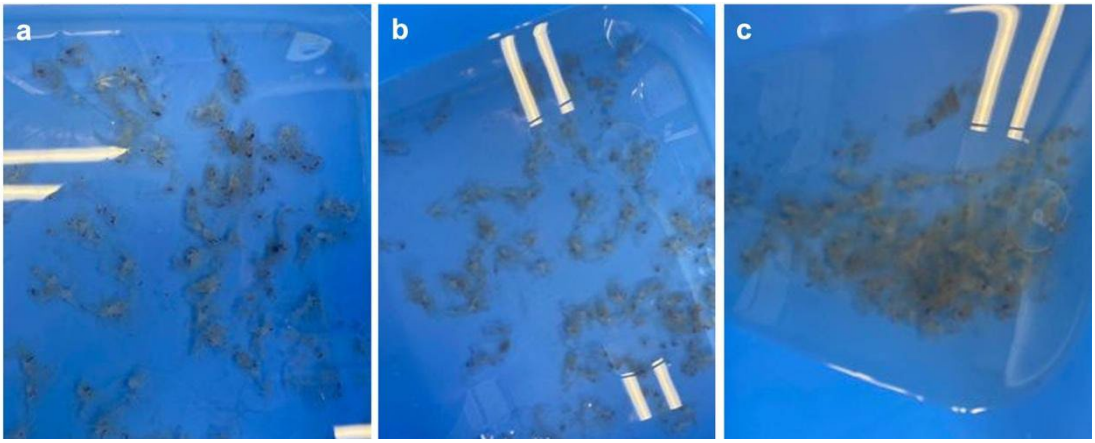

Figure 3.20 Image identifier 24380032-a (panel a), Image identifier 24380032-b (panel b), Image identifier 24380032-c (panel c) shows several images of *Apolemia* spp. siphonophores ("string jellies"). These images show the whole WP2 net sample from station 0032 following it's retrieval into the plastic bowl. The chains were between 5-15cm in length and extremely "sticky" and fragile, fragmenting easily upon physical disturbance. Panel c shows the individual specimens flocculating when gathered in the corner of the container.

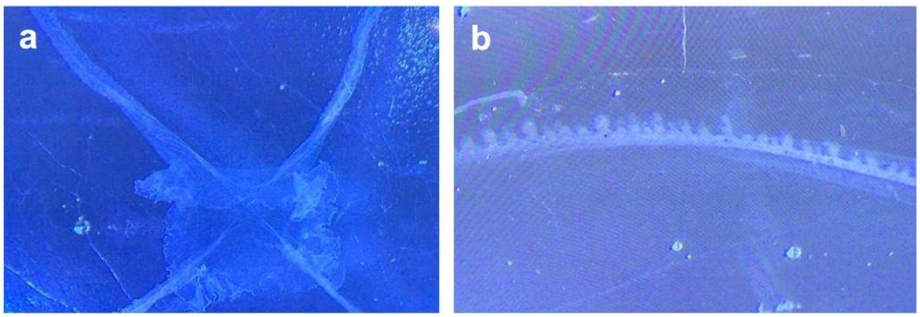

Figure 3.21 Image identifier 24380032-d (panel a), Image identifier 24380032-e (panel b) showing several magnified images of *Leptomudusa* spp. Panel (a) shows the centre of the bell and the four radial canals merging at the manubrium in the center. The elongated gonads along the radial canals are visible. Panel (b) shows the margin and the numerous bulb-like structures (ocelli) distributed along the margin.

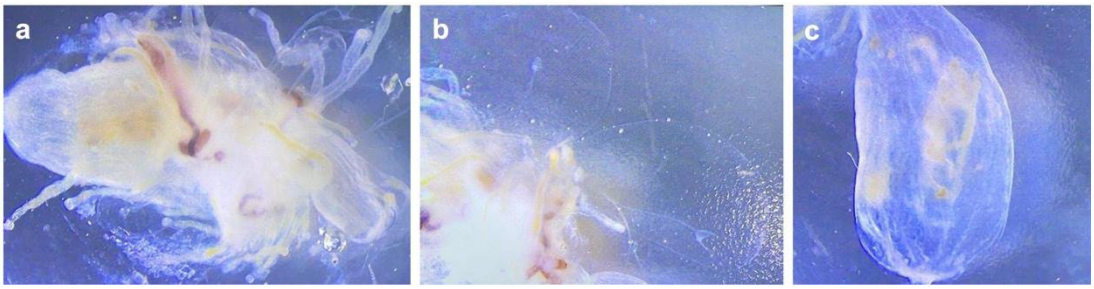

Figure 3.22 Image identifier 24380032-f (panel a), Image identifier 24380032-g (panel b), and Image identifier 24380032-h showing several magnified images of *Apolemia* spp. These specimens, along with some others were included as part of Rec No. 24380032-1 for sequencing. Panel a shows several palpons and a gastrozooid. Panel b shows two bracts. Panel c shows a gastrozooid.

3.1.5 Station 24380039

Station 24380039 was characterized by a large number of small larva type individuals (Figure 3.25). Gelatinous zooplankton were hand-picked from the total net sample and transferred to a clear petri-dish containing seawater. The remainder of the sample was passed through a 200um mesh and transferred in seawater to a 60mL plastic container and fixed with formalin which was labelled as 24380039 WP2 50m 1/1 (-Jellies) + Formalin. A selection of the hand-picked gelatinous zooplankton were imaged under the microscope (Figures 3.23 to 3.26) and transferred to sterile 50mL falcon tubes and preserved in 99% Ethanol. The remaining gelatinous zooplankton specimens were preserved in formalin and labelled as 24380039 WP2 50m 1/1 Jellies + Formalin. Details of the specimens imaged and preserved in ethanol for DNA sequencing are summarized in Table 3.5

Table 3.5 Summary of the gelatinous zooplankton specimens imaged and removed for DNA sequencing from station 24380039. *Two individuals of the unknown specimen were placed in 24380039-1 for sequencing. Numerous (10-12) individuals of this unknown specimen were placed in a 24380039-2 for sequencing.

Station	Image code	Magnification	Identity	Rec No.
24380039	a	0.75	*Agalma elegens*	24380039-1*
24380039	b	0.75	*Agalma elegens*	24380039-1*
24380039	c	0.75	*Agalma elegens*	24380039-1*
24380039	d	0.75	*Agalma elegens*	24380039-1*
24380039	e	0.75	*Actinula* larva	n/a
24380039	f	0.75	*Actinula* larva	n/a
24380039	g	0.75	*Aglanta digitales*	n/a
24380039	h	0.75	Unknown	24380039-2*
24380039	i	1.6	Unknown	24380039-2*
24380039	j	2.5	Unknown	24380039-2*

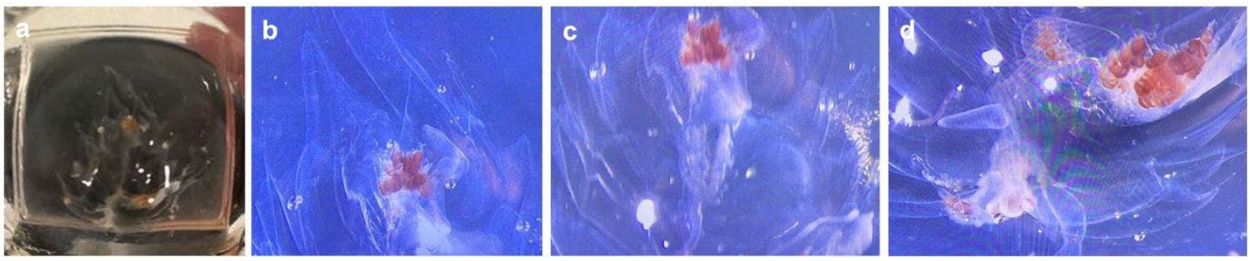

Figure 3.23 Image identifier 24380039-a (panel a), Image identifier 24380039-b (panel b), Image identifier 24380039-b (panel b), and Image identifier 24380039-b (panel b), several images of *Agalma* (likely *Agalma elegens*) This specimen, along with another were included as part of Rec No. 24380039-1 for sequencing. Panel a shows an intact specimen as viewed in the petri dish. Panels b, c and d show magnified images with visible piece of siphosome, with bracts (the transparent parts) and tentilla (the red parts). It is possible to make out two terminal filaments typical for the tricornuate tentilla of the genus.

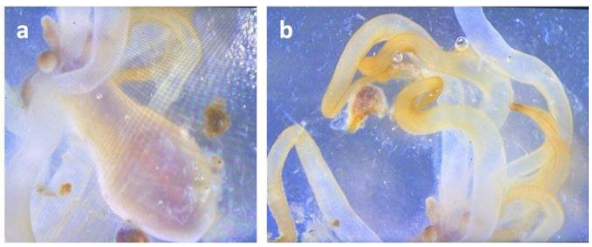

Figure 3.24 Image identifier 24380039-e (panel a), Image identifier 24380039-f (panel b), showing several magnified images of Actinula larva.

Figure 3.25 Image identifier 24380039-g, showing a magnified image of *Aglanta digitales*.

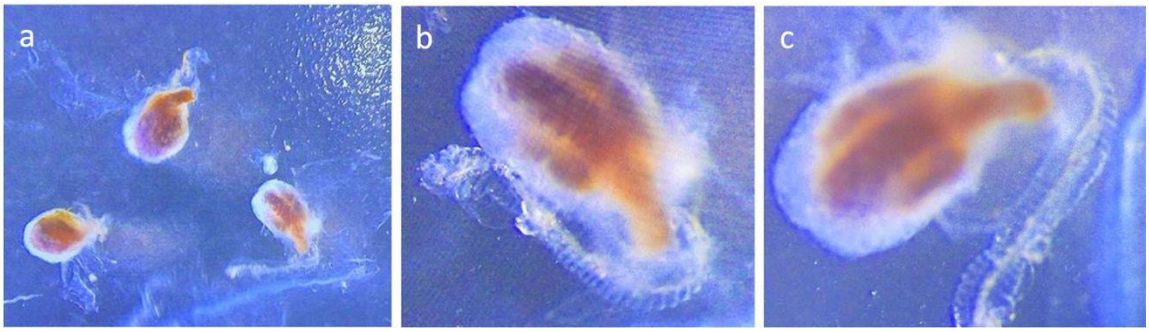

Figure 3.26 Image identifier 24380039-h (panel a), 24380039-i (panel b), 24380039-j (panel c), showing a magnified images of the very abundant unknown entity (possibly the remains of salps) found at this station. Approximately 10-12 of these individuals were transferred to ethanol as part of 24380039-2. These organisms were very numerous in the sample, amounting to between 50-100 in the total sample.

3.2 Demersal trawl observations

3.2.1 Station 24380049

Three large jelly fish specimens, approximately 15cm in diameter were recovered in the demersal trawl. These were photographed and small sections removed for sequencing.

Table 3.6 Images and record numbers of large jelly fish specimens recovered in the demersal trawl at station 24380049.

Station	Image code	Magnification	Identity	Rec No.
24380049	a	none	*Periphylla periphylla*	24380049-1
24380049	b	none	*Periphylla periphylla*	24380049-2
24380049	c	none	*Periphylla periphylla*	24380049-3

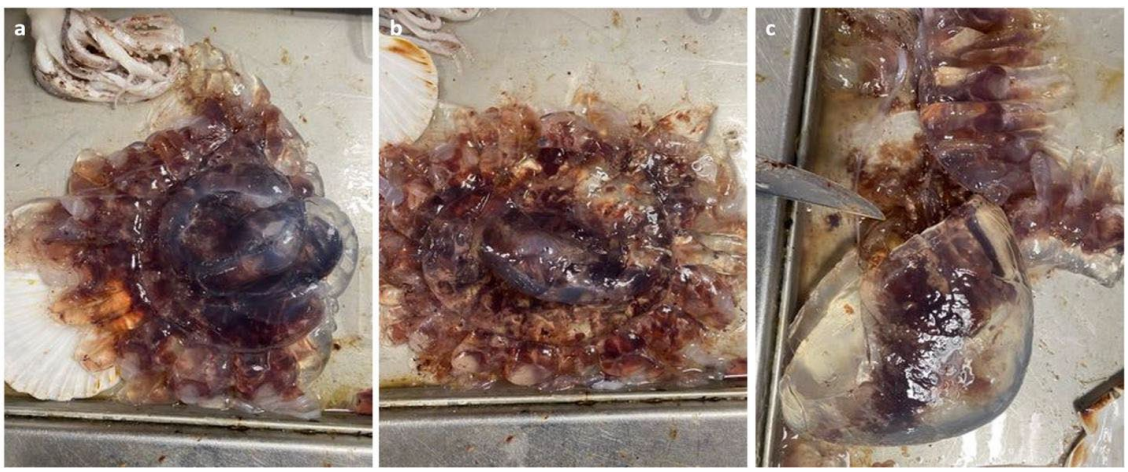

Figure 3.27 Image identifier 24380049-a (panel a), Image identifier 24380049-b (panel b), Image identifier 24380049-c (panel c) of *Periphylla periphylla* that were recovered in the demersal trawl. Subsamples of each of these specimens were stored in ethanol for DNA sequencing. See Table 3.6 for associated record numbers.

3.3 Stomach contents

The stomach content sampling was opportunistic based on the time availability of the fisheries scientists performing the analysis. During the survey, specimens from three locations were sampled on the Faroese bank for stomach content analysis. These are listed, along with the associated record number in Table 3.3.

Table 3.7 Summary of the gelatinous zooplankton removed from demersal fish stomachs for DNA sequencing.

Station	Record number	Fish species
24380008	#5026	*Melanogrammus aeglefinus*
24380012	#5026	*Melanogrammus aeglefinus*
24380042	#5025	*Melanogrammus aeglefinus*

4.Discussion

The weather conditions on the Faroe Bank during the survey period were uncharacteristically mild with quite low wind speeds (<10 m/s) for the majority of the trip. Only during the final day of the survey did wind speeds increase >10 m/s but no WP2 net casts were carried out on that day. The wind direction was predominantly southerly during the first few days, shifting to westerly north-westerly during the latter half of the cruise. The calm wind conditions facilitated easy deployment of the WP2 net and visual observations of the ocean surface which revealed an abundance of jellyfish observable from the ship.

A total of 49 images were collected and archived as part of this technical report. From these images it has been possibly to tentatively identify the following gelatinous zooplankton to at least genus level: Leptomedusa spp., Pleurobrachia spp., *Aglanta digitales*, Apolemia spp., Agalma elegens. Numerous examples of these specimens were preserved in ethanol for DNA sequencing to either confirm their taxonomic identification, improve taxonomic resolution or resolve species complexes. In addition three large specimens of *Periphylla periphylla* recovered from trawl samples were independently sample for DNA sequencing. A more general presentation of the ecological significance of these cases is presented below.

In addition to the specimens described above, there were a number of gelatinous zooplankton that remained elusive to taxonomically characterise. These included what appeared to be colonial radiolarian, Actinula larvae, sea star larva and components of salps. Examples of these specimens were also preserved in ethanol to verify their taxonomic identity. Additionally uncharacterised gelatinous remains removed from the gut of demersal fish recovered in the trawls were also preserved for sequencing. Combined with the samples described above, a total of 25 specimens were preserved for DNA sequencing.

4.1 *Leptomedusa* spp

Leptomedusa spp. were observed at all surveyed stations, albeit at low abundances (fewer than 5 individuals per haul). It remains unclear whether these specimens represent a single species or multiple species. Close-up images of the bell margin revealed the presence of ocelli, which are light-sensing organs. Ocelli, composed of clusters of photoreceptor cells, detect changes in light intensity and are believed to aid in environmental orientation and predator avoidance, particularly by sensing emerging shadows. There are few species of leptomedusae known to possess multiple

ocelli, including *Laodicea* spp., *Staurostoma* spp., and *Dipleurosoma* spp. Based on the number of ocelli and the presence of elongated gonads, the specimens are tentatively identified as *Laodicea undulata*. Observations from Norway suggest that *Laodicea undulata* may represent a species complex, and sequencing these specimens could help resolve this taxonomic uncertainty.

Leptomedusa species are within the class Hydrozoa, commonly found in marine environments ranging from coastal areas to the open ocean. Leptomedusa is the free-swimming, sexual reproductive stage of the life cycle of several hydrozoans. *Leptomedusa* produce gametes (eggs and sperm) that are released into the water column. Fertilization usually occurs externally, and the resulting zygote develops into a larva, which eventually settles and grows into a new polyp, continuing the cycle. The medusa is typically umbrella-shaped, with tentacles extending from the margin of the bell. They play a significant role in the marine food web, primarily as both predators and prey. Ecologically, *Leptomedusa* feed on a variety of small planktonic organisms, including copepods, larval fish, and other microscopic marine life. Using their tentacles, which are equipped with stinging cells (nematocysts), they capture and immobilize prey, contributing to the regulation of plankton populations. As mid-level predators, they help maintain the balance of planktonic communities and indirectly influence nutrient cycling in the marine ecosystem. *Leptomedusa* are also an important food source for higher trophic levels, including fish, larger jellyfish, and other marine predators. Their presence in the food web helps to transfer energy from the lower trophic levels, such as plankton, to higher ones, thereby supporting the productivity and stability of marine ecosystems. Furthermore, the gelatinous nature of *Leptomedusa* makes them a key component in the diet of species that specialize in consuming soft-bodied organisms, playing a crucial role in the diets of various marine animals.

4.2 *Pleurobrachia* spp

Pleurobrachia spp. were observed at three of the five stations on the Faroe Bank and their abundances ranged from 2-7 individuals per haul. It was not possible to distinguish the species of *Pleurobrachia* from the images but is most similar to either *P. bachei* or *P. pileus*. The observation of *Pleurobrachia* on the Faroe Bank is noteworthy because it has been a dominant component of zooplankton samples taken throughout 2024, with some indications that very large blooms occurred during the juvenile fish survey on the Faroese shelf during June 2024 (See Figure 3.28).

Figure 3.28 Example of contents of a juvenile fish trawl from June 2024 that is completely dominated by *Pleurobrachia* spp. individuals. Left panel shows a recieiving container from the trawl completely dominated by *Pleuorbrachia* spp individuals compared to juvenile fish. Right panel shows live Pleurobrachia specimens with visibile copepod prey inside.

Pleurobrachia spp. are not jellyfish, but ctenophores, meaning they lack nematocysts and do not sting their prey. Instead, they use colloblast cells, which secrete a sticky mucus to capture prey. *Pleurobrachia* spp. are approximately 15mm in diameter and slightly oval in shape. They use their sticky tentacles to capture small zooplankton, copepods, and fish larvae (1-5mm in length). When *Pleurobrachia* spp. populations bloom, their feeding behavior can significantly impact zooplankton populations, leading to cascading effects in marine ecosystems (Purcell 1985; Purcell, Uye, and Lo 2007). By consuming large quantities of zooplankton, *Pleurobrachia* spp. directly compete with juvenile fish for the same prey resources (Purcell and Arai 2001). This competition can result in reduced availability of copepods and other essential prey, which are crucial for the growth and survival of juvenile fish, consequently juvenile fish may experience slower growth, weakened condition, and higher mortality rates due to starvation or increased vulnerability to predators. These effects can lead to lower recruitment success and negatively impact fish populations in the long term (Bailey and Houde 1989; Lynam et al. 2005).

4.3 *Aglantha digitales*

Aglantha spp. were encountered in all of the samples, typically at abundances of around 5-10 individuals per haul. *Aglantha digitale* is the only known species in the region and so we tentatively assign these specimens their full species name. *A. digitale* is a small pelagic hydrozoan with a transparent bell-shaped medusa that is around 15 to 20mm in length. Typically, it has eight large tentacles, interspaced with smaller tentacles around the bell margin which are used for capturing prey. The tentacles contain specialized cells called nematocysts which are used for immobilizing prey. *A. digitale* contains ocelli which are used for detecting changes in light intensity that help in orientation and predator avoidance. *A. digitale* is well known and studied for its two different swimming mechanisms, a slow, regular swimming mode and a rapid escape response (Mackie 1980). The latter is unique among medusa and controlled by a specialized giant axon system (Satterlie, 1985). When threatened by a predator, it can quickly contract its bell and use jet propulsion to escape at high speeds.

Although it is one of the most abundant hydrozoans comprising gelatinous zooplankton communities in the northern hemisphere (Aizawa, Gao, and Yamaguchi 2023; Mańko, Gluchowska, and Weydmann-Zwolicka 2020; Williams and Conway 1981), and appears to be linked to Atlantification of the Arctic (Mańko et al. 2022), little to nothing is known about its distribution, abundance and ecological significance in the Faroese marine ecosystem. However, from other regions it is known as a versatile predator that moves through different size spectra of planktonic prey during it's ontogenetic development (Pagès, González, and González 1996). Smaller specimens consume protists (Williams and Conway 1981) whilst larger individuals feed on different life cycle stages of copepods (Pagès et al. 1996) It has also been shown to serve as a prey item for certain pelagic fish species that are commercially important for the Faroese economy, e.g. Atlantic Mackerel (Runge, Pepin, and Silvert 1987).

4.4 *Apolemia (uvaria)*

At station 24380032, colonies or chains of *Apolemia* (likely *A. uvaria*) were found in notable abundance. The observed colony lengths ranged from 5 to 10 cm, though both the size and number of colonies were difficult to accurately assess. The colonies were fragile and easily fragmented during sample handling. Figure 3.20 provides an illustration of the material recovered using the WP2 net.

Apolemia uvaria, often referred to as the "string jellyfish," belongs to the order Siphonophorae within the phylum Cnidaria, which includes organisms like jellyfish, corals, and sea anemones.

Unlike individual organisms, siphonophores like *A. uvaria* are colonial, composed of specialized and interconnected units called zooids, each performing specific functions such as feeding, reproduction, or movement. In appearance, *A. uvaria* is long, string-like, and delicately pink (see Figure 3.20c). It is a predator, feeding primarily on small fish and zooplankton. Its tentacles house stinging cells called nematocysts, which immobilize prey by delivering venom, and gastrozooids, which digest the captured food. *A. uvaria* plays a crucial role in the pelagic food web, both as a predator controlling populations of small fish and plankton, and as prey for larger predators, including fish and other deep-sea organisms.

Apolemia uvaria typically inhabits deep pelagic environments but is also found in coastal systems. In late 1997, significant numbers of *A. uvaria* were observed along the Norwegian coast and were linked to the death of farmed salmon (Båmstedt et al. 1998). More recently, in December 2023, another incident occurred in Norwegian waters where an influx of *A. uvaria* (locally known as "pearl-chain" or Perlesnormanet in Norwegian) led to the culling of approximately 1.2 million salmon by the aquaculture company SalMar, due to welfare issues caused by the stinging cells of *A. uvaria*. (https://weareaquaculture.com/news/aquaculture/salmar-loses-12-million-salmon-to-toxic-jellyfish-in-november). The sighting of *A. uvaria* on the Faroe Bank is noteworthy, as it indicates the presence of this species in the region, even though it is some distance from Faroese aquaculture facilities. This observation could be significant for understanding large-scale connectivity patterns, as it is currently believed that stinging jellyfish are transported toward the Norwegian coast via Atlantic water masses, such as those around the Faroe Islands. The observation has been shared and reported as part of the international JellySafe project.

4.5 *Algalma elegens*

Algalma elegans was detected at station at 24380039. It appeared as a quite large fragment of colony. Similar to *Apolemia uvaria*, *A. elegans* is a colonial siphonophore. It is in the order Physonectes, characterized by colonies with a gas-filled bell (pneumatophore) and swimming bells (nectaphores). Gonzozooids are reproductive zooids that allow the colony to produce offspring. Similar to other siphonophores, *A. elegens* is a carnivorous organism that captures small prey such as zooplankton and small fish using its tentilla (fishing filaments). These are identified as red tentilla in Figure 3.23. It is found in pelagic open ocean environments, often at great depths, and is thus difficult to study and little is know in detail about its ecology. Although adapted to living in the deep-sea, *A. elegens* can be found in surface waters, particularly during the night due to vertical diel migration. The specimen recorded here was sampled somewhere between the surface and 50m, over a water column with a depth of 176m at 08:24 (UCT).

4.6 *Periphylla periphylla*

Three specimens of *Periphylla periphylla* (helmet jellyfish), were retrieved from the demersal trawl at station 23480049 with a bottom depth of 288m. It is not possible to specify if the organisms were caught in the trawl at its deployment depth (300m), or were captured during recovery at some depth shallower. Day light is deadly for the younger helmet jellyfish and damaging for adults, which is why the jellyfish produces porfyrin, which give red colour to the tissue (Figure 3.27) and protect them from light. This indicates the specimens were caught deeper in the water column. The time of the trawl was 05:40 so it may have been returning to depth following a surface feeding event. Generally, the observation of *P. periphylla* on the shallow Faroese bank is noteworthy as it is typically considered a deep-species living at meso- and bathypelagic depths (>1000m) (Arai 1997; Morita et al. 2017). In some instances it has been considered as an effective competitor for fish due to its high growth rates, long-life spans and high reproductive success (Båmstedt et al., 2020; Jarms et al., 1999).

Although it is principally distributed in the deep ocean, diel vertical migration of *P. periphylla* and surface detection have been reported (Geoffroy et al. 2018; Youngbluth and Båmstedt 2001). As it migrates through the water layers it preys on plankton organisms such as copepods, krill, chaeognaths and ostracods, returning to depth. It has been commonly detected in deep Norwegian fjords, occasionally with long-lasting aggregations (Dalpadado et al. 1998; Jarms, Tiemman, and Båmstedt 2002; Tiller et al. 2017). Here we record its presence on the Faroe Bank. The large size of the specimens, with coronal diameters around 7cm, suggest these were developmentally mature specimens, with a possible age of 3-4 years (Jarms et al. 2002). Whether these *P.periphylla* specimens are resident to the Faroe Bank, or have been advected in remains unclear. *P. periphylla* have a holoplanktonic life cycle lacking the polyp stage (Aberle et al. 2024) and reproduce year round. Their presence might indicate changes in water mass distribution or influence, or better feeding conditions as fish stocks have recovered in recent years. There are still many unanswered questions regarding how they compete with juvenile fish for food and how they influence the rest of the ecosystem.

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