Comparative feeding ecology of roundnose grenadier *(Coryphaenoides rupestris)* in Norwegian fjords

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Thesis submitted in partial fulfillment of the requirements for the degree

Master of Biodiversity, Evolution and Ecology

by

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June 2017

Acknowledgements:

First of all, I would like to thank my supervisor Anne Gro Vea Salvanes from the University of Bergen. Without your valuable feedback, comments and support I would not have been able to succeed my Master of Science.

Furthermore, I would also like to thank Knut Helge Jensen, Richard Telford and Camilla Håkonsrud Jensen for guidance and cheering in the mystical world of R. I must also thank Frank Midtøy and Heikki Savolainen for the encouragement and help during my lab period.

Besides helping hands, I would also like to thank a couple of persons which have been persistent and motivating during my thesis;

I want to thank Aurélien Delaval for all the collaboration during field work and dissections, as well as motivation, fun times and social events. A special thanks to Inger Danielle Hjartaaker for impulsive trips, motivational support in and outside the reading room, and also social evenings which have kept me mentally balanced. My best friends, Ane Roppen and Ina Marie Solem, thank you for just being you. You have lifted me up and kept me on point every day, even through dark times.

My wonderful parents, Anne Grethe Stenseng Høie and Reidar Høie, thank you for mental and financial support, who enabled me to finish my Master of Science and made sure I could keep my everyday hero, Odin, which have kept me motivated all the way to the finish line.

Thank you,

Janne Stenseng Høie

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Abstract:

In the ocean, energy is transferred from the productive primary producers at the surface, down to the demersal fish fauna at the sea floor. When moving away from the surface layer, there is a decline in food availability, and demersal fish species has evolved different feeding strategies due to this (Merrett and Haedrich, 1997). Even though many studies have researched feeding ecology of demersal fish species in the ocean, little is known about the feeding ecology of demersal fish species in fjords. The aim of this thesis was to investigate the feeding ecology of roundnose grenadier (*Coryphaenoides rupestris*), a demersal fish species, in two Norwegian fjords. Three hypotheses were predicted; (1) that the diet would consist of mesopelagic fish and invertebrates, and benthic crustacean. (2) That diet and food composition would differ between the fjords. (3) Due to the importance of pelagic prey, a difference in prey composition and food amount would be found as a diurnal pattern, and there will be evidence that grenadiers migrate upwards during day or night to feed on pelagic prey. Stomach content of 303 roundnose grenadiers were analyzed to investigate importance of prey groups and differences between and within fjords. Pre-anal fin-length, weight, gonadosomatic index and hepatosomatic index were measured and calculated. In total, the diet consisted mostly of pelagic and benthic crustaceans, 19 % consisted of non-crustacean taxa. No major differences were found in prey composition between the fjords, with the exception of chaetognaths, which were only found as prey in Masfjord. Size of the grenadier influenced the foraging upon polychaetas and euphasids. Fish from Lustrafjord had more stomach content relative to body weight, while the Masfjord population had a higher distribution of sexually matured fish and more stored resources in the liver. There were no clear diurnal differences in consumed prey taxa or in food amount, but in general, pelagically caught fish contained more pelagic prey. Overall, diet analyses showed that roundnose grenadiers from two Norwegian fjords utilize food resources in both pelagic and demersal zone, and that size has an effect when specializing on specific prey groups such as krill and polychaetas. The feeding ecology of *C. rupestris* is similar to other populations in the Northwest-Atlantic, and they feed mostly on Amphipoda, Copepoda, Euphausiacea, Polychaetae and Mollusca, and are classified as 2nd or 3rd carnivorous consumer. Low amounts of fish found in the stomach content revealed that they rarely feed on fish. Diet consisted both of pelagic and benthic prey, no clear diurnal differences were found. Although the importance of pelagic prey was found, a diel vertical migration pattern could not be confirmed.

1. Introduction:

Primary producers make the foundation of the oceans food web. The energy is transferred through the pelagic food web, all the way down to demersal fish fauna at the sea floor. The deep sea is described as an unproductive abyssal area where there is no photosynthetic production, and deep-sea animals are dependent on the surface energy derived through the food chain (Merrett and Haedrich, 1997). The standing stock of plankton and micronekton shows a typical decreasing pattern correlated with depth in the North Atlantic Ocean. This emphasizes the decline in food availability when moving away from the surface layer (Angel, 1982). Decline in biomass production have caused adaptations in different feeding strategies within assemblages of deep sea demersal fish species (Haedrich and Merrett, 1992). The deep sea demersal fish feed on a variety of organisms. Marshall and Merrett (1977) have described three different feeding patterns from which their prey preference is either benthic or pelagic, or if the demersal fish species have a mixed diet and feeds on both pelagic and benthic prey. Diets studies from deep water fish species has shown that demersal species preys upon pelagic species during daytime, and that there is an overlap in depth range between the prey and predator, and this overlap could be caused by diel vertical migration cycle (Mauchline and Gordon, 1991).

Diel vertical migration (DVM) is a cyclic phenomenon in many marine and freshwater species. The observed pattern include that animals migrate vertically in the water column according to changes in light during dusk and dawn. The most common observation is that animals ascend to more shallow water at night, while they occupy deeper water layers during day (Busch and Mehner, 2011). The diel vertical migration pattern is closely related to a trade-off between foraging and antipredator behavior. Primary producers and visual predators are light dependent (Loose and Dawidowicz, 1994, Busch and Mehner, 2011), and the food availability and predator abundance is greatest at the surface. Downward migration for prey is beneficial during day time since the risk imposed by visual predators are higher during daylight hours, while migrating upwards during dusk increases the optimal foraging efficiency (Loose and Dawidowicz, 1994).

The demersal Macrouids is one of the most abundant families of the demersal deep-sea fishes in the North Atlantic, and their diet has shown to be very diverse with variable composition from scavenged food to benthic and pelagic prey (Merrett and Haedrich, 1997). Comparative investigation of different Macrourid feeding niches show that depth distribution and feeding habitats makes an ecological separation, and for the different species the diet varies in fish size, depth and region (Carrassón and Matallanas, 2002, Hoff *et al.*, 2000). The Macrourids have low metabolic rates (Seibel and Drazen, 2007) and it has been suggested that some Macrourid species may have a biannual reproductive cycle, since the females may need time to produce adequate energy stores to spawn (Devine *et al.*, 2012, Alekseyev *et al.*, 1992). Mature fish are shown to store energy reserves in the liver to supply the energy demands of spawning (Love, 1970), and Macrourid females studied with ripening ovaries has showed to have significantly lower amount of resources stored in the liver. Seasonal or interannually variation in food abundance and feeding activity has been discussed to affect the fishes' energetic storage and status (Drazen, 2002). In general, despite Macrourids high abundance and essential ecosystem services in the North-Atlantic, little is known of their feeding habits (Drazen *et al.*, 2001).

Coryphaenoides rupestris – roundnose grenadier:

Coryphaenoides rupestris is a deep-water fish in the family Macrouridae. Its distribution (figure 1.1) extends along shelves and deep sea areas of USA, Canada, Greenland, Mid-Atlantic ridge and Western Europe (west of Britain, France, Spain), Northern Africa as well as in fjords along Norway, in the Norwegian and North Sea (Bergstad *et al.,* 2003). In the Norwegian Deep Sea, *C. rupestris* is the only member of the Macrourid family that is found regularly and is therefore considered as a dominant member of the species assemblage in the Norwegian Deep. It is found at great depth, from ≥300 m, and the fish is defined as benthopelagic (Bergstad, 1990). The organism is slow growing and long-lived, the oldest grenadier reported is 72 years, and was found through otolith analysis, but it is believed that individuals can be much older (Bergstad, 1990, Devine *et al.*, 2012).

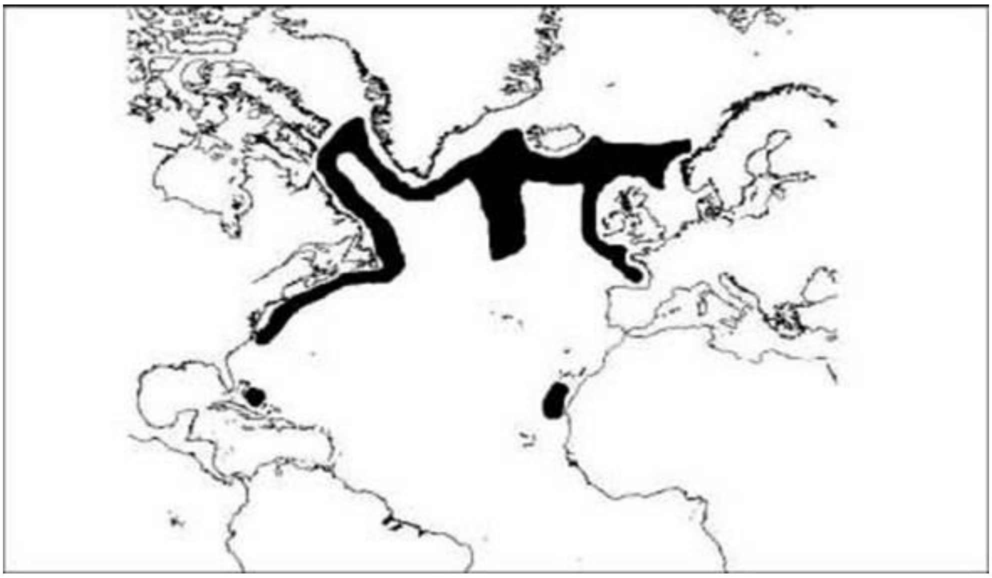


Figure 1.1: Map showing the distribution of *Coryphaenoides rupestris* on the northern hemisphere (shown in black) (COSEWIC, 2009).

The roundnose grenadier (figure 1.2) have a short and compressed body with a long and sharp pointed tail, which is typical for the Macrouridae family. Roundnose grenadier is a typical deep-water fish with a rounded head and big eyes, adapted to life on sea bottom where there is little light (Merrett and Haedrich, 1997). The body coloration is often grey to brown with dark colored parts by the mouth, gill cavity and fins (Iwamoto, 1990). Macrourids have adapted an extended lateral line system around the head and nose to increase the non-visual senses, in a habitat with low visibility. The atmospheric pressure in the deep sea is higher than at the surface (500 atm at 5000 m) and this affects the gas exchange in the swim bladder. For the swim bladder to work correctly, grenadiers have adapted a large liver with increased oil concentration as a buoyancy regulator, while the swim bladder secretes gas to maintain equilibrium (Merrett and Haedrich, 1997).

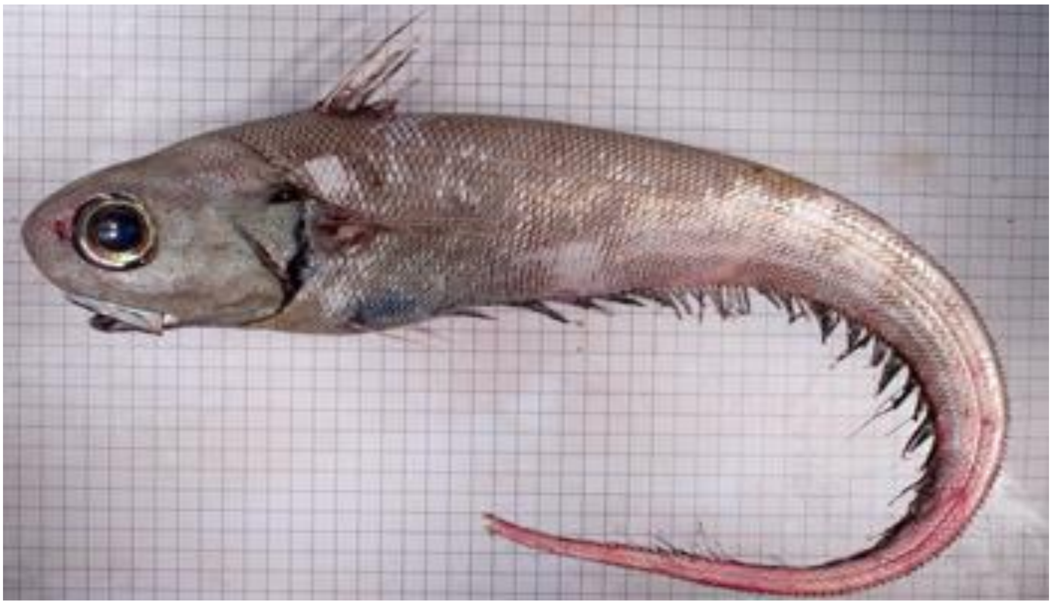


Figure 1.2: The roundnose grenadier (*Coryphaenoides rupestris*), Photo: Neat (2008).

Populations under pressure:

C. rupestris have been a commercially exploited species, both through direct fishing and as a product of by-catch. In the late 1950's a directed fishery was established in Canadian waters, along Labrador and the Newfoundland Shelves, with an average reported catch of 26,000 ton per year from 1967-1978. From the 1980s until early 1990s the targeted fishing dropped drastically from 5000 ton – 600 ton per year (Atkinson, 1995).

Since the roundnose grenadier has a slow growth rate, late maturity and low fecundity the species is fairly vulnerable to overfishing and bycatch since populations use long time to recover to a sustainable level (Baker *et al.*, 2009). The populations have declined in the Canadian waters, as well as Skagerrak and in the North Sea. The most recent report showed that the species has declined with 90 % over 40 years at the coast of Canada (FAO, 1990). In 2008, *C. rupestris* was listed by the Committee on the status of endangered wildlife in Canada as endangered, and in 2014 it was listed as critically endangered on IUCN's red list (Devine *et al.*, 2012) (FAO, 1990).

Reproduction and spawning

Several studies have determined the reported maturation age and length for roundnose grenadier, but the results vary according to locations. In Rockall Trough, age of first maturation was reached at 13 cm pre-anal fin-length (Gordon and Hunter, 1994), while in Skagerrak it was reported to happen at 10 years of age and 11 cm pre-anal fin-length (Bergstad, 1990). West of the British Isles the maturation age is between 9-11 years of age (Kelly *et al.*, 1996). Comparison of different estimations from sites in the North Atlantic have shown that the age of maturation ranges between 8-14 years (Devine *et al.*, 2012). There has also been conflicting results about spawning season (Allain, 2001). Some have reported a long spawning season from July to August (Kelly *et al.*, 1996), others have concluded with a short spawning season happening in mid-April (Geistdoerfer, 1979), and several studies have reported that the roundnose grenadier have a prolonged spawning period throughout the year, with one major spawning occurring in autumn (Bergstad, 1990, Gordon and Hunter, 1994, Magnússon and Magnússon, 1995).

Diet and diel vertical migration:

Previous studies have shown that *Coryphaenoides rupestris* feed on different deep-sea invertebrates such as amphipods, squids, and pelagic crustaceans (Bergstad, 1990, Podrazhanskaya, 1967). In Skagerrak, hyperbenthic crustaceans were the dominant prey, but the pelagic euphasid *Meganyctiphanes norvegica* was also present in the diet (Bergstad *et al.*, 2003). Other taxa found were mostly planktonic or hyperbenthic organisms and detritus. The diet of *C. rupestris* in Skagerrak is sustained by both pelagic and hyperbenthic organisms (Bergstad *et al.*, 2003, Mauchline and Gordon, 1984, Mauchline and Gordon, 1991). Stomach content from grenadier populations on the Mid-Atlantic ridge shows that *C. rupestris,* mainly feed on cephalopods, pelagic shrimps and fish. For large individual's shrimps and fish were most important, while as for the young and small individuals the cephalopods was considered as the most important prey (Bergstad *et al.*, 2010). Since pelagic prey is found in the diet of *C. rupestris,* it is believed that the predators may migrate vertically in the water column to eat different types of pelagic species. Either way, energy transfer to the sea floor either comes from migrating predator or from mesopelagic migrating prey (Haedrich and Henderson, 1974).

Fjords on the west coast of Norway inhabits roundnose grenadiers, and mikronekton and zooplankton in the fjords have diel vertical migration patterns (Balino and Aksnes, 1993). The mikronecton biomass mainly consists of the mesopelagic species *Benthosema glaciale, Maurolicus muelleri, Pashiphea multidentata, Sergestes arcticus* and *Meganyctiphanes norvegica*. The animals have been well studied in Masfjord, and stomach content analyses showed that mesopelagic fish follow the vertical migration pattern of the zooplankton, and that they typically stay deeper during the day than at night (Giske *et al.*, 1990). In fjords, the pelagic processes and vertical migration behavior of mesopelagic fish has been studied extensively, but few studies have incorporated specific analyses of energy transfer from surface layer to deep-living demersal fish (Bergstad *et al.*, 2003).

Aim and hypothesis:

The major aim of this thesis is to study the diet and feeding ecology of roundnose grenadier in two different fjords, Masfjord and Lustrafjord, in Norway. Few fjord studies have described the energy transfer from surface layer to deep-living demersal fish, and little is known about fjords in relation to demersal fish species feeding ecology (Bergstad *et al.*, 2010). Several studies point out that the grenadier may feed on both pelagic and demersal organism (Mauchline and Gordon, 1984, Mauchline and Gordon, 1991, Bergstad, 1990, Bergstad *et al.*, 2003, Bergstad *et al.*, 2010, Gushchin and Podrazhanskaya, 1984). We therefore hypothesize that the fish in the fjords will feed on mesopelagic fish and invertebrates, and benthic Crustacea.

However, food-spectra, trophic relationships, spawning period and size for roundnose grenadiers have shown to vary within different regions in the North-Atlantic (Gushchin and Podrazhanskaya, 1984, Bergstad *et al.*, 2003, Bergstad *et al.*, 2010, Mauchline and Gordon, 1984), and the differences may be linked to prey abundance, environmental conditions, and the trophic structures of the demersal communities in the different regions (Gushchin and Podrazhanskaya, 1984, Bergstad, 1990, Allain, 2001). Since the two fjords are in different regions, we hypothesize that food spectra and prey compositions for the two fjord populations will differ, and that the amount of food eaten depends on resource allocation and size, with respect to maturity and sex.

Some studies and fishery catch data has shown evidence for diurnal migration pattern of the roundnose grenadier, which can also be explained as an overlap between migratory prey and predator (Bergstad, 1990, Bergstad *et al.*, 2003, Haedrich and Henderson, 1974, Merrett and Haedrich, 1997, Pechenik and Troyanovsky, 1970). Many findings show that roundnose grenadier eats pelagic prey species, but it is not known if this is due to a diel vertical migration pattern from the predator, or if its caused by downward migration from prey during daytime. Therefore, we hypothesize that the roundnose grenadiers in Masfjord and Lustrafjord eat pelagic prey, and that the predator migrates upwards during night or day to feed on pelagic prey.

2. Materials and method

Study area and collected materials:

Masfjord and Lustrafjord (figure 2.1.) are two Norwegian fjords, located on the west coast of Norway. Masfjord is 20 km long with an average width of 1 km, maximum depth at 494 m with a sill located at 75 m depth between Fensfjord and Masfjord (Balino and Aksnes, 1993). Lustrafjorden is a 40 km long tributary fjord of Sognefjord (Aasen, 1952). The roudnose grenadier was one of several fish species sampled during the annual field courses in Masfjord (2011-2016) and in Lustrafjord (2016), an overview of collected materials is shown in table 2.1 The surveys have been part of an obligatory field course, for the marine biology master program at UiB.

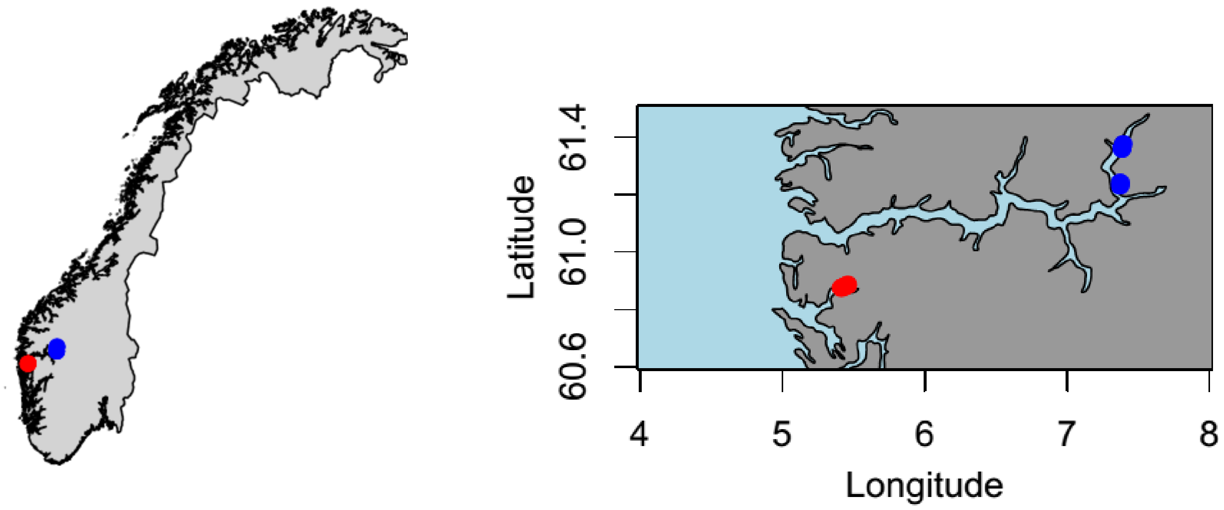


Figure: 2.1: Left: shows the location of Masfjord (red point) and Lustrafjord (blue point) in Norway. Right: Map of study areas and sampling stations.

Table 2.1: An overview of collected materials of roundnose grenadier (*Coryphaenoides rupestris*), caught with pelagic and bottom trawl in Masfjord, 2012, 2015 and 2016 (only pelagic trawling). In 2016, it was also collected materials from Lustrafjord.

Location	**Year**	**Data collected**
Masfjord	2012	Trawl data Fish frozen onboard and transported to UiB
	2015	Trawl data Fish frozen onboard and transported to UiB
	2016	Pre-anal fin-length (cm), weight (g), gutted weight (g) and otoliths. Gonads, liver and stomach (not everted) was frozen and transported to UiB.
Lustrafjord	2016	Pre-anal fin-length (cm), weight (g), gutted weight (g) and otoliths. Gonads, liver and stomach (not everted) was frozen and transported to UiB.

Roundnose grenadiers were sampled from both pelagic and demersal zone using trawls. The demersal zone was covered using a Campelen 1800 bottom trawl with one cod-end (opening ~50 m, 4-5 meter high). With bottom trawl, 151 individuals were caught in Masfjord in 2012, 2015 and 2016, while in Lustrafjord in 2016, 198 individuals were caught (table 2.2). A Harstad trawl (22 mm mesh size, cod-end taper 1 m^2 and opening 51 m^2) was used for pelagic trawling. Pelagic catch of roudnose grenadier in Masfjord 2012, 2015 and 2016 consisted of 62 individuals, and in Lustrafjord in 2016 it was 7 individuals (table 2.3).

Table 2.2: Overview of collected materials from bottom trawls in Masfjord (2012, 2015, 2016) and Lustrafjord (2016). Bottom trawling was not allowed in Masfjord in 2016.

Location	**Year**	**Station number**	**No. roundnose grenadiers**	**Fishing depth (m)**	**Fishing time (min)**	**Day/night**
Masfjord	2012	354	50	469	13	Night
	2015	111	50	400	29	Night
		115	50	340	20	Day
		120	1	425	29	Day
	2016	No bottom trawling				
Lustrafjord	2016	155	2	646	30	Day
		157	5	374	40	Day
		160	6	374	24	Night
		163	6	376	30	Day
		164	109	652	41	Day
		173	58	649	19	Night
		180	12	375	20	Night

Table 2.3: Overview of collected materials from pelagic trawls in Masfjord (2012, 2015, 2016), and Lustrafjord (2016).

Location	**Year**	**Station**	**no. roundnose grenadiers**	**Start depth/ end depth**	**Fishing time (min)**	**Day/night**
Masfjord	2012	357	10	346/0	52	Day
		358	15	400/35	20	Day
	2015	116	3	430/300	30	Day
		117	1	400/200	30	Day
		119	3	440/280	32	Night
		121	17	420/250	39	Day
		135	3	390/290	25	Night
		136	3	410/300	20	Night
	2016	153	2	450/350	30	Night
		154	1	464/350	40	Night
		151	1	459/350	30	Day
		152	3	460/350	32	Day
Lustrafjord	2016	165	2	610/0	20	Day

Dissections and stomach collection:

A total of 206 *C. rupestris* were frozen onboard in October 2012 and September 2015 and dissected later. The specimens were kept in the freezer at the University of Bergen. The fish were partly defrosted before dissection and stomachs, not everted during trawling, were collected. Each *C. rupestris* was given a specific ID-number and their pre-anal fin-length (rounded down to the nearest 0.1 cm, PAFL, figure 2.2), weight, gonad and liver weight were measured (sartorius, BL 1500 S, 0.01 g). Sex and maturation stage were determined according to visible appearances (table 2.4). Otoliths were removed and preserved for later studies. A total of 151 stomachs were sealed in an ID-numbered plastic bag and put back into the freezer for later examination of diet. In September 2016, a total of 200 *C. rupestris* from Lustrafjord and 7 individuals from Masfjord were sampled during the Ocean Science field course. Pre-anal fin-length (cm), weight (g) and gutted weight (g) were measured onboard (Marel M2000), while liver and gonads were frozen and transported to UiB to be measured on a finer scale (sartorius, BL 1500 S). 162 stomachs were dissected out, labeled and preserved by freezing for later examination. A total of 404 roudnose grenadier have been dissected and 313 individuals have been examined for diet (table 2.5)

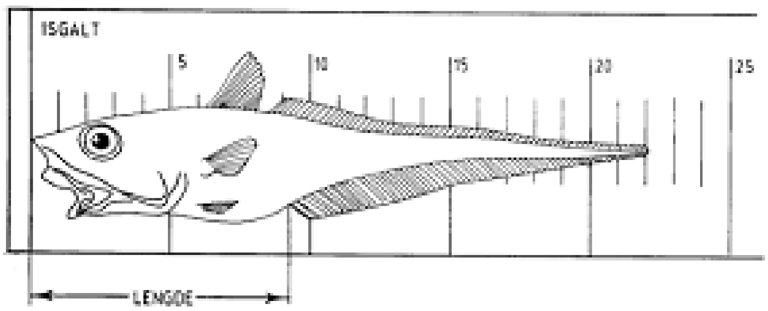


Figure 2.2: Because of tail breakage in the trawl, that prevents accurate measure of total length, pre-anal fin-length (PAFL) is used as standard measurement for roundnose grenadiers. PAFL are measured from the snout to the anterior edge of the anal fin, and rounded down to the nearest 0.1 cm (Mjanger *et al.*, 2011).

Table 2.4: Maturity stages for roundnose grenadiers according to visible appearances (Mjanger *et al.*, 2011).

Stage	**Description**
1	Immature: Gonads are small and no eggs or milt is visible
2	Maturing: Gonads are larger in volume.
3	Spawning: Running gonads. Milt or eggs released when applying pressure to the abdomen.
4	Spent/resting: When dissecting, there may be visible blood. Gonads are retracted and small, with loose gonad tissue. Larger in volume than stage 1.

Table 2.5: an overview of the total amount of dissected fish, amount of everted and stomachs analyzed for diet in Masfjord and Lustrafjord.

LOCATION	**FISH DISSECTED**	**NO. EVERTED STOMACHS**	**STOMACHS ANALYZED**
MASFJORD	213	56	157
LUSTRAFJORD	200	35	156
TOTAL	404	91	313

Identification of prey

Stomach analyses were conducted in the laboratory from June – November 2016.

Before analysis, the stomachs were defrosted and each stomach was wet weighed before and after removal of stomach content to the nearest 0,01 g, to calculate total weight of stomach content (kern EW-6000 2M, 0.01 g). All stomach content was analyzed and identified under a stereo microscope (x16). After sorting out the main categories of prey, stomach content was sieved through a 0.25 mm mesh, to remove small digested particles and flush out remaining organisms. Each prey item was counted and identified to the lowest taxonomical level possible. The identification of encountered prey depended on the level of decay and each prey was classified qualitatively using a five-stage digestion scale (table 2.6). Fragmented prey items were also counted e.g. number of eyes, heads or other anatomical parts identifiable to a single specimen. When identifying fish species, direct visual species identification of fish with little decay, or by otolith identification was used (Sanson and Sanson, 2011), from which the individual's morphological characteristics was unidentifiable.

Table 2.6: shows description of the qualitative digestion scale of 1-5 and 0, in which the stomach content is classified to visible appearances (Mjanger *et al.*, 2011).

Degree	**Description**
1	Undigested: Easy to identify species
2	Digestion has begun: taxonomical identification down to species level
3	Semi digested: identification of prey group is possible. Difficult to identify species or genus since the necessary anatomical parts may be fragmented.
4	Almost completely digested: Fragmented prey makes it difficult to identify species, but group or phylum is still possible.
5	Stomach content completely digested: The stomach content is too far decayed to make an accurate identification of prey composition.
0	Empty stomach

To carry out statistical diet analyses of the stomach content, the prey items were grouped into functional groups. 12 prey categories were selected to describe the diet and diet composition: Amphipoda, Copepoda, Euphausiacea, Decapoda, Mollusca, Chaetognatha, Tunicata, Polychaeta, Other Crustaceans, Pisces, stone/mud and Other (item which did not fit into any other category). Various degrees of decay may cause a bias in the quantitative count of prey items consumed. Degree of digestion was therefore considered as an important parameter whilst estimating prey items. Prey items which were classified as unidentified were excluded from all analysis since stomach content were too digested for accurate evaluation.

Data analysis:

Different indexes were calculated to analyze resource allocation, qualitative and quantitative diet data (table 2.7) of collected *C. rupestris* in Masfjord and Lustrafjord. In tables and figures, the values were used as percentages, while in the statistical analyses the values were expressed in proportions to fit the models used for testing.

Table 2.7: Equations for calculating diet, liver and gonad indices for *Coryphaenoides rupestris*.

Index	**Equation**
Frequency of occurrence (%F): Expresses the frequency of occurrence in percentage for prey category i, where Fi is number of predators which have eaten at least 1 prey item of prey category i, and Ftot is the total number of predators examined (Bergstad *et al.*, 2010).	$\%F = (\frac{Fi}{Ftot}) * 100$ Equation 2.1
Percentage of prey by count number (%N): Expresses the percentage of each prey category in number, where Ni is numbers of counted prey category i, and Ntot is the total number of prey specimens found (Bergstad *et al.*, 2010)	$\%N = \frac{Ni}{Ntot} * 100$ Equation 2.2
Percentage of stomach content weight relative to body weight (%SW): Expressed as proportion of stomach content weight (Ws) in relation to the total weight (Wt) of the fish (Chipps and Garvey, 2007).	$\%SW = (\frac{Ws}{Wt}) * 100$ Equation 2.3
Gonadosomatic index (GSI): Gonadosomatic index describes the gonad weight (Gw) as a percentage of the total weight (Wt) (Allison, 2011).	$GSI = (\frac{Gw}{Wt}) *100$ Equation 2.4
Hepatosomatic Index (HSI): Heposomatic index is expressed as the liver weight (Lw) in relation to total weight (Wt) of the fish (Allison, 2011).	$HSI = \left(\frac{Lw}{Wt}\right) *100$ Equation 2.5

Statistical methods:

All biological data were imported into the R software version 3.3.0 (2016-05-03) for statistical analyses and plotting of results.

General linear mixed model:

A general linear mixed-effects model (glmm) was used to test for differences in the indexes. I assumed a quasibinomial distribution. Station and year were used as random effect factors to account for differences in amount of fish sampled per station and per years. The R equation was:

```
Fit1.glmm = glmmPQL(index~effect, random=~+1|year/st.nr, family=quasibinomial, data=data.frame)
```

Where the index reflects the stomach content relative to body weight, gonadosomatic or hepatosomatic indices. Effect is fjord, sex, year, pelagic/bottom, day/night or length. When testing for differences in effect of years, year was removed as random factor. Data.frame reflects to name of the data files.

Linear mixed-effect model:

When testing for differences in the biological parameters; weight and pre-anal fin-length between the different effects, it was used a linear-mixed effect model. The R equation was:

```
Fit1.lme = lme(biological.parameter~ effect, random=~+1|year/station, data=tot.df, na.action=na.omit)
```

Where biological parameter reflects weight or pre-anal fin-length, and effect is fjord, sex, year, pelagic/bottom, day/night. data=tot.df reflects to the name of the datafile used.

T-test:

T-test where used to calculate differences in biological parameters and index values between males and females, the R equation was:

```
t.test (parameter.tested~sex, data=data.frame)
```

Where parameter.tested reflects either stomach content relative to body weight, gonadosomatic index, hepatosomatic index, pre-anal fin-length or weight. Sex is the categorical variable being tested, and data.frame reflects to the name of datafile used.

Chi-squared test:

Chi-squared test was used to test for differences i) between fjords (pooled data), ii) sex within each fjord, iii) years in Masfjord, iv) pelagic or bottom catches within each fjord, and v) day or night catches within each fjord, in number of predators which had consumed and not consumed prey. All prey categories were tested separately (See Appendix A.1 – Stomach analyses).

3. Results:

Diet analyses:

Diet data of roundnose grenadier was collected from two different fjords in Norway. In total, 313 stomachs were examined, in which 18 were empty and 23 contained unidentifiable content. Identification of species or genus was difficult because of digested stomach content. Often, it was only possible to count defragmented prey items, mostly eyes or legs. Of the prey items recognized, 80.9% was crustaceans, varying from small copepods to anomurans. Non-crusteceans taxa found were polychaetas, bivalves, tunicates, chaetognaths and ostracods. There were found fish remains and otoliths in only 8 stomachs, and the they were identified to 4 individuals of *Benthosema glaciale,* 2 individuals of *Maurolicus muelleri,* and 2 individuals from the family of Gadidae (figure 3.1).

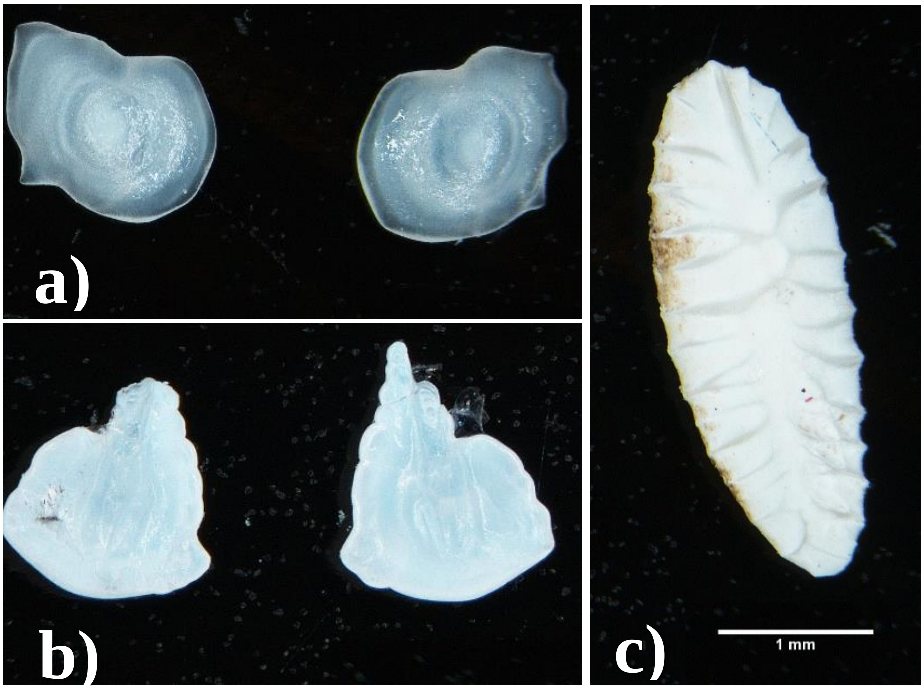


Figure 3.1: Otoliths of (a) *Benthosema glaciale*, (b) *Maurolicus muelleri*, and (c) from the Gadidae family, recognized under stereomicroscope during stomach analyses of *Coryphaenoides rupestris*.

Stomach analyses from the two fjords (pooled data) showed that diet varied, but same prey categories, except for Chaetognatha which was only present in stomachs from Masfjord, was found. For both fjords, the major prey components were Amphipoda, Copepoda, Euphausiacea, and Mollusca, which was found in over half of the stomachs analyzed from both fjords (figure 3.2). The most eaten prey in Masfjord were Copepoda and Euphausiacea, while in Lustrafjord it was Amphipoda.

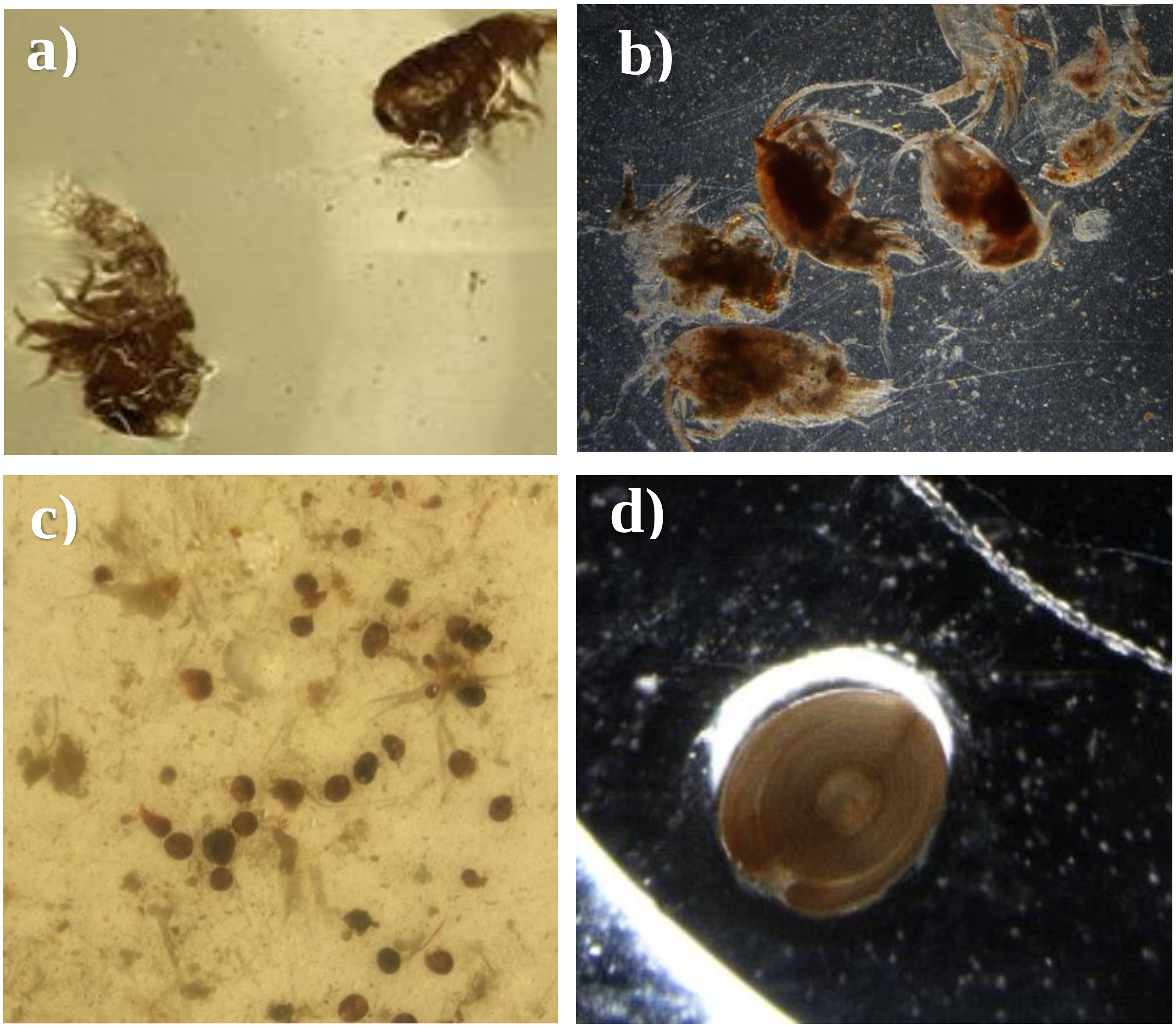


Figure 3.2: The major prey components identified through stomach analyses of *Coryphaenoides rupestris*; (a) hyperiid amphipods, (b) calanoid copepods, (c) eyes of defragmented krill and (d) bivalve.

Masfjord:

From Masfjord, 157 stomach were examined, in which 10 were empty and 7 contained unidentifiable content. The diet for females and males differed slightly within the fjord. The most dominating prey category in males where Amphipoda, while for females Amphipoda, Copepoda and Euphausiacea were the most important. In general, females had a higher diversity and amount of prey items, compared to males.

Annual variations in diet for *C. rupestris* in Masfjord were investigated and there were small variations in occurrence and amount of prey components. Copepoda was the most frequent prey category through all years, and was eaten in high proportions. Amphipoda was only found in high proportions from fish collected in 2015 and 2016, there was also a large amount of fish from 2015 which had consumed Euphausiacea and Mollusca. In comparison, other Crustaceans species and Tunicata were more prominent in 2012.

Diurnal variations in prey composition were investigated, and all prey categories were observed in fish collected both day and night, with an exception for Pisces which only occurred in the diet of fish caught during day. Bottom dwelling Mollusca were more prominent in fish caught during night, and Tunicata during day. Amphipoda, Copepoda and mesopelagic Euphausiacea were all represented in high proportions both day and night.

Pelagic and bottom trawl catches were analyzed to investigate occurrence and amount of prey eaten in pelagic and demersal zone. *C. rupestris* caught pelagically had a diet consisting of many different pelagic and benthopelagic prey, such as; small staged *Calanus spp*, Euphausiacea, and also a high count of Decapoda, specifically *Pasiphae spp* and *Sergestes arcticus*. A higher proportion of the bottom trawl catches contained bottom dwelling organisms such as; Amphipoda, Mollusca (bivalves), Tunicata and Polychaeta. There were also a higher proportion of bottom trawled individuals which had eaten stone and mud.

Occurrence of prey categories and amount of prey varied according to predator size. Only large grenadiers (>16 cm pre-anal fin-length) had eaten Pisces, while Tunicata was consumed more often in intermediary sized grenadier (10-14 cm pre-anal fin-length). Occurrence and number of prey categories; Decapoda, Mollusca, Chaetognatha and stone/mud increased with the size of the grenadier. Copepoda, Amphipoda, Euphausiacea were dominating prey items in all length groups analyzed.

Lustrafjord:

In total, 156 stomachs were examined from Lustrafjord, in which 8 were empty and 16 contained unidentifiable content. Diet comparison between females and males showed that there are small variations between the sexes. Amphipoda and Copepoda were the most important prey categories for both sexes. In general, the proportion of females consuming the various prey categories were higher than the proportion of males consuming the same prey categories. This was true for all prey categories, with the exception of Amphipoda.

The stomach content data was analyzed for diurnal variation in prey composition and number of prey items eaten. Same prey categories were found both day and night, but amount and occurrence varied for only a few prey groups. The occurrence and number of prey of Pisces and other were higher during night, while stone and mud occurred more often during day.

Comparing occurrence of prey categories in the diet of roundnose grenadier collected with bottom and pelagic trawl, showed that fish collected from demersal zone had a higher occurrence of bottom dwelling Amphipoda, Euphausiacea, Decapoda, other Crustaceans and stone/mud.

Proportion of prey composition within length groups varied according to predator size. Amphipoda, Copepoda, Euphausiacea and Mollusca occurred in large proportions within all length groups analyzed. With increasing length, the predators had a higher occurrence of Decapoda and Pisces in the stomach analyses, and the same trend was seen for Polychaetae, Other Crustaceans, Other and stone/mud.

Comparing fjords:

When testing for statistical differences in foraged prey between the fjords, it was found a difference for Chaetognatha (Chi-squared; X^2= 5.89, df = 1, p=0.015, table 3.1), which was only found as prey in Masfjord, and foraged stone/mud (Chi-squared; X^2 = 6.49, df = 1, p=0.010), in which there was a higher consumption of in Lustrafjord. There was also a trend in higher consumption of Copepoda (Chi-squared; X^2 = 3.82, df = 1, p=0.050) in Masfjord, and a trend in higher consumption of Mollusca in Lustrafjord (Chi-squared; X^2 = 3.35, df = 1, p=0.067).

Table 3.1: Frequency of occurrence (F %), percentages of counted prey (N %) and p-values from Chi-squared test of independence for *Coryphaenoides rupestris*, when testing for differences in number of foraging predators and non-foraging predators, for each prey category, between Masfjord and Lustrafjord.

	Masfjord (N= 140)		**Lustrafjord** (N=132)		Chi-squared Test, differences in consumption of prey
Prey category	F (%)	N (%)	F (%)	N (%)	X^2
Amphipoda	72.1	44.1	78.8	28.3	p=0.258
Copepoda	80.0	22.4	68.9	33.3	p=0.050
Euphausiacea	74.3	12.9	66.7	10.7	p=0.213
Decapoda	22.9	1.3	30.3	5.4	p=0.209
Mollusca	54.3	12.4	65.9	12.4	p=0.067
Chaetognatha	5.7	0.5	0.0	0.0	**p=0.015**
Tunicata	21.4	2.7	26.5	3.7	p=0.400
Polychaeta	16.4	1.4	21.2	1.7	p=0.392
Other Crustaceans	15.0	1.0	14.4	2.3	p=1
Pisces	1.4	0.1	4.5	0.3	p=0.245
Other	7.9	0.6	9.8	0.5	p=0.715
Stone/mud	17.1	0.7	31.1	1.5	**p=0.010**

Sex differences in each fjord:

When testing for statistical differences in amount of foraged prey between sexes, differences were found in consumption of Chaetognatha (Chi-squared; $X^2 = 4.5035$, df = 1, p=0.033, table 3.2) in Masfjord, which were only found as prey in females. In Lustrafjord, females had a higher consumption of stone/mud (Chi-squared; $X^2 = 11.21$, df = 1, p=0.0008).

Table 3.2: Frequency of occurrence (F %), percentages of counted prey (N %) and p-values from Chi-squared test of independence for *Coryphaenoides rupestris*, when testing for differences in number of foraging predator and non-foraging predator, for each prey category, between females and males, in Masfjord and Lustrafjord.

	Masfjord					**Lustrafjord**				
	Female (N= 69)		Male (N= 50)		Chi-squared Test, differences in consumption of prey	Female (N= 77)		Male (N=23)		Chi-squared Test, differences in consumption of prey
Prey category	F (%)	N (%)	F (%)	N (%)	X^2	F (%)	N (%)	F (%)	N (%)	X^2
Amphipoda	78.3	35.1	60	52.4	p=0.050	89.6	26.5	91.3	33.4	p=1
Copepoda	78.3	23.3	84	19.5	p=0.584	66.2	31.0	60.9	33.4	p=0.822
Euphausiacea	79.7	15.2	62	10.4	p=0.054	71.4	10.6	52.2	10.8	p=0.141
Decapoda	29.0	1.9	18	1.0	p=0.245	41.6	6.2	30.4	7.5	p=0.473
Mollusca	65.2	15.5	46	10.9	p=0.057	74.0	13.7	60.9	9.0	p=0.337
Chaetognatha	11.6	1.1	0	0.0	p=**0.033**	0.0	0.0	0.0	0.0	NaN
Tunicata	20.3	2.6	22	2.8	p=1	29.9	4.3	17.4	0.7	p=0.360
Polychaeta	21.7	2.2	14	0.9	p=0.404	28.6	2.2	17.4	1.1	p=0.422
Other Crustaceans	18.8	1.2	12	1.0	p=0.452	14.3	2.2	13.0	2.6	p=1
Pisces	2.9	0.2	0	0.0	p=0.622	5.2	0.3	4.3	0.2	p=1
Other	8.7	0.5	8	0.7	p=1	13.0	0.6	13.0	0.9	p=1
Stone/mud	23.2	1.1	12	0.5	p =0.189	0.18	2.2	8.7	0.4	p=**0.0008**

Comparing day and night catches in each fjord:

No statistical differences in consumed prey for *C. rupestris* caught night and day within Masfjord and Lustrafjord was found, except for a higher consumption of prey category Other (Chi-squared; $X^2 = 4.0818$, df = 1, p=0.043, table 3.3), during night in Lustrafjord. Prey category Other, in Lustrafjord, included human food (sausage, corn), tree remains (as bark and small twigs), insects (two individuals of terrestrial Ptegyota) and plastic.

Table 3.3: Frequency of occurrence (F %), percentages of counted prey (N %) and p-values from Chi-squared test of independence for *Coryphaenoides rupestris*, when testing for differences in number of foraging predator and non-foraging predator, for each prey category, between day and night within Masfjord and Lustrafjord.

	Masfjord					Lustrafjord				
	Day (N=65)		Night (N=75)		Chi-squared Test, consumption of prey	Day (N= 97)		Night (N= 35)		Chi-squared Test, consumption of prey
Prey category	F (%)	N (%)	F (%)	N (%)	X^2	F (%)	N (%)	F (%)	N (%)	X^2
Amphipoda	75.4	45.5	69.3	42.8	p=0.543	77.3	28.7	82.9	27.1	p=0.655
Copepoda	83.1	20.2	77.3	24.3	p=0.525	70.1	34.1	65.7	31.0	p=0.788
Euphausiacea	70.8	13.7	77.3	12.2	p=0.488	64.9	10.8	71.4	10.4	p=0.625
Decapoda	26.2	1.4	20.0	1.3	p=0.507	29.9	6.5	31.4	2.6	p=1
Mollusca	49.2	11.5	58.7	13.1	p=0.343	64.9	9.7	68.6	19.2	p=0.857
Chaetognatha	6.2	0.6	5.3	0.05	p=1	0.0	0.0	0.0	0.0	NaN
Tunicata	29.2	2.9	14.7	2.5	p=0.0598	25.8	3.9	28.6	3.2	p=0.921
Polychaeta	18.5	1.6	14.7	1.2	p=0.707	22.7	1.9	17.1	1.3	p=0.655
Other Crustaceans	18.5	1.2	12.0	0.8	p=0.406	14.4	2.2	14.3	2.4	p=1
Pisces	3.1	0.2	0.0	0.0	p=0.414	3.1	0.2	8.6	0.7	p=0.389
Other	7.7	0.6	8.0	0.5	p=1	6.2	0.3	20.0	1.2	p=**0.043**
Stone/mud	13.8	0.6	20.0	0.9	p=0.460	34.0	1.7	22.9	1.1	p=0.312

Comparing bottom and pelagic catches in each fjord:

No differences were found in consumed prey when testing between pelagic and bottom trawl catches within Masfjord and Lustrafjord. However, the test revealed a trend in higher consumption of Amphipoda (Chi-squared; X^2 =3.30, df = 1, p=0.069, table 3.4) in bottom trawl catches in Masfjord.

Table 3.4: Frequency of occurrence (F %), percentages of counted prey (N %) and p-values from Chi-squared test of independence for *Coryphaenoides rupestris*, when testing for differences in number of foraging predator and non-foraging predator, for each prey category, between pelagic and bottom trawl catches, within Masfjord and Lustrafjord.

	Masfjord					**Lustrafjord**				
	Pelagic (N= 40)		Bottom (N= 100)		Chi-squared Test, consumption of prey	Pelagic (N= 2)		Bottom (N= 130)		Chi-squared Test, consumptio n of prey
Prey category	F (%)	N (%)	F (%)	N (%)	X^2	F (%)	N (%)	F (%)	N (%)	X^2
Amphipoda	60.0	37.0	77.0	45.4	p=0.069	100	50.0	78.5	28.2	p=1
Copepoda	87.5	30.7	77.0	20.8	p=0.242	50	25.0	69.2	33.3	p=1
Euphausiacea	67.5	13.6	77.0	12.8	p=0.343	0	0.0	67.7	10.7	p=0.207
Decapoda	22.5	2.5	23.0	1.1	p=1	0	0.0	30.8	5.4	p=0.869
Mollusca	47.5	10.4	57.0	12.7	p=0.405	50	16.7	66.2	12.3	p=1
Chaetognatha	0.0	0.0	8.0	0.6	p=0.150	0	0.0	0.0	0.0	NaN
Tunicata	15.0	1.7	24.0	2.9	p=0.344	50	8.3	26.2	3.7	p=1
Polychaeta	12.5	1.5	18.0	1.4	p=0.588	0	0.0	21.5	1.8	p=1
Other Crustaceans	10.0	1.0	17.0	1.0	p=0.431	0	0.0	14.6	2.3	p=1
Pisces	0.0	0.0	2.0	0.1	p=0.910	0	0.0	4.6	0.3	p=1
Other	5.0	0.4	9.0	0.6	p=0.654	0	0.0	10.0	0.5	p=1
Stone/mud	15.0	1.2	18.0	0.6	p=0.859	0	0.0	31.5	1.5	p=0.851

Comparing length groups in Masfjord:

There was found a statistical difference in consumed Euphausiacea (Chi-squared; $X^2 = 4.55$, df = 1, p=0.032, table 3.5) between length groups in Masfjord. Number of predators foraging on Euphausiacea increased with the pre-anal fin-length of the grenadier.

Table 3.5: Frequency of occurrence (F %), percentages of counted prey (N %) and p-values from Chi-squared test of independence for *Coryphaenoides rupestris*, when testing for differences in number of foraging predator and non-foraging predator, for each prey category, between length groups (measured pre-anal fin-length), within Masfjord.

Pre-anal fin-length of *C. rupestris* (cm) in Masfjord:											
	[<10] (N=44)		[10 - <12] (N=32)		[12- <14] (N=22)		[14- <16] (N=16)		[> 16] (N=27)		Chi-squared Test, consumption of prey
Prey category:	F (%)	N (%)	F (%)	N (%)	F (%)	N (%)	F (%)	N (%)	F (%)	N (%)	X^2
Amphipoda	72.7	43.3	59.4	52.5	68.2	29.2	75.0	36.4	88.9	47.3	p=0.444
Copepoda	81.8	29.6	90.6	22.2	86.4	28.2	68.8	22.7	66.7	11.9	p=1
Euphausiacea	70.5	15.1	75.0	11.6	81.8	17.7	50.0	9.0	85.2	10.7	p=**0.032**
Decapoda	11.4	0.6	15.6	0.7	18.2	1.6	37.5	2.8	44.4	1.9	p=0.89
Mollusca	34.1	4.8	46.9	6.1	68.2	16.9	68.8	21.2	74.1	20.3	p=0.980
Chaetognatha	2.3	0.4	3.1	0.2	9.1	0.4	12.5	1.2	7.4	0.7	p=0.989
Tunicata	18.2	3.7	31.2	2.1	22.7	2.3	25.0	3.7	14.8	2.6	p=0.671
Polychaeta	4.5	0.9	21.9	1.5	22.7	1.6	18.8	0.9	22.2	1.8	p=1
Other Crustaceans	15.9	1.1	15.6	0.9	9.1	0.8	12.5	0.6	18.5	1.2	p=0.928
Pisces	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.4	0.4	p=0.714
Other	2.3	0.1	21.9	1.7	9.1	0.4	0.0	0.0	3.7	0.1	p=1
Stone/mud	6.8	0.4	15.6	0.6	18.2	0.8	25.0	1.2	29.6	1.0	p=1

Comparing length groups in Lustrafjord:

No statistical differences in consumed prey categories between length groups in Lustrafjord was found. However, there was a trend in Polychaetae (Chi-squared; X^2 =3.03, df = 1, p=0.081, table 3.6), in which the number of foraging predators increased with pre-anal fin-length of the grenadier.

Table 3.6: Frequency of occurrence (F %), percentages of counted prey (N %) and p-values from Chi-squared test of independence for *Coryphaenoides rupestris*, when testing for differences in number of foraging predator and non-foraging predator, for each prey category, between length groups (measured pre-anal fin-length), within Lustrafjord.

Pre-anal fin-length of *C. rupestris* (cm) in Lustrafjord:											
	[<10] (N=39)		[10 - <12] (N=37)		[12- <14] (N=26)		[14- <16] (N=19)		[> 16] (N=11)		Chi-squared Test, consumption of prey
Prey category	F (%)	N (%)	F (%)	N (%)	F (%)	N (%)	F (%)	N (%)	F (%)	N (%)	X^2
Amphipoda	56.4	31.0	86.5	25.8	88.5	30.7	89.5	27.8	90.9	27.0	p=1
Copepoda	74.4	41.6	75.7	48.5	69.2	17.9	47.4	17.4	54.5	21.8	p=1
Euphausiacea	69.2	9.1	59.5	7.9	69.2	16.7	78.9	12.6	54.5	8.8	p=0.321
Decapoda	5.1	0.3	21.6	1.6	42.3	5.0	63.2	14.2	72.7	14.2	p=0.893
Mollusca	56.4	12.4	62.2	8.7	76.9	14.2	78.9	15.4	63.6	15.2	p=0.627
Chaetognatha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	p=NaN
Tunicata	25.6	2.8	16.2	2.7	23.1	3.3	36.8	4.8	54.5	5.8	p=0.575
Polychaeta	7.7	0.6	10.8	0.5	42.3	5.0	47.4	2.8	9.1	0.6	p=0.081
Other Crustaceans	7.7	1	16.2	2.2	23.1	3.3	15.8	1.1	9.1	4.8	p=1
Pisces	2.6	0.3	5.4	0.4	3.8	0.2	5.3	0.2	9.1	0.6	p=1
Other	0.0	0.0	13.5	0.6	15.4	0.8	15.8	1.1	9.1	0.3	p=1
Stone/mud	10.3	0.6	24.3	1.1	57.7	2.9	57.9	2.5	27.3	0.9	p=0.214

Comparing years in Masfjord:

Chi-squared test was used to test for statistical differences in consumption of foraged prey between years in Masfjord. A difference for all prey categories tested (Chi-squared; $p<0.001$, table 3.7) was found.

Table 3.7: Frequency of occurrence (F %), percentages of counted prey (N %) and p-values from Chi-squared test of independence for *Coryphaenoides rupestris*, when testing for differences in number of foraging predator and non-foraging predator, for each prey category, between years in Masfjord.

	Masfjord 2012 (N = 47)		**Masfjord 2015** (N = 88)		**Masfjord 2016** (N = 5)		Chi-squared Test, differences in consumption of prey
Prey category	F (%)	N (%)	F (%)	N (%)	F (%)	N (%)	X^2
Amphipoda	38.3	6.2	88.6	49.6	100	70.9	**p<0.001**
Copepoda	76.6	40.0	81.8	19.7	80	12.0	**p<0.001**
Euphausiacea	61.7	14.6	80.7	12.8	80	7.7	**p<0.001**
Decapoda	25.5	3.5	20.5	0.9	40	2.6	**p<0.001**
Mollusca	44.7	16.9	58.0	11.9	80	5.1	**p<0.001**
Chaetognatha	2.1	0.4	8.0	0.5	0	0.0	**p<0.001**
Tunicata	31.9	10.2	17.0	1.5	0	0.0	**p<0.001**
Polychaeta	14.9	2.3	18.2	1.3	0	0.0	**p<0.001**
Other Crustaceans	21.3	3.1	11.4	0.6	20	1.7	**p<0.001**
Pisces	0.0	0.0	2.3	0.1	0	0.0	**p<0.001**
Other	8.5	0.8	8.0	0.5	0	0.0	**p<0.001**
Stone/mud	19.1	1.9	17.0	0.5	0	0.0	**p<0.001**

Stomach content relative to body weight (%) differences between fjords:

In total, stomach content weight data were collected for 271 individuals of *C. rupestris* from Masfjord and Lustrafjord. Fish from Lustrafjord had more stomach content in terms of weight, than the fish from Masfjord, when testing for differences between the two fjords (glmmPQL; $F_{1,21}$ =38, p<0.001, figure 3.3 a). From the 132 stomachs analyzed from Lustrafjord, the mean percentage of stomach content relative to body weight was 1.06% ± 1.05 (mean ± SD), and the values ranged from 0.10 to 7.29. 139 stomachs from Masfjord had a mean percentage of 0.48% ± 0.43, while values ranged from 0.079 to 2.83.

Sex differences:

It was found that the males (t.test; t=2.34, df=23, p=0.0279, figure 3.3 b) and females (t.test; t=5.51, df=90 p<0.001) from Lustrafjord had more stomach content in terms of weight, compared to Masfjord. There was no sex difference within Masfjord (glmmPQL; $F_{1,102}$=0.04, p=0.834) or in Lustrafjord (glmmPQL; $F_{1,92}$=0.33, p=0.564).

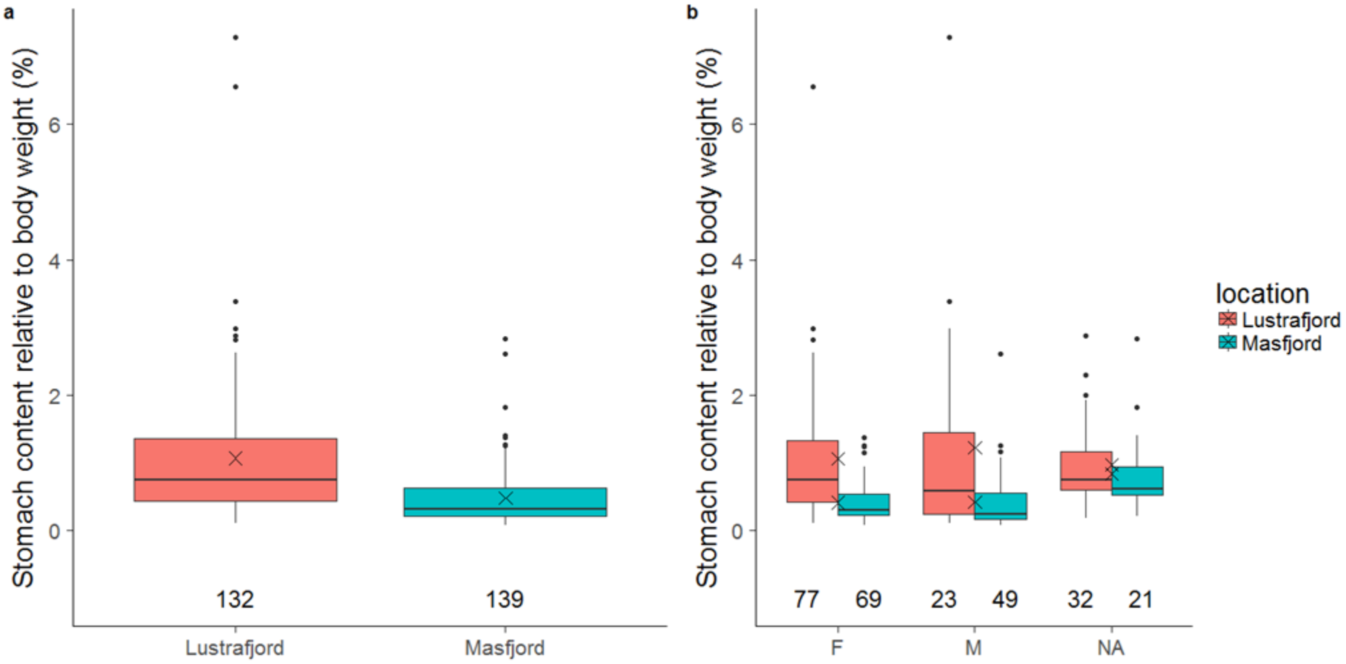


Figure 3.3: (a) Boxplot of stomach content relative to body weight (%) for *Coryphaenoides rupestris* caught in Lustrafjord and Masfjord. (b) Boxplot of stomach content relative to body weight for females (F), males (M) and individuals with unidentified sex (NA), of *C. rupestris* caught in Lustrafjord and Masfjord. Sample sizes are shown beneath the boxes and corresponds to the different locations from left to right. X indicates mean, thick line indicates median, and black dots outside the whiskers corresponds to outliers.

Day and night & pelagic and bottom trawl catches:

Comparing day and night catches, revealed no differences in stomach content relative to body weight in Masfjord (glmmPQL; $F_{1,13}$=1.19, p=0.29, figure 3.4 a) or in Lustrafjord (glmmPQL; $F_{1,6}$=1.24, p=0.307). There were also no differences between bottom and pelagic catches in Masfjord (glmmPQL; $F_{1,13}$=1.58, p=0.230, figure 3.4 b) or in Lustrafjord (glmmPQL; $F_{1,6}$=0.95, p=0.365).

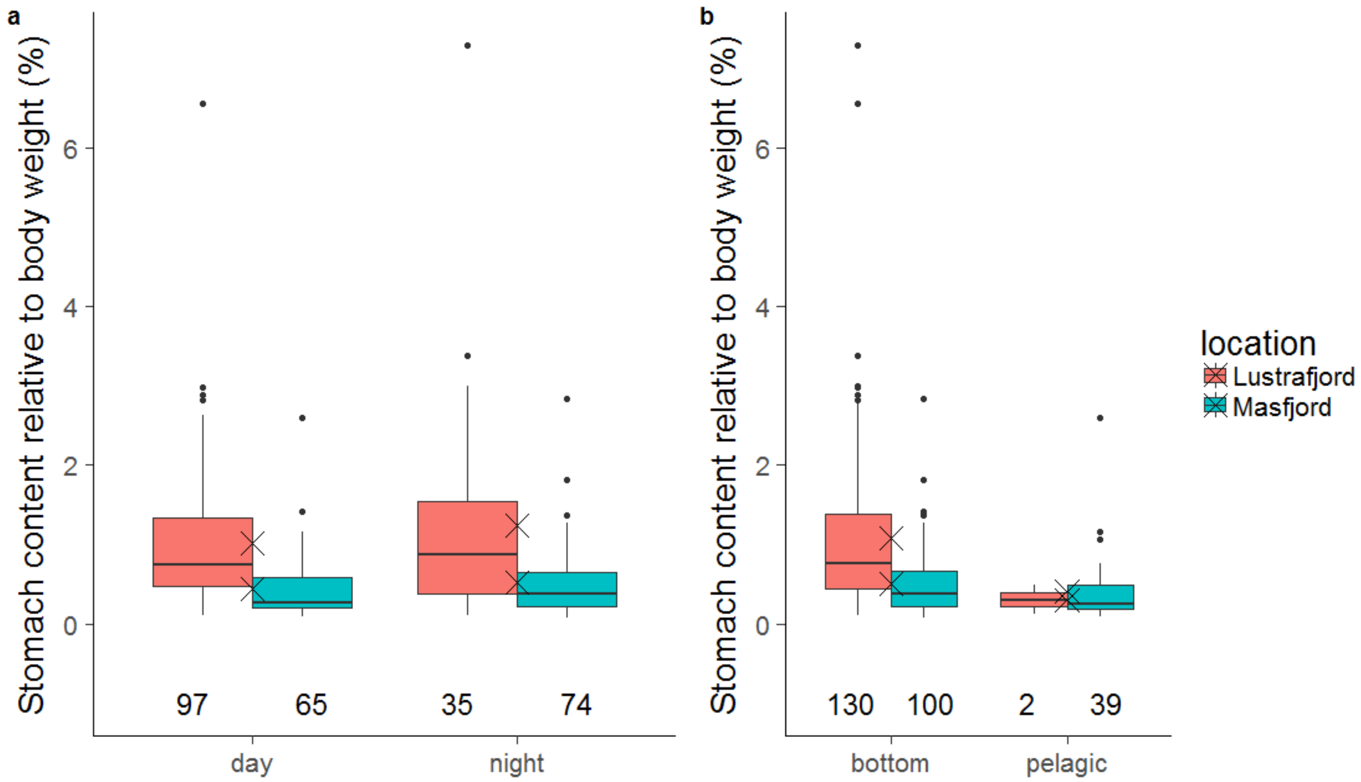


Figure 3.4: (a) Boxplot of stomach content relative to body weight (%) *Coryphaenoides rupestris* caught night and day in Masfjord and Lustrafjord. (b) Boxplot of stomach content relative to body weight for *Coryphaenoides rupestris* caught with bottom and pelagic trawl in Masfjord and Lustrafjord. Sample sizes are shown beneath the boxes and corresponds to the different locations from left to right. X indicates mean, thick line indicates median, and black dots outside the whiskers corresponds to outliers.

Annual variations

There were no annual differences in stomach content relative to weight when comparing fish collected from different years in Masfjord (glmmPQL; $F_{1,13}$=0.266 p=0.614, figure 3.5).

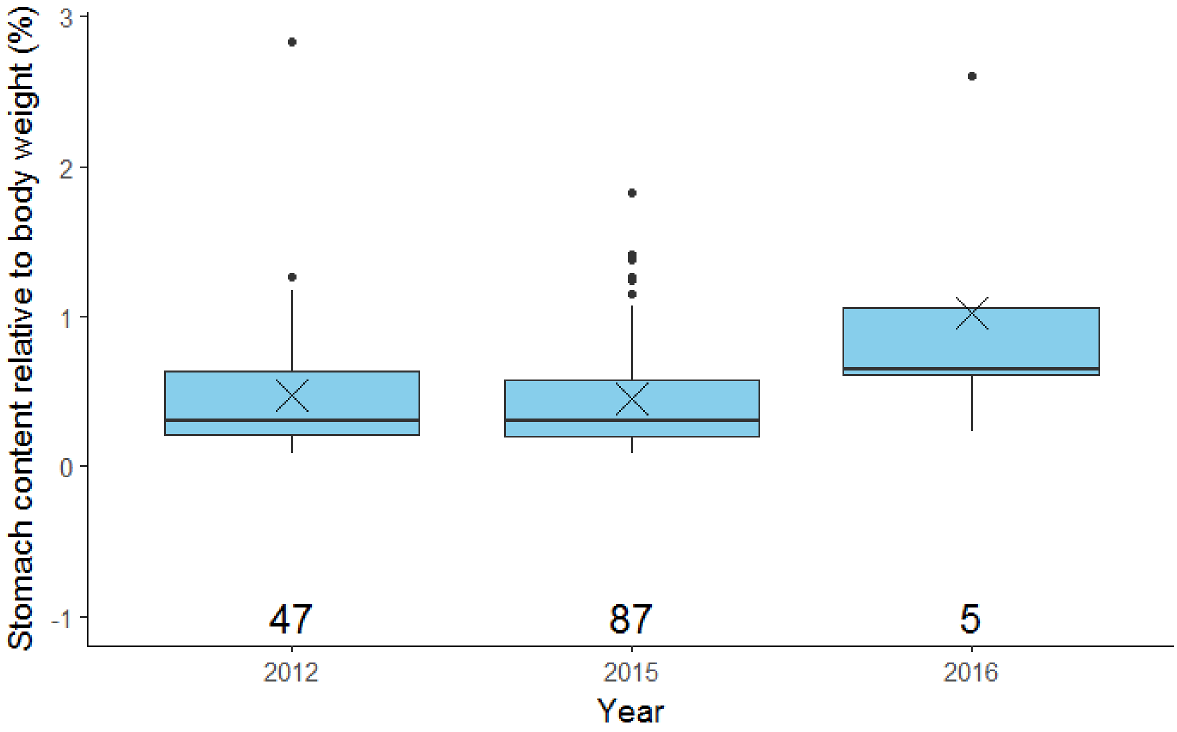


Figure 3.5: Boxplot of stomach content relative to body weight (%), categorized by years (2012, 2015 and 2016 (only pelagically caught individuals)), for *Coryphaenoides rupestris* caught in Masfjord. Sample sizes are shown beneath the boxes and corresponds to the different locations from left to right. X indicates mean, thick line indicates median, and black dots outside the whiskers corresponds to outliers.

Pre-anal fin-length and weight differences between fjords:

When comparing roundnose grenadiers from the two fjords, no differences were found in pre-anal fin-length (LME; $F_{1,20}$=0.79, p = 0.383, figure 3.6 a) or in weight (LME; $F_{1,20}$= 0.10, p=0.753, figure 3.6 b). 213 *C rupestris* from Masfjord were collected and mean pre-anal fin-length was 12.29 ± 3.9 (mean ± SD), values ranged from 4.0 to 23.2 cm. The mean weight was 358.9 ± 419.93 g, with values ranging from 11.9 – 1662.8 g. 200 individuals were collected from Lustrafjord and the mean pre-anal fin-length was 10.49 ± 3.7 cm with ranges from 4.4-20.6 cm. The mean weight was 193.34 ± 306.79 g and values ranged between from 10.5 – 1805.0 g.

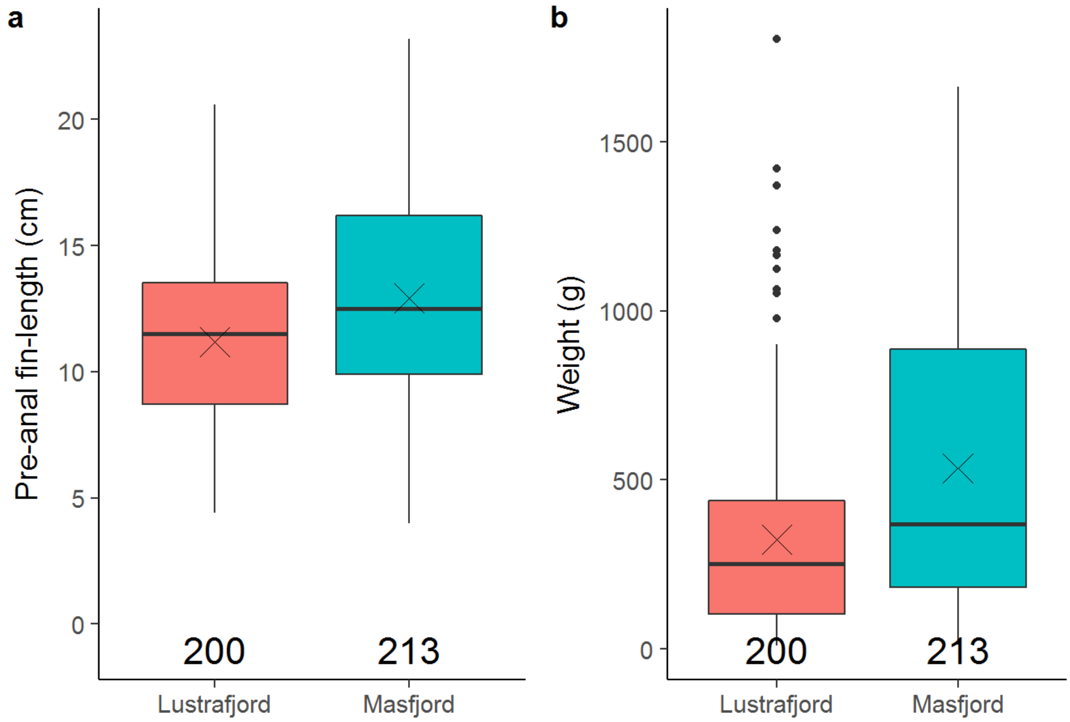


Figure: 3.6: a) Boxplot of (a) pre-anal fin-length and (b) weight from Lustrafjord and Masfjord. Sample sizes are shown beneath the boxes and corresponds to the different locations from left to right. X indicates mean, thick line indicates median, and black dots outside the whiskers corresponds to outliers.

Sex differences:

Females in Masfjord were heavier (t-test: t= 2.35, df=161, p=0.019, figure 3.7 b), but there was no sex difference in pre-anal fin-length (t-test; t=0.8, df=156, p=0.388, figure 3.7 a) between the fjords. Males from Lustrafjord were both shorter (t-test: t=2.65, df=77 p=0.009) and lighter (t-test: t=3.8, df=89, p=0.0002) than males from Masfjord. There were no differences in pre-anal fin-length (t-test; t=0.59, df=170, p=0.553) or in weight (t-test; t=0.06, df=179, p=0.950) between the sexes in Masfjord, and neither a difference in weight in Lustrafjord (t-test; t=1.74, df=96, p=0.086). However, males were smaller than the females when comparing pre-anal fin-length in Lustrafjord (t-test; t=2.5, df=69, p=0.012).

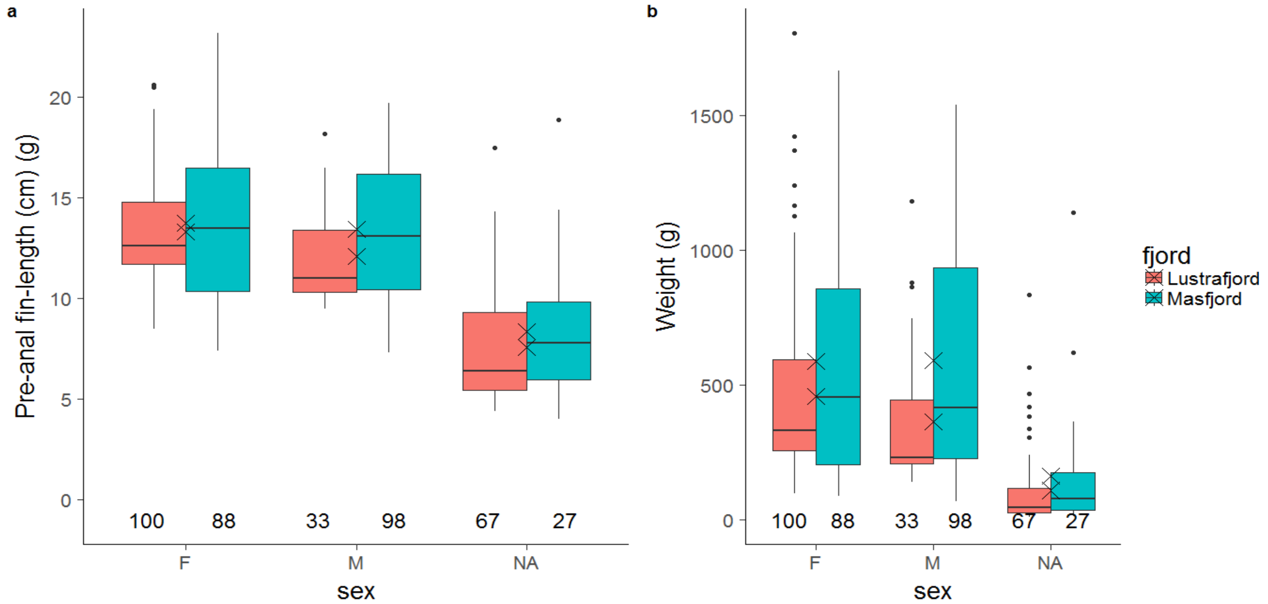


Figure 3.7: Boxplot of (a) pre-anal fin-length and (b) weight for females (F), males (M) and individuals with unidentified sex (NA) of C*oryphaenoides rupestris*, caught in Masfjord, and Lustrafjord. Sample sizes are shown beneath the boxes and corresponds to the different locations from left to right. X indicates mean, thick line indicates median, and black dots outside the whiskers corresponds to outliers.

Day and night & pelagic and bottom trawl catches:

No differences were found in pre-anal fin-length or weight when comparing day/night and pelagic/bottom catches within Masfjord and Lustrafjord (table 3.8, figure 3.8).

Table 3.8: Values from linear mixed-effect models when testing pre-anal fin-length and weight between day and night, and between pelagic and bottom catches in Masfjord and Lustrafjord.

	Masfjord		**Lustrafjord**	
	Day and night	Pelagic and bottom	Day and night	Pelagic and bottom
Pre-anal fin-length	LME $F_{1,196}$=0.0003 p=0.985	LME $F_{1,12}$=2.15 p=0.167	LME $F_{1,6}$=0.50 p=0.502	LME $F_{1,6}$=0.08 p=0.781
Weight	LME $F_{1,196}$=0.08 p=0.769	LME $F_{1,12}$=0.71 p=0.413	LME $F_{1,6}$=0.52 p=0.496	LME $F_{1,6}$=0.01 p=0.909

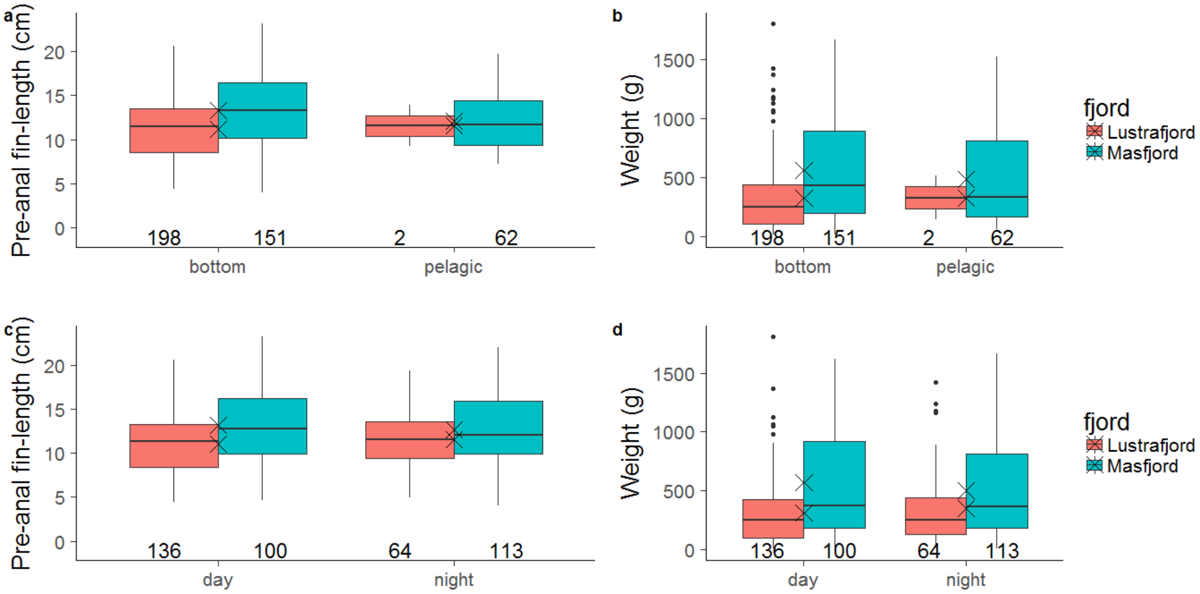


Figure 3.8: Boxplots (a) pre-anal fin-length and (b) weight for *Coryphaenoides rupestris* collected from pelagic and bottom catches. (c) Pre-anal fin-length and (d) weight for day and night catches Lustrafjord and Masfjord. Sample sizes are shown beneath the boxes and corresponds to the different locations from left to right. X indicates mean, thick line indicates median, and black dots outside the whiskers corresponds to outliers.

Annual differences:

No differences were found in pre-anal fin-length (LME; $F_{1,14}$=0.61, p=0.447, figure 3.9 a) or in weight (LME; $F_{1,14}$=0.28, p=0.604, figure 3.9 b), when comparing years in Masfjord.

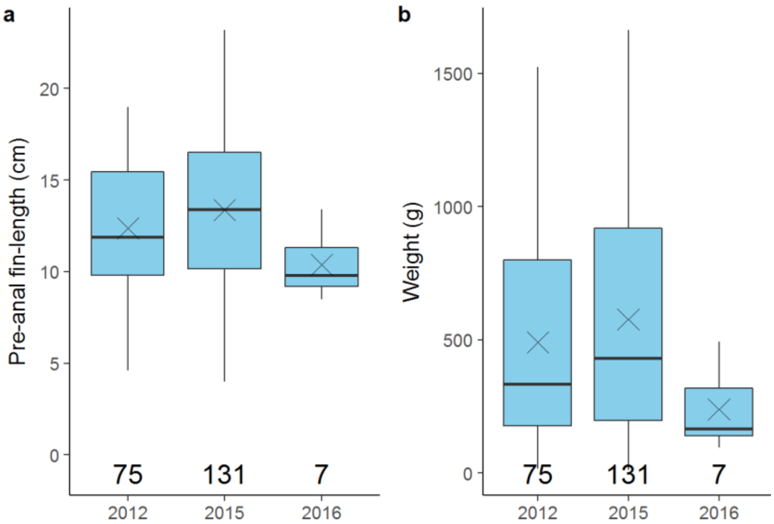


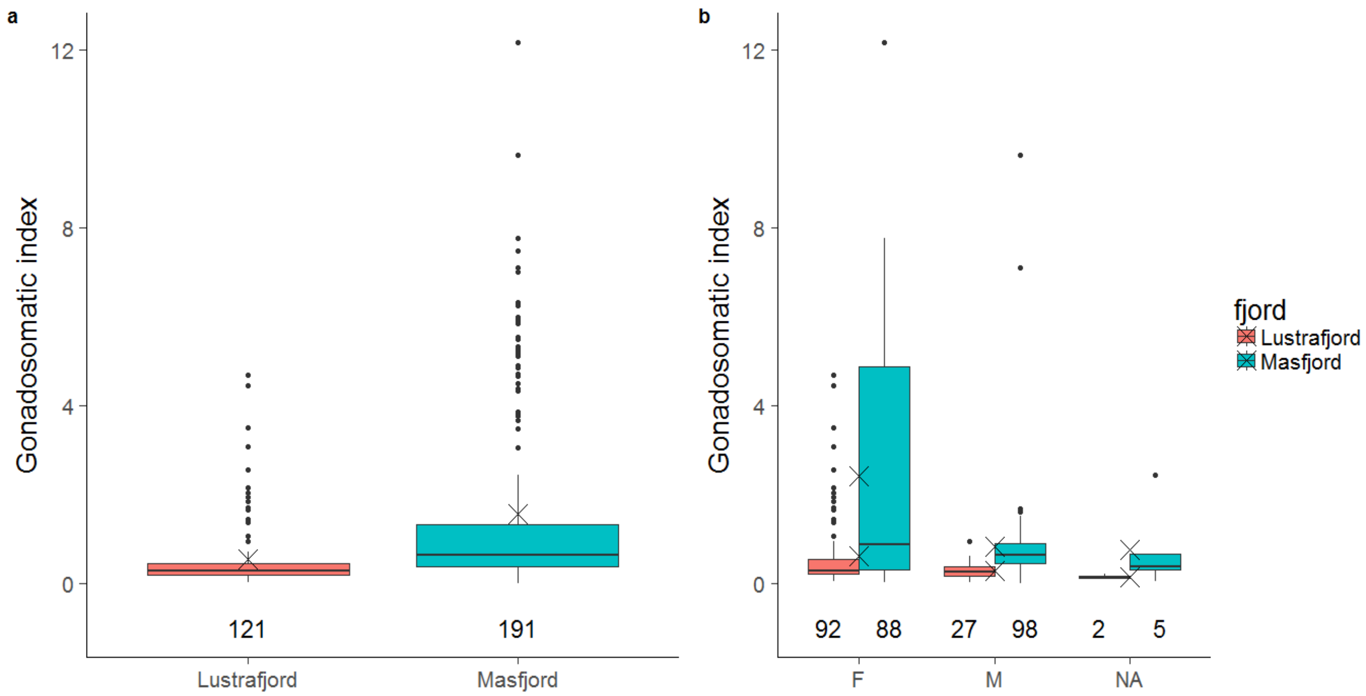
Figure 3.9: Boxplot of (a) pre-anal fin-length and (b) weight for individuals caught in 2012, 2015 and 2016 (only pelagically caught individuals) in Masfjord. Sample sizes are shown beneath the boxes and corresponds to the different locations from left to right. X indicates mean, thick line indicates median, and black dots outside the whiskers corresponds to outliers.

<u>Gonadosomatic index differences between fjords:</u>

The population from Masfjord had a higher gonadosomatic index than the population from Lustrafjord (glmmPQL; $F_{1,20}$=27, p<0.001, figure 3.10 a). In Masfjord, the index mean was 0.77 ± 2.11 (mean ± SD) and it ranged from 0.01 to 12.17. In Lustrafjord the index mean was 0.32 ± 0.78 with values ranging from 0.22 to 7.11.

Sex differences:

Both sexes in Masfjord had a higher gonadosomatic index when comparing females (t-test; t=6.1, df=105, p<0.001, figure 3.10 b) and males (t-test; t=4.2, df=115, p<0.001) between the fjords. Females from both Masfjord (t-test; t=5.27, df=117, p<0.001) and Lustrafjord (t-test; t=3.22, df=115, p=0.001) had a higher gonadosomatic index compared to males.



<u>Figure 3.10:</u> Boxplot of (a) gonadosomatic index for *Coryphaenoides rupestris* in Masfjord and Lustrafjord and (b) boxplot of gonadosomatic index for the different sexes; females (F), males (M) and individuals with unidentified sex (NA), in Masfjord and Lustrafjord. Sample sizes are shown beneath the boxes and corresponds to the different locations from left to right. X indicates mean, thick line indicates median, and black dots outside the whiskers corresponds to outliers.

Annual variations:

There were no differences in gonadosomatic index when comparing sampled grenadiers between years in Masfjord (glmmPQL; $F_{1,14}$=1.2, p=0.291. , figure 3.11)

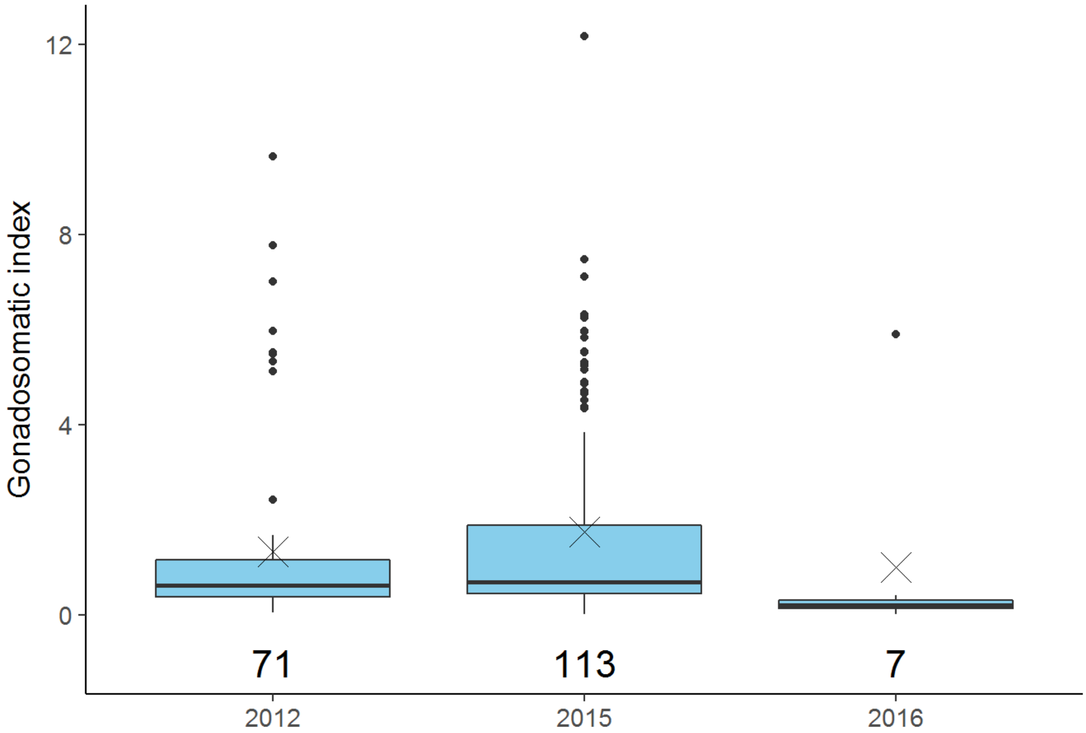


Figure 3.11: Boxplot of gonadosomatic index of *Coryphaenoides rupestris*, caught in 2012, 2015 and 2016 (only pelagically caught individuals) in Masfjord. Sample sizes are shown beneath the boxes and corresponds to the different locations from left to right. X indicates mean, thick line indicates median, and black dots outside the whiskers corresponds to outliers.

Hepatosomatic index differences between fjords:

Coryphaenoides rupestris from Masfjord had a higher hepatosomatic index (glmmPQL; $F_{1,20}$=8.02, p=0.0103, figure 3.12 a) compared to Lustrafjord. Index mean for Masfjord was 1.76 ± 1.28 (mean±SD) and values ranged from 0.22 to 7.11, while in Lustrafjord the index mean was 0.84 ± 0.79. Values ranged from 0.15 to 4.90.

Sex differences:

Both sexes from Masfjord had a higher hepatosomatic index, when comparing females (t-test; t=6.78, df=181, p=<0.001, figure 3.12 b) and males (t-test; t=4.63, df=93, p=<0.001) between the fjords. Males from Masfjord (t-test; t=3.6, df=154, p=0.0004) and Lustrafjord (t-test; t=2.5, df=50, p=0.014) had a higher hepatosomatic index compared to females within fjord.

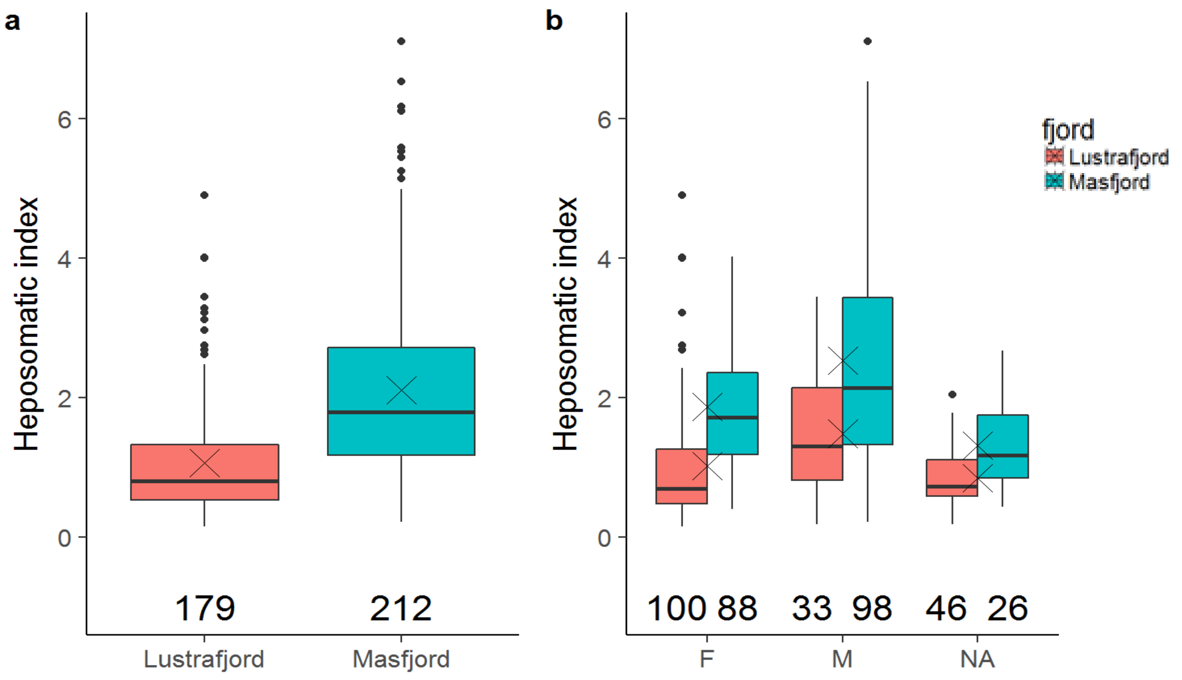


Figure 3.12: Boxplot of (a) hepatosomatic index for *Coryphaenoides rupestris* in Masfjord and Lustrafjord and (b) boxplot of hepatosomatic index for the different sexes; females (F), males (M) and individuals with unidentified sex (NA), in Masfjord and Lustrafjord. Sample sizes are shown beneath the boxes and corresponds to the different locations from left to right. X indicates mean, thick line indicates median, and black dots outside the whiskers corresponds to outliers.

Annual variations:

There were found differences in hepatosomatic index between grenadiers sampled in 2012, 2015 and 2016 in Masfjord (glmmPQL; denDF=14, F=19.4, p=<0.001. , figure 3.13). Fish sampled in 2012 had the highest gonad output, while fish from 2015 had the lowest.

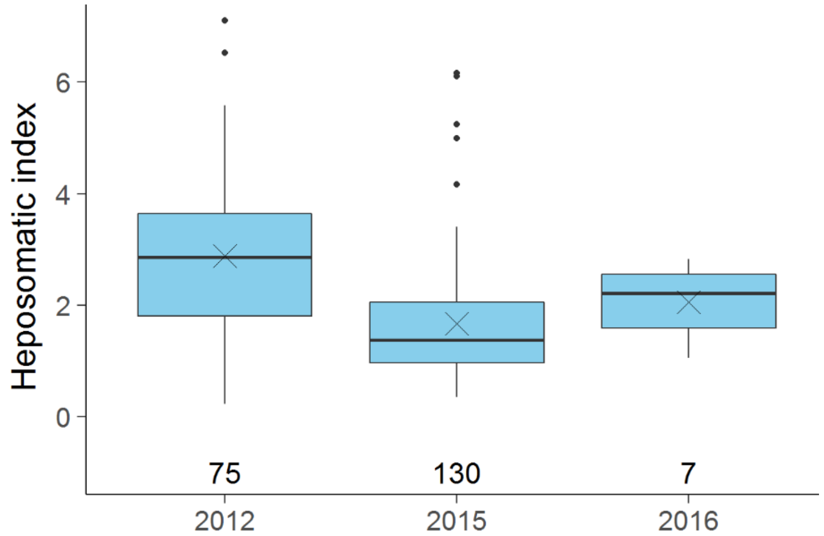


Figure 3.13: Boxplots of hepatosomatic index for of *Coryphaenoides rupestris*, caught in 2012, 2015 and 2016 (only pelagically caught individuals) in Masfjord. Sample sizes are shown beneath the boxes and corresponds to the different locations from left to right. X indicates mean, thick line indicates median, and black dots outside the whiskers corresponds to outliers.

4. Discussion:

Summarize of results:

Roundnose grenadier (*C. rupestris*) were sampled from two different Norwegian fjords to investigate feeding ecology, diet differences and consumption of pelagic prey species to identify a possible diel vertical migration pattern. In total, the diet consisted mostly of crustaceans, 19 % of identified prey items were non-crustacean taxa. There were some diet difference between the fjords, Chaetognatha were only found as prey in Masfjord, besides this no other major differences were found. Fish from Lustrafjord had more food in the stomach, while the Masfjord population had a higher amount of sexually matured fish and more stored resources in the liver. There were no clear diurnal differences in consumed prey taxa, but in general pelagically caught fish contained more pelagic prey and fish caught with bottom trawl had a higher occurrence of bottom dwelling organisms.

Feeding ecology of roundnose grenadier in Norwegian fjords:

We hypothesized that *C. rupestris* in the fjords would feed on different types of pelagic and benthic prey, since other studies have pointed that out (Mauchline and Gordon, 1984, Mauchline and Gordon, 1991, Bergstad, 1990, Bergstad *et al.*, 2003, Bergstad *et al.*, 2010, Gushchin and Podrazhanskaya, 1984). Common benthic prey organisms were; Crustacea, Tunicata, Mollusca, Polychaeta. It was expected that *C. rupestris* would feed on mesopelagic fish, but this was not the case, as the most frequent pelagic preys eaten were pelagic crustaceans and zooplankton. The low amount of Pisces eaten shows that fish collected from the fjords, rarely feed on fish. Feeding of roundnose grenadier on macroplankton, pelagic crustaceans, and small amount of fish will classify the roundnose grenadiers in the fjords as consumers of the 2^{nd} or 3^{rd} level. The same findings has been found by Gushchin and Podrazhanskaya (1984), which classified the populations in the Northwest Atlantic as 2^{nd} or 3^{rd} level consumers.

Diet and population comparisons between fjords:

Studies have shown that the North-East region of the Atlantic have larger grenadiers with fish being the most important prey, while in the West region the most important prey is crustaceans (Gushchin and Podrazhanskaya, 1984). Since the populations studied are in two different fjords on the west coast of Norway, we hypothesized that there would be a difference in food-spectra and prey composition. When comparing prey categories, both fjord populations had eaten the same prey categories, apart from chaetognaths (only found as prey item in Masfjord). Amount of pelagic and benthic prey differed between the fjords. The fish from Masfjord had more frequently eaten pelagic prey; small staged Copepoda, Chaetognatha and Euphausiacea, while there were a higher occurrence of bottom dwelling Mollusca, Crustacea and Polychaeta in Lustrafjord. Also, the fish from Lustrafjord had a higher consumption of stone/mud in the stomach content. This may be an indication that the population of *C. rupestris* in Lustrafjord forage more often on the sea floor and are therefore observed with more benthic prey items in the stomach analyses. However, the sample sizes for pelagically caught individuals in Masfjord is much higher (n=40), than the pelagic catch in Lustrafjord (n=2). When comparing the bottom trawls, fish from both locations were presented with high amount of bottom dwelling organisms such as; mollusks and benthic crustaceans. The underrepresentation of pelagically caught individuals in Lustrafjord may cause a bias in the stomach analyses when comparing pooled data between the fjords. With that in mind, the conclusion is that there is no difference in diet between the fjord populations examined.

The size distribution between the two fjords showed that there was a smaller distribution among the fish in Lustrafjord, compared to Masfjord. Comparing size distributions for the sampled fish with gonadosomatic indices, establish that collected fish from Lustrafjord had a higher distribution of younger individuals. It could be that small fish were inadequately represented in the catches from Masfjord. Studies on size distribution of *C. rupestris* on the west-coast of Norway (Eliassen, 1986, Eliassen, 1983), Skagerrak (Bergstad, 1990) and Iceland (Savvatimsky, 1987) states that there usually is a dominance of larger fish. There is no indication in the data suggesting a lower representation of juvenile fish in the collected materials from Masfjord, but Bergstad (1990) discussed that observations of such trends may come from a combination of high juvenile mortality and low mortality among old fish (Bergstad, 1990).

Because of difficulties in identifying maturation stages, the raw data collected from maturation stages were too unreliable for analysis, and only gonadosomatic indices were used to estimate gonad production. Several studies, in and nearby, Norwegian coastal waters have reported a prolonged spawning period with a peak in autumn to early winter (Bergstad, 1990, Eliassen, 1983, Gordon and Hunter, 1994, Magnússon and Magnússon, 1995). It could be that the roundnose grenadiers in the fjords reproduce biannually, as suggested by Devine *et al.* (2012) and Alekseyev *et al.* (1992), or that they reproduce only during seasons with good food availability, but because of lack in data there is no concluding remarks. The high gonadosomatic indices from Masfjord, indicated a spawning period at time of sampling, in September-October, each year investigated.

Due to a high reproductive output, there should be a trade-off in smaller amount of preserved energy reserves in the liver, as discussed by Love (1970). This trade-off is seen between sex, but not when comparing between fjords. Whilst comparing feeding activity, it was expected that fish with high gonad production need more energy and therefore more food. When comparing gonad output and liver output to stomach content weight there is a high indication that the fish in Lustrafjord eat more, even though they have less stored resources in the liver and lower gonad output. The trade-off in resource allocation is not seen between the fjords. It is plausible that because of the shortage of saved resources, the amount of energy input is much higher, and therefore a pattern of higher feeding activity is seen in Lustrafjord. However, even though there is a direct difference in resource allocation, it could also be that the seasonal dynamics of roundnose grenadier feeding and reproductive ecology may be different in the two fjords. Usually, *C. rupestris* in the North-Atlantic is reported to experience an increase in feeding activity during spring to autumn, with a peak happening in September to November which correlates to spawning season (Gushchin and Podrazhanskaya, 1984). It could be that the seasonal dynamics in Lustrafjord is delayed due to latitudinal and longitudinal gradients which affects interannually variations in food abundance and the species energetic storage and status, as pointed out by Drazen (2002). The Lustrafjord population may spawn later in the autumn, compared to the Masfjord population. Either way, stomachs, gonad and liver data were collected from fish sampled in September-October and since the samples where restricted to these months, a full analysis of annual diet and reproductive biology was not available. Nonetheless, the feeding activity in Lustrafjord is much higher compared to Masfjord.

Diet effects within fjord:

It does not appear that the diet of *C. rupestris* in Masfjord and Lustrafjord is affected by sexual or annual factors. There are differences between the fjords, but no major differences within each fjord. A larger proportion of females within each fjord seemed more opportunistic compared to males, but the statistical analyses revealed no large differences. The only exception was for females in Masfjord, which had consumed chaetognaths in 2012 and 2015. The small sample size of males from Lustrafjord made it difficult to find any clear patterns of diet divergence. Therefore, the conclusion is that there is no sexual effect on diet.

Size of grenadiers have shown to affect diet. Mauchline and Gordon (1984) found that amphipods, mysids, euphausiids, decapods and especially fish were more prominent in larger grenadiers. In this study, an increase in consumption of euphasiids in Masfjord and polychaetas in Lustrafjord correlated to an increase in pre-anal fin-length was found. Occurrence of decapods increased with increasing length in both fjords, and mollusks were more prominent in larger grenadiers in Lustrafjord. This concludes that size influences the diet.

Due to a small sample size in 2016, the chi-squared tests are clearly biased when comparing annual diet analysis of *C. rupestris* in Masfjord. Looking at the stomach content relative to body weight, it appears that the fish in 2016 had a higher value compared to other years. Bergstad *et al.* (2010) discussed that diet analysis may not reveal information on the diet composition because of advanced digestion of prey contents. Digestion rates for prey components vary, and therefore some prey items, as example prey with exoskeleton may be overrepresented while soft tissue prey is easily digested. Fish collected in 2016 was dissected and stomachs were removed and frozen directly after the fish were collected from the trawl, while in 2012 and 2015 the fish were collected from the trawl, frozen down and later thawed before collection of stomach. Due to differences in stomach collection it is reasonable to argue that fish stomachs collected from *C. rupestris* in Masfjord, 2016, have a more accurate and representable stomach content analysis, compared to those of 2012 and 2015. The qualitative digestion scale is a good measure, but because of a small sample size in 2016, a full comparison is difficult to interpret.

Diel vertical migration

Due to the amount of pelagic prey found in the stomach analyses from Masfjord, there is expected an overlap between the predator and prey. Causes for this overlap may be that pelagic invertebrates with diel vertical migration migrates closer to the bottom in Masfjord, or that *C. rupestris* have a diel vertical migration pattern which increases occurrence of foraging on pelagic prey, or that both prey and predator have vertical movements, and this creates opportunities to predate on pelagic prey. Several studies have shown evidence for migrating diurnal patterns in roundnose grenadiers; Haedrich and Henderson (1974) caught 49 *C. rupestris* in Denmark Strait with use of pelagic nets in mid-water, and in a joint study by Casey and Myers (1998) in which different species were investigated for diel variation in catchability by the coast of Newfoundland and Labrador, they found out that *C. rupestris* had a higher catchability at night with the use of pelagic trawl. When comparing diet analyses and stomach content relative to body weight in the fjords, there is no evidence to suggest that *C. rupestris* migrate upwards during night or day to forage on pelagic prey, the only evidence is that the fish eats pelagic prey and that it is catchable in the pelagic zone. A more precise study on the foraging behavior of *C. rupestris* is needed to investigate a possible diel vertical migration pattern in the two fjords.

Concluding remarks:

Overall, the diet analyses showed that roundnose grenadiers from two Norwegian fjords utilize food resources in both pelagic and demersal zone, and that size influences the diet. The amount of qualitative data from the study is sufficient to establish that the feeding ecology of *C. rupestris* have no major differences when compared to populations in the Northwest-Atlantic. They feed mostly on Amphipoda, Copepoda, Euphausiacea, Polychaetae and Mollusca, and is classified as 2^{nd} or 3^{rd} carnivorous consumer. We hypothesized that diet within each fjord would differ, but there was no clear difference in diet between the two fjords. Both populations were presented with pelagic and benthic prey, and even though the amount of different prey categories varied, no clear differences was found, and therefore the hypothesis is rejected. There were no clear variations in the diet between males and females, or annually in Masfjord, but size has an effect when specializing on other larger prey groups as krill and polychaetas. Since collection of materials were only performed during autumn, full analysis of annual diet and reproductive biology was not possible, but there was an indication of a spawning period happening in Masfjord, in September/October each year. Also, decayed stomach content and no quantitative length-weight data of each prey species gives an insufficient precision of diet descriptions, and therefore a lack in statistical support when determining the importance of prey species. We also hypothesized that the stomach content would be dominated by different pelagic prey species, and this was confirmed. Although the importance of pelagic prey was high and this indicates that roundnose grenadiers in fjords forage in the pelagic zone, the hypothesis regarding a diel vertical migration pattern for the predator could not be confirmed. The only evidences found were that the grenadier was catchable in the pelagic zone, and that they forage on pelagic prey.

Further research:

Since fjord studies rarely involves demersal fish species and little is known about the trophic interactions of *C. rupestris* in Norwegian fjords (Bergstad, 1990), further research is recommended. The possible differences in vertical trophic levels can be examined by use of trophic biomarkers, such as fatty-acid and isotope profiles (Drazen and Sutton, 2017), along with annual gonad and diet analysis to investigate seasonal variations in prey consumption, feeding activity and reproduction. It is also recommended to investigate stomach content from a larger sample size of pelagically caught individuals in fjords. To identify a possible diel vertical migration pattern for *C. rupestris*, acoustic surveys on foraging behavior will be needed.

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Appendix:

A: R-syntax:

A.1: Stomach analyses:

#Differences between fjords:

##Import data;

mage.df <- read.table('mageanalyse.csv', header=T, sep=';', dec=',')

##Subsets of Masfjord and Lustrafjord

mas.df <- subset(mage.df, location == "Masfjord")

lus.df <- subset(mage.df, location == "Lustrafjord")

#Loading packages:

library(knitr)

#Calculating frequency of occurrence in Masfjord

fo.mas <- as.data.frame(colSums((mas.df[,23:34] !=0) /nrow(mas.df))*100)

names(fo.mas)[1] <- 'Masfjorden'

fo.mas[,1] <- round(fo.mas[,1],1)

#Calculating frequency of occurrence in Lustrafjord

fo.lus <- as.data.frame(colSums((lus.df[,23:34] !=0) /nrow(lus.df))*100)

names(fo.lus)[1] <- 'Lustrafjorden'

fo.lus[,1] <- round(fo.lus[,1],1)

 # Calculating proportion of prey by number in Masfjord:

ni.mas <- as.data.frame(colSums((mas.df[,23:34]) /sum(rowSums(subset(mas.df, select=23:34)))))*100

names(ni.mas)[1] <- '%N Masfjorden'

ni.mas[,1] <- round(ni.mas[,1],1)

 # Calculating proportion of prey by number in Lustrafjord:

ni.lus <- as.data.frame(colSums((lus.df[,23:34]) /sum(rowSums(subset(lus.df, select=23:34))))*100) #Lustrafjord in total

names(ni.lus)[1] <- '%N Lustrafjorden'

```
ni.lus[,1] <- round(ni.lus[,1],1)
```

#Making table of F% and N%:

```
fo.ni.tot<-cbind(fo.mas,fo.lus, ni.mas,ni.lus)
knitr::kable(fo.ni.tot)
```

##Chi-squared Test: #extracting values for grenadier eaten and grenadier not eaten prey component:

```
f.lus<-(c(colSums((lus.df[,23:34]!=0),colSums(lus.df[,23:34] == 0))))
f.ikke.lus<-(c(colSums(lus.df[,23:34] == 0)))

f.mas<-(c(colSums((mas.df[,23:34]!=0),colSums(mas.df[,23:34] == 0))))
f.ikke.mas<-(c(colSums(mas.df[,23:34] ==0 )))
```

#Making a table of the variables:

```
observed<-as.data.frame(rbind(f.lus, f.ikke.lus, f.mas, f.ikke.mas), ncol=12)
```

#Making a matrix of each prey variable:

```
amp<-matrix(observed$Amphipoda, ncol=2)
cop<-matrix(observed$Copepoda, ncol=2)
eup<-matrix(observed$Euphausiacea, ncol=2)
dec<-matrix(observed$Decapoda, ncol=2)
mol<-matrix(observed$Mollusca, ncol=2)
cha<-matrix(observed$Chaetognatha, ncol=2)
tun<-matrix(observed$Tunicata, ncol=2)
pol<-matrix(observed$Polychaeta, ncol=2)
ot.cru<-matrix(observed$Other.Crusteceans, ncol=2)
pis<-matrix(observed$Pisces, ncol=2)
other<-matrix(observed$Other, ncol=2)
stone<-matrix(observed$stone.mud, ncol=2)
```

#Exctracting one prey variable at a time for test:

```
chisq.test(amp)
chisq.test(cop)
chisq.test(eup)
```

```
chisq.test(dec)
chisq.test(mol)
chisq.test(cha)
chisq.test(tun)
chisq.test(pol)
chisq.test(ot.cru)
chisq.test(pis)
chisq.test(other)
chisq.test(stone)
```

 # Sex differences:

```
##Import;
mage.df <- read.table('mageanalyse.csv', header=T, sep=';', dec=',')
##Subsets of Masfjord and Lustrafjord
mas.df <- subset(mage.df, location == "Masfjord")
lus.df <- subset(mage.df, location == "Lustrafjord")
#Subsetting sex in Masfjord:
female.masfjord.df = subset(mas.df, sex == 'F')
male.masfjord.df = subset(mas.df, sex == 'M')
#Subsetting sex in Lustrafjord:
female.lustrafjord.df = subset(lus.df, sex == 'F')
male.lustrafjord.df = subset(lus.df, sex == 'M')
#Loading knitr
library(knitr)

#Frequency of occurrence for sex in Masfjord:
fo.female.masfjord<-as.data.frame(colSums((female.masfjord.df[,23:34] !=0)
/nrow(female.masfjord.df))*100)
names(fo.female.masfjord)[1] <- 'Masfjord female'
fo.female.masfjord[,1] <- round(fo.female.masfjord[,1],1)


fo.male.masfjord<-as.data.frame(colSums((male.masfjord.df[,23:34] !=0)
/nrow(male.masfjord.df))*100)
names(fo.male.masfjord)[1] <- 'Masfjord male'
fo.male.masfjord[,1] <- round(fo.male.masfjord[,1],1)
```

 # Frequency of occurrence for sex in Lustrafjord:

```
fo.female.lustrafjord<-as.data.frame(colSums((female.lustrafjord.df[,23:34] !=0)
/nrow(female.lustrafjord.df))*100)

names(fo.female.lustrafjord)[1] <- 'Lustrafjord female'

fo.female.lustrafjord[,1] <- round(fo.female.lustrafjord[,1],1)


fo.male.lustrafjord<-as.data.frame(colSums((male.lustrafjord.df[,23:34] !=0)
/nrow(male.lustrafjord.df))*100)

names(fo.male.lustrafjord)[1] <- 'Lustrafjord male'

fo.male.lustrafjord[,1] <- round(fo.male.lustrafjord[,1],1)
```

#Calculating proportion of prey by number in Masfjord:

```
ni.female.mas <- as.data.frame(colSums((female.masfjord.df[,23:34])
/sum(rowSums(subset(female.masfjord.df, select=23:34)))))*100

names(ni.female.mas)[1] <- '%N female Masfjorden'

ni.female.mas[,1] <- round(ni.female.mas[,1],1)


ni.male.mas <- as.data.frame(colSums((male.masfjord.df[,23:34])
/sum(rowSums(subset(male.masfjord.df, select=23:34)))))*100

names(ni.male.mas)[1] <- '%N male Masfjorden'

ni.male.mas[,1] <- round(ni.male.mas[,1],1)
```

#Calculating proportion of prey by number in Lustrafjord:

```
ni.female.lus <- as.data.frame(colSums((female.lustrafjord.df[,23:34])
/sum(rowSums(subset(female.lustrafjord.df, select=23:34)))))*100

names(ni.female.lus)[1] <- '%N Female Lustrafjord'

ni.female.lus[,1] <- round(ni.female.lus[,1],1)


ni.male.lus <- as.data.frame(colSums((male.lustrafjord.df[,23:34])
/sum(rowSums(subset(male.lustrafjord.df, select=23:34)))))*100

names(ni.male.lus)[1] <- '%N Male Lustrafjord'

ni.male.lus[,1] <- round(ni.male.lus[,1],1)
```

#Making table of F% and N%

```
fo.ni.tot<-cbind(fo.female.masfjord, fo.male.masfjord,

        fo.female.lustrafjord, fo.male.lustrafjord,
```

```
                ni.female.mas, ni.male.mas,
                ni.female.lus, ni.male.lus)
knitr::kable(fo.ni.tot)
```

#Chi-squared Test; extracting values for grenadier eaten and grenadier not eaten prey component for sex in Lustrafjord:

```
f.sexF.lus<-(c(colSums((female.lustrafjord.df[,23:34]!=0),colSums(female.lustrafjord.df[,23:34] == 0))))
f.sexF.ikke.lus<-(c(colSums(female.lustrafjord.df[,23:34] == 0)))

f.sexM.lus<-(c(colSums((male.lustrafjord.df[,23:34]!=0),colSums(male.lustrafjord.df[,23:34] == 0))))
f.sexM.ikke.lus<-(c(colSums(male.lustrafjord.df[,23:34] == 0)))
```

#Making a table of the variables:

```
observed<-as.data.frame(rbind(f.sexF.lus, f.sexF.ikke.lus,
                        f.sexM.lus,f.sexM.ikke.lus), ncol=12)
```

#Making a matrix of each prey variable:

```
amp<-matrix(observed$Amphipoda, ncol=2)
cop<-matrix(observed$Copepoda, ncol=2)
eup<-matrix(observed$Euphausiacea, ncol=2)
dec<-matrix(observed$Decapoda, ncol=2)
mol<-matrix(observed$Mollusca, ncol=2)
cha<-matrix(observed$Chaetognatha, ncol=2)
tun<-matrix(observed$Tunicata, ncol=2)
pol<-matrix(observed$Polychaeta, ncol=2)
ot.cru<-matrix(observed$Other.Crusteceans, ncol=2)
pis<-matrix(observed$Pisces, ncol=2)
other<-matrix(observed$Other, ncol=2)
stone<-matrix(observed$stone.mud, ncol=2)
```

#Exctracting one prey variable at a time for test:

```
chisq.test(amp)
chisq.test(cop)
chisq.test(eup)
```

```
chisq.test(dec)
chisq.test(mol)
chisq.test(cha)
chisq.test(tun)
chisq.test(pol)
chisq.test(ot.cru)
chisq.test(pis)
chisq.test(other)
chisq.test(stone)
```

#Chi-squared Test; extracting values for grenadier eaten and grenadier not eaten prey component for sex in Masfjord:

```
f.sexF.mas<-(c(colSums((female.masfjord.df[,23:34]!=0),colSums(female.masfjord.df[,23:34] == 0))))
f.sexF.ikke.mas<-(c(colSums(female.masfjord.df[,23:34] == 0)))

f.sexM.mas<-(c(colSums((male.masfjord.df[,23:34]!=0),colSums(male.masfjord.df[,23:34] == 0))))
f.sexM.ikke.mas<-(c(colSums(male.masfjord.df[,23:34] == 0)))
```

#Making a table of the variables:

```
observed<-as.data.frame(rbind(f.sexF.mas, f.sexF.ikke.mas,
                        f.sexM.mas,f.sexM.ikke.mas), ncol=12)
```

#Making a matrix of each prey category:

```
amp<-matrix(observed$Amphipoda, ncol=2)
cop<-matrix(observed$Copepoda, ncol=2)
eup<-matrix(observed$Euphausiacea, ncol=2)
dec<-matrix(observed$Decapoda, ncol=2)
mol<-matrix(observed$Mollusca, ncol=2)
cha<-matrix(observed$Chaetognatha, ncol=2)
tun<-matrix(observed$Tunicata, ncol=2)
pol<-matrix(observed$Polychaeta, ncol=2)
ot.cru<-matrix(observed$Other.Crusteceans, ncol=2)
pis<-matrix(observed$Pisces, ncol=2)
other<-matrix(observed$Other, ncol=2)
stone<-matrix(observed$stone.mud, ncol=2)
```

#Exctracting one prey variable at a time for test:

```
chisq.test(amp)
chisq.test(cop)
chisq.test(eup)
chisq.test(dec)
chisq.test(mol)
chisq.test(cha)
chisq.test(tun)
chisq.test(pol)
chisq.test(ot.cru)
chisq.test(pis)
chisq.test(other)
chisq.test(stone)
```

#Annual variations:

##Import:

```
mage.df <- read.table('mageanalyse.csv', header=T, sep=';', dec=',')
```

#Subset of Masfjord

```
mas.df <- subset(mage.df, location == "Masfjord")
```

#Subsetting by years in Masfjord:

```
y2012.df = subset(mas.df, year=='2012')
y2015.df = subset(mas.df, year=='2015')
y2016.df = subset(mas.df, year=='2016')
```

#Calculating frequency of occurrence by years:

```
y12<-as.data.frame(colSums((y2012.df[,23:34] !=0) /nrow(y2012.df))*100)
names(y12)[1] <- 'Masfjorden 2012'
y12[,1] <- round(y12[,1],1)

y15<-as.data.frame(colSums((y2015.df[,23:34] !=0) /nrow(y2015.df))*100)
names(y15)[1] <- 'Masfjorden 2015'
y15[,1] <- round(y15[,1],1)
```

```
y16<-as.data.frame(colSums((y2016.df[,23:34] !=0) /nrow(y2016.df))*100)

names(y16)[1] <- 'Masfjorden 2016'

y16[,1] <- round(y16[,1],1)
```

#Calculating proportion of prey in numbers by years:

```
ni.2012 <- as.data.frame(colSums((y2012.df[,23:34]) /sum(rowSums(subset(y2012.df, select=23:34)))))*100

names(ni.2012)[1] <- '%N 2012'

ni.2012[,1] <- round(ni.2012[,1],1)


ni.2015 <- as.data.frame(colSums((y2015.df[,23:34]) /sum(rowSums(subset(y2015.df, select=23:34)))))*100

names(ni.2015)[1] <- '%N 2015'

ni.2015[,1] <- round(ni.2015[,1],1)


ni.2016 <- as.data.frame(colSums((y2016.df[,23:34]) /sum(rowSums(subset(y2016.df, select=23:34)))))*100

names(ni.2016 )[1] <- '%N 2016'

ni.2016 [,1] <- round(ni.2016 [,1],1)
```

#Making table of F% and N%

```
fo.ni.tot<-cbind(y12, y15, y16, ni.2012, ni.2015, ni.2016)

knitr::kable(fo.ni.tot)
```

#Chi-squared Test; extracting values for grenadier eaten and grenadier not eaten prey component for years;

#2012:

```
f.y2012<-(c(colSums((y2012.df[,23:34]!=0),colSums(y2012.df[,23:34] == 0))))

f.ikke.y2012<-(c(colSums(y2012.df[,23:34] == 0)))
```

#2015

```
f.y2015<-(c(colSums((y2015.df[,23:34]!=0),colSums(y2015.df[,23:34] == 0))))

f.ikke.y2015<-(c(colSums(y2015.df[,23:34] ==0 )))
```

#2016

```
f.y2016<-(c(colSums((y2016.df[,23:34]!=0),colSums(y2016.df[,23:34] == 0))))

f.ikke.y2016<-(c(colSums(y2016.df[,23:34] == 0)))
```

#Making a table of the variables:

```
observed<-as.data.frame(rbind(f.y2012,f.ikke.y2012, f.y2015, f.ikke.y2015, f.y2016, f.ikke.y2016), ncol=12)
```

#Making a matrix of each prey variable:

```
amp<-matrix(observed$Amphipoda, ncol=2)
cop<-matrix(observed$Copepoda, ncol=2)
eup<-matrix(observed$Euphausiacea, ncol=2)
dec<-matrix(observed$Decapoda, ncol=2)
mol<-matrix(observed$Mollusca, ncol=2)
cha<-matrix(observed$Chaetognatha, ncol=2)
tun<-matrix(observed$Tunicata, ncol=2)
pol<-matrix(observed$Polychaeta, ncol=2)
ot.cru<-matrix(observed$Other.Crusteceans, ncol=2)
pis<-matrix(observed$Pisces, ncol=2)
other<-matrix(observed$Other, ncol=2)
stone<-matrix(observed$stone.mud, ncol=2)
```

#Exctracting one prey variable at a time for test:

```
chisq.test(amp)
chisq.test(cop)
chisq.test(eup)
chisq.test(dec)
chisq.test(mol)
chisq.test(cha)
chisq.test(tun)
chisq.test(pol)
chisq.test(ot.cru)
chisq.test(pis)
chisq.test(other)
chisq.test(stone)
```

```
#Differences between night and day:
##Import;
mage.df <- read.table('mageanalyse.csv', header=T, sep=';', dec=',')

#Subsets of Masfjord and Lustrafjord
mas.df <- subset(mage.df, location == "Masfjord")
lus.df <- subset(mage.df, location == "Lustrafjord")

#Subsets of day and night trawl in Masfjord:
day.mas.df <- subset(mas.df, day.night == "day")
night.mas.df <- subset(mas.df, day.night == "night")

#Subsets of day and night trawl in Lustrafjord:
day.lus.df <- subset(lus.df, day.night == "day")
night.lus.df <- subset(lus.df, day.night == "night")

#Calculating frequency of occurrence in Masfjord:
day.masfjord <- as.data.frame(colSums((day.mas.df[,23:34] !=0) /nrow(day.mas.df))*100)
names(day.masfjord)[1]<- 'Day Masfjord'
day.masfjord[,1]<-round(day.masfjord[,1],1)

night.masfjord<-as.data.frame(colSums((night.mas.df[,23:34] !=0) /nrow(night.mas.df))*100)
names(night.masfjord)[1]<- 'Night Masfjord'
night.masfjord[,1]<-round(night.masfjord[,1],1)
#Calculating frequency of occurrence in Lustrafjord:
day.lustrafjord<-as.data.frame(colSums((day.lus.df[,23:34] !=0) /nrow(day.lus.df))*100)
names(day.lustrafjord)[1]<- 'Day Lustrafjord'

day.lustrafjord[,1]<-round(day.lustrafjord[,1],1)
night.lustrafjord<-as.data.frame(colSums((night.lus.df[,23:34] !=0) /nrow(night.lus.df))*100)
names(night.lustrafjord)[1]<- 'Night'
night.lustrafjord[,1]<-round(night.lustrafjord[,1],1)
```

#Calculating proportion of prey by numbers in Masfjord:

ni.day.m <- as.data.frame(colSums((day.mas.df[,23:34]) /sum(rowSums(subset(day.mas.df, select=23:34)))))*100

names(ni.day.m)[1] <- '%N day.m '

ni.day.m [,1] <- round(ni.day.m [,1],1)

ni.night.m <- as.data.frame(colSums((night.mas.df[,23:34]) /sum(rowSums(subset(night.mas.df, select=23:34)))))*100

names(ni.night.m)[1] <- '%N night.m'

ni.night.m[,1] <- round(ni.night.m[,1],1)

#Calculating proportion of prey by numbers in Lustrafjord:

ni.day.l <- as.data.frame(colSums((day.lus.df[,23:34]) /sum(rowSums(subset(day.lus.df, select=23:34)))))*100

names(ni.day.l)[1] <- '%N day lus'

ni.day.l[,1] <- round(ni.day.l[,1],1)

ni.night.l <- as.data.frame(colSums((night.lus.df[,23:34]) /sum(rowSums(subset(night.lus.df, select=23:34)))))*100

names(ni.night.l)[1] <- '%N night.l'

ni.night.l[,1] <- round(ni.night.l[,1],1)

#Making a table of the results:

fo.ni.tot<-cbind(day.masfjord, night.masfjord, day.lustrafjord, night.lustrafjord,

ni.day.m, ni.night.m , ni.day.l, ni.night.l)

knitr::kable(fo.ni.tot)

#Chi-squared Test; extracting values for grenadier eaten and grenadier not eaten prey component in Masfjord:

f.dmas<-(c(colSums((day.mas.df[,23:34]!=0),colSums(day.mas.df[,23:34] == 0))))

f.ikke.dmas<-(c(colSums(day.mas.df[,23:34] == 0)))

f.nmas<-(c(colSums((night.mas.df[,23:34]!=0),colSums(night.mas.df[,23:34] == 0))))

f.ikke.nmas<-(c(colSums(night.mas.df[,23:34] ==0)))

#Making a table of the variables:

```
observed<-as.data.frame(rbind(f.dmas, f.ikke.dmas, f.nmas, f.ikke.nmas), ncol=12)
```

#Making a matrix of each prey variable:

```
amp<-matrix(observed$Amphipoda, ncol=2)
cop<-matrix(observed$Copepoda, ncol=2)
eup<-matrix(observed$Euphausiacea, ncol=2)
dec<-matrix(observed$Decapoda, ncol=2)
mol<-matrix(observed$Mollusca, ncol=2)
cha<-matrix(observed$Chaetognatha, ncol=2)
tun<-matrix(observed$Tunicata, ncol=2)
pol<-matrix(observed$Polychaeta, ncol=2)
ot.cru<-matrix(observed$Other.Crusteceans, ncol=2)
pis<-matrix(observed$Pisces, ncol=2)
other<-matrix(observed$Other, ncol=2)
stone<-matrix(observed$stone.mud, ncol=2)
```

#Exctracting one prey variable at a time for test:

```
chisq.test(amp)
chisq.test(cop)
chisq.test(eup)
chisq.test(dec)
chisq.test(mol)
chisq.test(cha)
chisq.test(tun)
chisq.test(pol)
chisq.test(ot.cru)
chisq.test(pis)
chisq.test(other)
chisq.test(stone)
```

#Chi-squared Test; extracting values for grenadier eaten and grenadier not eaten prey component in Lustrafjord:

```
f.dlus<-(c(colSums((day.lus.df[,23:34]!=0),colSums(day.lus.df[,23:34] == 0))))
f.ikke.dlus<-(c(colSums(day.lus.df[,23:34] == 0)))

f.nlus<-(c(colSums((night.lus.df[,23:34]!=0),colSums(night.lus.df[,23:34] == 0))))
f.ikke.nlus<-(c(colSums(night.lus.df[,23:34] == 0)))
```

#Making a table of the variables:

```
observed<-as.data.frame(rbind(f.dlus, f.ikke.dlus, f.nlus, f.ikke.nlus), ncol=12)
```

#Making a matrix of each prey variable:

```
amp<-matrix(observed$Amphipoda, ncol=2)
cop<-matrix(observed$Copepoda, ncol=2)
eup<-matrix(observed$Euphausiacea, ncol=2)
dec<-matrix(observed$Decapoda, ncol=2)
mol<-matrix(observed$Mollusca, ncol=2)
cha<-matrix(observed$Chaetognatha, ncol=2)
tun<-matrix(observed$Tunicata, ncol=2)
pol<-matrix(observed$Polychaeta, ncol=2)
ot.cru<-matrix(observed$Other.Crusteceans, ncol=2)
pis<-matrix(observed$Pisces, ncol=2)
other<-matrix(observed$Other, ncol=2)
stone<-matrix(observed$stone.mud, ncol=2)
```

#Exctracting one prey variable at a time for test:

```
chisq.test(amp)
chisq.test(cop)
chisq.test(eup)
chisq.test(dec)
chisq.test(mol)
chisq.test(cha)
chisq.test(tun)
chisq.test(pol)
chisq.test(ot.cru)
```

```
chisq.test(pis)
chisq.test(other)
chisq.test(stone)
```

#Differences in pelagic and bottom trawl catches:

#Import;

```
mage.df <- read.table('mageanalyse.csv', header=T, sep=';', dec=',')
```

#Subsets of Masfjord and Lustrafjord

```
mas.df <- subset(mage.df, location == "Masfjord")
lus.df <- subset(mage.df, location == "Lustrafjord")
```

#Subsets of pelagic and bottom trawl in Masfjord:

```
pelagic.mas.df <- subset(mas.df, pel.bot == "pelagic")
bottom.mas.df <- subset(mas.df, pel.bot == "bottom")
```

#Subsets of pelagic and bottom trawl in Lustrafjord:

```
pelagic.lus.df <- subset(lus.df, pel.bot == "pelagic")
bottom.lus.df <- subset(lus.df, pel.bot == "bottom")
```

#Calculating frequency of occurrence for fish caught with pelagic and bottom trawl in Masfjord:

```
pelagic.masfjord <- as.data.frame(colSums((pelagic.mas.df[,23:34] !=0) /nrow(pelagic.mas.df))*100)
names(pelagic.masfjord)[1] <- 'Pelagic Masfjord'
pelagic.masfjord[,1] <- round(pelagic.masfjord[,1],1)

bottom.masfjord <- as.data.frame(colSums((bottom.mas.df[,23:34]  !=0) /nrow(bottom.mas.df ))*100)
names(bottom.masfjord)[1]<- 'Bottom Masfjord'
bottom.masfjord[,1]<-round(bottom.masfjord[,1],1)
```

#Calculating frequency of occurrence for fish caught with pelagic and bottom trawl in Lustrafjord:

```
pelagic.lustrafjord <- as.data.frame(colSums((pelagic.lus.df[,23:34] !=0) /nrow(pelagic.lus.df))*100)
names(pelagic.lustrafjord)[1] <- 'Pelagic Lustrafjord'
pelagic.lustrafjord[,1] <- round(pelagic.lustrafjord[,1],1)

bottom.lustrafjord <- as.data.frame(colSums((bottom.lus.df[,23:34]  !=0) /nrow(bottom.lus.df))*100)
names(bottom.lustrafjord)[1]<- 'Bottom Lustrafjord'
```

```
bottom.lustrafjord[,1]<-round(bottom.lustrafjord[,1],1)
```

#Calculating proportion of prey by number in Masfjord

```
ni.pelagic.m <- as.data.frame(colSums((pelagic.mas.df[,23:34]) /sum(rowSums(subset(pelagic.mas.df, select=23:34)))))*100

names(ni.pelagic.m )[1] <- '%N pelagic.m '

ni.pelagic.m [,1] <- round(ni.pelagic.m [,1],1)


ni.bottom.m  <- as.data.frame(colSums((bottom.mas.df[,23:34]) /sum(rowSums(subset(bottom.mas.df, select=23:34)))))*100

names(ni.bottom.m)[1] <- '%N bottom.m'

ni.bottom.m[,1] <- round(ni.bottom.m[,1],1)
```

#Calculating proportion of prey by number in Lustrafjord:

```
ni.pelagic.l <- as.data.frame(colSums((pelagic.lus.df[,23:34]) /sum(rowSums(subset(pelagic.lus.df, select=23:34)))))*100

names(ni.pelagic.l)[1] <- '%N pelagic lus'

ni.pelagic.l[,1] <- round(ni.pelagic.l[,1],1)


ni.bottom.l <- as.data.frame(colSums((bottom.lus.df[,23:34]) /sum(rowSums(subset(bottom.lus.df, select=23:34)))))*100

names(ni.bottom.l)[1] <- '%N bottom.l'

ni.bottom.l[,1] <- round(ni.bottom.l[,1],1)
```

#Making a table of F% and N%

```
fo.ni.tot<-cbind(pelagic.masfjord, bottom.masfjord, pelagic.lustrafjord, bottom.lustrafjord,
        ni.pelagic.m, ni.bottom.m , ni.pelagic.l,  ni.bottom.l)

knitr::kable(fo.ni.tot)
```

#Chi-squared Test; extracting values for grenadier eaten and grenadier not eaten prey component in Masfjord:

```
f.dmas<-(c(colSums((pelagic.mas.df[,23:34]!=0),colSums(pelagic.mas.df[,23:34] == 0))))

f.ikke.dmas<-(c(colSums(pelagic.mas.df[,23:34] == 0)))


f.nmas<-(c(colSums((bottom.mas.df[,23:34]!=0),colSums(bottom.mas.df[,23:34] == 0))))
```

```
f.ikke.nmas<-(c(colSums(bottom.mas.df[,23:34] ==0 )))
#making a table of the variables:
observed<-as.data.frame(rbind(f.dmas, f.ikke.dmas, f.nmas, f.ikke.nmas), ncol=12)

#Making a matrix of each prey variable:
amp<-matrix(observed$Amphipoda, ncol=2)
cop<-matrix(observed$Copepoda, ncol=2)
eup<-matrix(observed$Euphausiacea, ncol=2)
dec<-matrix(observed$Decapoda, ncol=2)
mol<-matrix(observed$Mollusca, ncol=2)
cha<-matrix(observed$Chaetognatha, ncol=2)
tun<-matrix(observed$Tunicata, ncol=2)
pol<-matrix(observed$Polychaeta, ncol=2)
ot.cru<-matrix(observed$Other.Crusteceans, ncol=2)
pis<-matrix(observed$Pisces, ncol=2)
other<-matrix(observed$Other, ncol=2)
stone<-matrix(observed$stone.mud, ncol=2)

#Exctracting one prey variable at a time for test:
chisq.test(amp)
chisq.test(cop)
chisq.test(eup)
chisq.test(dec)
chisq.test(mol)
chisq.test(cha)
chisq.test(tun)
chisq.test(pol)
chisq.test(ot.cru)
chisq.test(pis)
chisq.test(other)
chisq.test(stone)
```

#Chi-squared Test; extracting values for grenadier eaten and grenadier not eaten prey component in Lustrafjord:

```
f.dlus<-(c(colSums((pelagic.lus.df[,23:34]!=0),colSums(pelagic.lus.df[,23:34] == 0))))
f.ikke.dlus<-(c(colSums(pelagic.lus.df[,23:34] == 0)))

f.nlus<-(c(colSums((bottom.lus.df[,23:34]!=0),colSums(bottom.lus.df[,23:34] == 0))))
f.ikke.nlus<-(c(colSums(bottom.lus.df[,23:34] == 0)))
```

#Making a table of the variables:

```
observed<-as.data.frame(rbind(f.dlus, f.ikke.dlus, f.nlus, f.ikke.nlus), ncol=12)
```

#Making a matrix of each prey variable:

```
amp<-matrix(observed$Amphipoda, ncol=2)
cop<-matrix(observed$Copepoda, ncol=2)
eup<-matrix(observed$Euphausiacea, ncol=2)
dec<-matrix(observed$Decapoda, ncol=2)
mol<-matrix(observed$Mollusca, ncol=2)
cha<-matrix(observed$Chaetognatha, ncol=2)
tun<-matrix(observed$Tunicata, ncol=2)
pol<-matrix(observed$Polychaeta, ncol=2)
ot.cru<-matrix(observed$Other.Crusteceans, ncol=2)
pis<-matrix(observed$Pisces, ncol=2)
other<-matrix(observed$Other, ncol=2)
stone<-matrix(observed$stone.mud, ncol=2)
```

#Exctracting one prey variable at a time for test:

```
chisq.test(amp)
chisq.test(cop)
chisq.test(eup)
chisq.test(dec)
chisq.test(mol)
chisq.test(cha)
chisq.test(tun)
chisq.test(pol)
chisq.test(ot.cru)
```

```
chisq.test(pis)
chisq.test(other)
chisq.test(stone)

#Differences in length groups in Masfjord:
#Import;
mage.df <- read.table('mageanalyse.csv', header=T, sep=';', dec=',')

#Subsets of Masfjord
mas.df <- subset(mage.df, location == "Masfjord")

#Making length groups:
x1<-mas.df[which(mas.df$length <= 10), ]
x2<-mas.df[which(mas.df$length>10 & mas.df$length<=12),]
x3<-mas.df[which(mas.df$length>12 & mas.df$length<=14),]
x4<-mas.df[which(mas.df$length>14 & mas.df$length<=16),]
x5<-mas.df[which(mas.df$length >=16), ]

#Calculating frequency of occurrence:
fol1<-as.data.frame((colSums(x1[,23:34]!=0)/nrow(x1[,23:34])) *100)
names(fol1)[1]<-'Masfjorden [<= 10]'
fol1[,1]<-round(fol1[,1],1)

fol2<-as.data.frame((colSums(x2[,23:34]!=0)/nrow(x2[,23:34])) *100)
names(fol2)[1]<-'[10 - <12]'
fol2[,1]<-round(fol2[,1],1)

fol3<-as.data.frame((colSums(x3[,23:34]!=0)/nrow(x3[,23:34])) *100)
names(fol3)[1]<-'[12- <14]'
fol3[,1]<-round(fol3[,1],1)

fol4<-as.data.frame((colSums(x4[,23:34]!=0)/nrow(x4[,23:34])) *100)
names(fol4)[1]<-'[14- <16]'
fol4[,1]<-round(fol4[,1],1)
```

```
fol5<-as.data.frame((colSums(x5[,23:34]!=0)/nrow(x5[,23:34])) *100)
names(fol5)[1]<-'[> 16]'
fol5[,1]<-round(fol5[,1],1)
#Calculating proportion of prey in numbers:
ni.x1.m <- as.data.frame(colSums((x1[,23:34]) /sum(rowSums(subset(x1, select=23:34)))))*100
names(ni.x1.m )[1] <- '%N Masfjorden [<= 10]'
ni.x1.m [,1] <- round(ni.x1.m [,1],1)

ni.x2.m  <- as.data.frame(colSums((x2[,23:34]) /sum(rowSums(subset(x2, select=23:34)))))*100
names(ni.x2.m)[1] <- '%N [10 - <12]'
ni.x2.m[,1] <- round(ni.x2.m[,1],1)

ni.x3.m <- as.data.frame(colSums((x3[,23:34]) /sum(rowSums(subset(x3, select=23:34)))))*100
names(ni.x3.m )[1] <- '%N Masfjorden [12- <14]'
ni.x3.m [,1] <- round(ni.x3.m [,1],1)

ni.x4.m  <- as.data.frame(colSums((x4[,23:34]) /sum(rowSums(subset(x4, select=23:34)))))*100
names(ni.x4.m)[1] <- '%N [14- <16]'
ni.x4.m[,1] <- round(ni.x4.m[,1],1)

ni.x5.m  <- as.data.frame(colSums((x5[,23:34]) /sum(rowSums(subset(x5, select=23:34)))))*100
names(ni.x5.m)[1] <- '%N [> 16]'
ni.x5.m[,1] <- round(ni.x5.m[,1],1)


#Making a table for F% and N%
fol<-cbind(fol1,fol2,fol3,fol4,fol5,
        ni.x1.m, ni.x2.m, ni.x3.m, ni.x4.m, ni.x5.m)
knitr::kable(fol)
```

#Chi-squared Test; extracting values for grenadier eaten and grenadier not eaten prey component for length groups in Masfjord:

```
f.dmas<-(c(colSums((x1[,23:34]!=0),colSums(x1[,23:34] == 0))))
f.ikke.dmas<-(c(colSums(x1[,23:34] == 0)))

f.nmas<-(c(colSums((x2[,23:34]!=0),colSums(x2[,23:34] == 0))))
f.ikke.nmas<-(c(colSums(x2[,23:34] ==0 )))

f.dmas<-(c(colSums((x3[,23:34]!=0),colSums(x3[,23:34] == 0))))
f.ikke.dmas<-(c(colSums(x3[,23:34] == 0)))

f.nmas<-(c(colSums((x4[,23:34]!=0),colSums(x4[,23:34] == 0))))
f.ikke.nmas<-(c(colSums(x4[,23:34] ==0 )))

f.dmas<-(c(colSums((x5[,23:34]!=0),colSums(x5[,23:34] == 0))))
f.ikke.dmas<-(c(colSums(x5[,23:34] == 0)))
```

#Making a table of the variables:

```
observed<-as.data.frame(rbind(f.dmas, f.ikke.dmas, f.nmas, f.ikke.nmas), ncol=12)
```

#Making a matrix of each prey variable:

```
amp<-matrix(observed$Amphipoda, ncol=2)
cop<-matrix(observed$Copepoda, ncol=2)
eup<-matrix(observed$Euphausiacea, ncol=2)
dec<-matrix(observed$Decapoda, ncol=2)
mol<-matrix(observed$Mollusca, ncol=2)
cha<-matrix(observed$Chaetognatha, ncol=2)
tun<-matrix(observed$Tunicata, ncol=2)
pol<-matrix(observed$Polychaeta, ncol=2)
ot.cru<-matrix(observed$Other.Crusteceans, ncol=2)
pis<-matrix(observed$Pisces, ncol=2)
other<-matrix(observed$Other, ncol=2)
stone<-matrix(observed$stone.mud, ncol=2)
```

#Exctracting one prey variable at a time for test:

```
chisq.test(amp)
chisq.test(cop)
chisq.test(eup)
chisq.test(dec)
chisq.test(mol)
chisq.test(cha)
chisq.test(tun)
chisq.test(pol)
chisq.test(ot.cru)
chisq.test(pis)
chisq.test(other)
chisq.test(stone)
```

#Differences in length groups in Lustrafjord:

#Import;

```
mage.df <- read.table('mageanalyse.csv', header=T, sep=';', dec=',')
```

#Subsets of Lustrafjord

```
lus.df <- subset(mage.df, location == "Lustrafjord")
```

#Making length groups:

```
x6<-lus.df[which(lus.df$length < 10), ]
x7<-lus.df[which(lus.df$length>10 & lus.df$length<=12),]
x8<-lus.df[which(lus.df$length>12 & lus.df$length<=14),]
x9<-lus.df[which(lus.df$length>14 & lus.df$length<=16),]
x10<-lus.df[which(lus.df$length >=16), ]
```

#Calculating frequency of occurrence:

```
fol6<-as.data.frame((colSums(x6[,23:34]!=0)/nrow(x6[,23:34])) *100)
names(fol6)[1]<-'Lustrafjorden [< 10]'
fol6[,1]<-round(fol6[,1],1)
```

```
fol7<-as.data.frame((colSums(x7[,23:34]!=0)/nrow(x7[,23:34])) *100)
names(fol7)[1]<-'[10 - <12]'
fol7[,1]<-round(fol7[,1],1)

fol8<-as.data.frame((colSums(x8[,23:34]!=0)/nrow(x8[,23:34])) *100)
names(fol8)[1]<-'[12- <14]'
fol8[,1]<-round(fol8[,1],1)

fol9<-as.data.frame((colSums(x9[,23:34]!=0)/nrow(x9[,23:34])) *100)
names(fol9)[1]<-'[14- <16]'
fol9[,1]<-round(fol9[,1],1)

fol10<-as.data.frame((colSums(x10[,23:34]!=0)/nrow(x10[,23:34])) *100)
names(fol10)[1]<-'[> 16]'
fol10[,1]<-round(fol10[,1],1)

#Calculating proportion of prey by number:
ni.x6.m <- as.data.frame(colSums((x6[,23:34]) /sum(rowSums(subset(x6, select=23:34)))))*100
names(ni.x1.m )[1] <- '%N Masfjorden [<= 10]'
ni.x1.m [,1] <- round(ni.x1.m [,1],1)

ni.x7.m  <- as.data.frame(colSums((x7[,23:34]) /sum(rowSums(subset(x7, select=23:34)))))*100
names(ni.x7.m)[1] <- '%N [10 - <12]'
ni.x7.m[,1] <- round(ni.x7.m[,1],1)

ni.x8.m <- as.data.frame(colSums((x8[,23:34]) /sum(rowSums(subset(x8, select=23:34)))))*100
names(ni.x8.m )[1] <- '%N Masfjorden [12- <14]'
ni.x8.m [,1] <- round(ni.x8.m [,1],1)

ni.x9.m  <- as.data.frame(colSums((x9[,23:34]) /sum(rowSums(subset(x9, select=23:34)))))*100
names(ni.x9.m)[1] <- '%N [14- <16]'
ni.x9.m[,1] <- round(ni.x9.m[,1],1)
ni.x10.m  <- as.data.frame(colSums((x10[,23:34]) /sum(rowSums(subset(x10, select=23:34)))))*100
names(ni.x10.m)[1] <- '%N [> 16]'
```

```
ni.x10.m[,1] <- round(ni.x10.m[,1],1)


#Making a table of F% and N%
fol<-cbind(fol6,fol7,fol8,fol9,fol10,
      ni.x6.m, ni.x7.m, ni.x8.m, ni.x9.m, ni.x10.m)
knitr::kable(fol)


#Chi-squared Test; extracting values for grenadier eaten and grenadier not eaten prey component for length groups in Lustrafjord:
f.dlus<-(c(colSums((x6[,23:34]!=0),colSums(x6[,23:34] == 0))))
f.ikke.dlus<-(c(colSums(x6[,23:34] == 0)))


f.nlus<-(c(colSums((x7[,23:34]!=0),colSums(x7[,23:34] == 0))))
f.ikke.nlus<-(c(colSums(x7[,23:34] ==0 )))


f.dlus<-(c(colSums((x8[,23:34]!=0),colSums(x8[,23:34] == 0))))
f.ikke.dlus<-(c(colSums(x8[,23:34] == 0)))


f.nlus<-(c(colSums((x9[,23:34]!=0),colSums(x9[,23:34] == 0))))
f.ikke.nlus<-(c(colSums(x9[,23:34] ==0 )))


f.dlus<-(c(colSums((x10[,23:34]!=0),colSums(x10[,23:34] == 0))))
f.ikke.dlus<-(c(colSums(x10[,23:34] == 0)))


#Making a table of the variables:
observed<-as.data.frame(rbind(f.dlus, f.ikke.dlus, f.nlus, f.ikke.nlus), ncol=12)


#Making a matrix of each prey variable:
amp<-matrix(observed$Amphipoda, ncol=2)
cop<-matrix(observed$Copepoda, ncol=2)
eup<-matrix(observed$Euphausiacea, ncol=2)
dec<-matrix(observed$Decapoda, ncol=2)
mol<-matrix(observed$Mollusca, ncol=2)
cha<-matrix(observed$Chaetognatha, ncol=2)
```

```
tun<-matrix(observed$Tunicata, ncol=2)
pol<-matrix(observed$Polychaeta, ncol=2)
ot.cru<-matrix(observed$Other.Crusteceans, ncol=2)
pis<-matrix(observed$Pisces, ncol=2)
other<-matrix(observed$Other, ncol=2)
stone<-matrix(observed$stone.mud, ncol=2)

#Extracting one prey variable at a time for test:
chisq.test(amp)
chisq.test(cop)
chisq.test(eup)
chisq.test(dec)
chisq.test(mol)
chisq.test(cha)
chisq.test(tun)
chisq.test(pol)
chisq.test(ot.cru)
chisq.test(pis)
chisq.test(other)
chisq.test(stone)
```

A.2: Stomach content relative to body weight:

```
#Differences between fjords:
#Import of data;
mage.df <- read.table('mageanalyse.csv', header=T, sep=';', dec=',')

#making a new variable for proportion of stomach content weight relative to body weight (called bw):
mage.df$bw<-(mage.df$content.weight/mage.df$weight)

#Subset of Masfjord and Lustrafjord
mas.df <- subset(mage.df, location == "Masfjord")
lus.df <- subset(mage.df, location == "Lustrafjord")
```

```
#Loading packages:
library(ggplot2)
library(MASS)
library(nlme)

#give.n gives the sample sizes in the figures, beneath the boxplots:
give.n <- function(x){
  return(c(y= c(-1), label = c(length(x))))
}



#Making a model and analyzing it:
fit4a.glmm = glmmPQL(bw~location,random=~+1|st.nr/year, family='quasibinomial',
                     data=mage.df, na.action="na.exclude")
anova.lme(fit4a.glmm)

#Calculating mean, range and sd:
#Masfjord:
mean (mas.df$bw*100, na.rm=TRUE)
range (mas.df$bw*100, na.rm=TRUE)
sd (mas.df$bw*100, na.rm=TRUE)
#Lustrafjord:
mean (lus.df$bw*100, na.rm=TRUE)
range (lus.df$bw*100, na.rm=TRUE)
sd (lus.df$bw*100)

#Plot:
plot.bw.tot <- ggplot(mage.df,aes(x=location, y=bw*100, fill=location))+
  geom_boxplot()+
  ylab('Stomach content relative to body weight (%)')+
  geom_boxplot()+
  guides(fill=FALSE)+
  stat_summary( fun.data = give.n,
                geom = "text", position=position_dodge(width=0.9), size=6)+
```

```
  stat_summary(fun.y=mean, geom="point", shape=4, size=4)+ #To add crosses for mean values
  labs(x="")+
  theme_classic(base_size=20)
```

#Differences between sex:

#Making a model of the Masfjord subset and analyzing it:

```
fit4b.glmm = glmmPQL(bw~sex,random=~+1|st.nr/year, family='quasibinomial',
                     data=mas.df, na.action="na.exclude")
anova.lme(fit4b.glmm)
```

#Making a model of the Lustrafjord subset and analyzing it:

```
fit4bb.glmm = glmmPQL(bw~sex,random=~+1|st.nr/year, family='quasibinomial',
                      data=lus.df, na.action="na.exclude")
anova.lme(fit4bb.glmm)
```

#Testing males between the fjords:

```
male.df<-subset(mage.df, sex =='M')
t.test(bw~location, data=male.df)
```

#Testing females between the fjords:

```
female.df<-subset(mage.df, sex =='F')
t.test(bw~location, data=female.df)
```

#Plot:

```
plot.bw.sex.tot<-ggplot(mage.df, aes(x=sex, y=bw*100, fill=location))+
  ylab('Stomach content relative to body weight (%)')+
  geom_boxplot()+
  labs(x="")+
  stat_summary( fun.data = give.n,
               geom = "text", position=position_dodge(width=0.9), size=6)+
    stat_summary(fun.y=mean, geom="point", shape=4, size=4)+
  theme_classic(base_size=20)
```

#Combine the two plots of fjords and sex:

```
cowplot::plot_grid(plot.bw.tot, plot.bw.sex.tot, labels=c('a','b'))
```

#Differences between years in Masfjord:

#Making a model and analyzing it:

```
fit4d.glmm = glmmPQL(bw~year,random=~+1|st.nr, family='quasibinomial',
                data=mas.df, na.action="na.exclude")
anova.lme(fit4d.glmm)
```

#Plot:

```
plot.bw.year.tot<-ggplot(mas.df, aes(x=factor(year), y=bw*100))+
  geom_boxplot(fill="skyblue")+
  guides(fill=FALSE)+
  labs(x="Year", y="Stomach content relative to body weight (%)") +
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+ #To add crosses for mean values
  stat_summary( fun.data = give.n,
              geom = "text", position=position_dodge(width=0.9), size=6)+
  theme_classic(base_size=20)
plot.bw.year.tot
```

#Differences between night and day:

#Making a model of Masfjord dataset and analyzing it:

```
fit4e1.glmm = glmmPQL(bw~day.night,random=~+1|st.nr, family='quasibinomial',
                data=mas.df, na.action="na.exclude")
anova.lme(fit4e1.glmm)
```

#Making a model of Lustrafjord dataset and analyzing it:

```
fit4f1.glmm = glmmPQL(bw~day.night,random=~+1|st.nr, family='quasibinomial',
                data=lus.df, na.action="na.exclude")
anova.lme(fit4f1.glmm)
```

#Plot:

```
plot.bw.daynight.tot<-ggplot(mage.df, aes(x=day.night, y=bw*100, fill=location))+
  ylab('Stomach content relative to body weight (%)')+
  geom_boxplot()+
  labs(x="")+
  guides(fill=FALSE)+
  theme_classic(base_size=20)+
```

```
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+ #To add crosses for mean values
  stat_summary( fun.data = give.n,
              geom = "text", position=position_dodge(width=0.9), size=6)+
  theme(plot.title = element_text(lineheight=.8, face="bold"))
```

#Differences in pelagic and bottom trawl catches:

#Making a model of Masfjord dataset and analyzing it:

```
fit4e2.glmm = glmmPQL(bw~pel.bot,random=~+1|st.nr, family='quasibinomial',
                  data=mas.df, na.action="na.exclude")
anova.lme(fit4e2.glmm)
```

#Making a model of Lustrafjord dataset and analyzing it:

```
fit4f2.glmm = glmmPQL(bw~pel.bot,random=~+1|st.nr, family='quasibinomial',
                  data=lus.df, na.action="na.exclude")
anova.lme(fit4f2.glmm)
```

#Plot:

```
plot.bw.pelbot.tot<-ggplot(mage.df, aes(x=pel.bot, y=bw*100, fill=location))+
  ylab('Stomach content relative to body weight (%)')+
  geom_boxplot()+
  labs(x="")+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+ #To add crosses for mean values
  stat_summary( fun.data = give.n,
              geom = "text", position=position_dodge(width=0.9), size=6)+
  theme_classic(base_size=20)
```

#Combine the plots of day/night and pel/bot:

```
cowplot::plot_grid(plot.bw.daynight.tot, plot.bw.pelbot.tot,  labels=c('a','b'))
```

A.3: Pre-anal fin-length and weight:

```
#Differences between fjords:
#Import dataset:
tot.df <- read.table('samplingdata.18.04.csv', header=T, sep=';', dec=',')

#Making subsets of Lustrafjord and Masfjord:
lustrafjord.df<-subset(tot.df, fjord=='Lustrafjord')
masfjord.df<-subset(tot.df, fjord=='Masfjord')

#Loading packages:
library(nlme)
library(ggplot2)

#give.n gives the sample sizes in the figures, beneath the boxplots:
give.n <- function(x){
  return(c(y= c(-1), label = c(length(x))))
}

#Making a model of pre-anal fin-length and analyzing it:
fit1a.lme = lme(length~fjord, random=~+1|year/station,
        data=tot.df, na.action = na.omit)
anova(fit1a.lme)

#Making a model of weight and analyzing it:
#Making a linear-mixed effect to test for differences model between the fjords:
fit1f.lme = lme(weight~fjord, random=~+1|year/station,
        data=tot.df, na.action = na.omit)
summary(fit1f.lme)

#Calculating mean, range and sd for pre-anal fin-length:
#Masfjord:
exp(mean(log(masfjord.df$length)))
range (masfjord.df$length)
```

```
sd(masfjord.df$length)
#Lustrafjord:
exp(mean(log(lustrafjord.df$length)))
range (lustrafjord.df$length)
sd(lustrafjord.df$length)

#Calculating mean, range and sd for weight:
#Masfjord:
exp(mean(log(masfjord.df$weight)))
sd(masfjord.df$weight)
range (masfjord.df$weight)

#Lustrafjord
exp(mean(log(lustrafjord.df$weight)))
sd(lustrafjord.df$weight)
range (lustrafjord.df$weight)

#Plot:
length.tot<-ggplot(tot.df, aes(y=length, x=fjord, fill=fjord))+
  geom_boxplot()+
  ylab('Pre-anal fin-length (cm)')+
  labs(x="")+
  guides(fill=FALSE)+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+ #To add crosses for mean values
  theme_classic(base_size=20)+
  stat_summary( fun.data = give.n,
                 geom = "text", position=position_dodge(width=0.9), size=6)

weight.tot<-ggplot(tot.df, aes(y=weight, x=fjord, fill=fjord))+
  geom_boxplot()+
  ylab('Weight (g)')+
  guides(fill=FALSE)+
  labs(x="")+
  theme_classic()+
```

```
  stat_summary( fun.data = give.n,
               geom = "text", position=position_dodge(width=0.9), size=6)+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+
  theme_classic(base_size=20)

  #Length and weight boxplots from the two locations
cowplot::plot_grid(length.tot, weight.tot, labels=c('a','b'))
```

#Differences between sex:

#Subset males and females:

```
female.df <- subset(tot.df, sex=='F')
male.df <- subset(tot.df, sex=='M')
```

#Pre-anal fin-length:

#Test females and males between fjords:

```
t.test(length~fjord, data=female.df)
t.test(length~fjord, data=male.df)
```

#Test for differences within fjords:

```
t.test(length~sex, data=masfjord.df)
t.test(length~sex, data=lustrafjord.df)
```

#Weight:

#Test females and males between fjords:

```
t.test(weight~fjord, data=female.df)
t.test(weight~fjord, data=male.df)
```

#Test for differences within fjords:

```
t.test(weight~sex, data=masfjord.df)
t.test(weight~sex, data=lustrafjord.df)
```

#Plot:

```
plot.sex.length.tot<-ggplot(tot.df, aes(y=length, x=sex, fill=fjord))+
  geom_boxplot()+
  theme_classic(base_size = 8)+
  guides(fill=FALSE)+
```

```
  ylab('Pre-anal fin-length (cm) (g)')+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+ #To add crosses for mean values
  theme_classic(base_size=20)+
  stat_summary( fun.data = give.n,
              geom = "text", position=position_dodge(width=0.9), size=6)

plot.sex.weight.tot<-ggplot(tot.df, aes(y=weight, x=sex, fill=fjord))+
  geom_boxplot()+
  theme_classic()+
  ylab('Weight (g)')+
  stat_summary( fun.data = give.n,
              geom = "text", position=position_dodge(width=0.9), size=6)+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+
  theme_classic(base_size=20)

#Combine plots:
cowplot::plot_grid(plot.sex.length.tot, plot.sex.weight.tot, labels=c('a','b'))

#Differences between years in Masfjord:
#Length
fit1c.lme = lme(length~year, random=~+1|station,
              data=masfjord.df, na.action = na.omit)
anova(fit1c.lme)

#Weight:
fit1h.lme = lme(weight~year, random=~+1|station,
              data=masfjord.df, na.action = na.omit)
anova(fit1h.lme)

plot.year.length<-ggplot(masfjord.df, aes(x=as.factor(year), y=length, fill=fjord))+
  scale_fill_manual(values=c('skyblue'))+
  ylab('Pre-anal fin-length (cm)')+
  geom_boxplot()+
  guides(fill=FALSE)+
```

```
  labs(x="")+
  theme_classic()+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+ #To add crosses for mean values
  theme_classic(base_size=20)+
stat_summary( fun.data = give.n,
              geom = "text", position=position_dodge(width=0.9), size=6)

  plot.year.weight<-ggplot(masfjord.df, aes(x=as.factor(year), y=weight, fill=fjord))+
  scale_fill_manual(values=c('skyblue'))+
  ylab('Weight (g)')+
  guides(fill=FALSE)+
  geom_boxplot()+
  labs(x="")+
  theme_classic()+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+ #To add crosses for mean values
  theme_classic(base_size=20)+
    stat_summary( fun.data = give.n,
     geom = "text", position=position_dodge(width=0.9), size=6)
```

#Combine plots:

```
cowplot::plot_grid(plot.year.length, plot.year.weight, labels=c('a','b'))
```

#Differences between day and night:

#Length:

```
fit1d.mas.lme = lme(length~day.or.night, random=~+1|year/station,
                data=masfjord.df, na.action = na.omit)
anova(fit1d.mas.lme)

fit1d.lus.lme = lme(length~day.or.night, random=~+1|year/station,
                data=lustrafjord.df, na.action = na.omit)
anova(fit1d.lus.lme)
```

#Weight:

```
fit1i.mas.lme = lme(weight~day.or.night, random=~+1|year/station,
          data=masfjord.df, na.action = na.omit)
summary(fit1i.mas.lme)

fit1i.lus.lme = lme(weight~day.or.night, random=~+1|year/station,
          data=lustrafjord.df, na.action = na.omit)
summary(fit1i.lus.lme)
```

#Plot:

```
plot.length.day.night<-ggplot(tot.df, aes(x=day.or.night, y=length, fill=fjord))+
 ylab('Pre-anal fin-length (cm)')+
 geom_boxplot()+
 labs(x="")+
 guides(fill=FALSE)+
 theme_classic()+
 stat_summary(fun.y=mean, geom="point", shape=4, size=6)+ #To add crosses for mean values
 theme_classic(base_size=20)+
 stat_summary( fun.data = give.n,
        geom = "text", position=position_dodge(width=0.9), size=6)

 plot.weight.day.night<-ggplot(tot.df, aes(x=day.or.night, y=weight, fill=fjord))+
 ylab('Weight (g)')+
 geom_boxplot()+
 labs(x="")+
 theme_classic(base_size = 8)+
 stat_summary(fun.y=mean, geom="point", shape=4, size=6)+
 theme_classic(base_size=20)+
  stat_summary( fun.data = give.n,
        geom = "text", position=position_dodge(width=0.9), size=6)
```

#Differences in pelagic and bottom trawling:

#Length:

```
fit1e.mas.lme = lme(length~pel.bot, random=~+1|year/station,
```

```
                data=masfjord.df, na.action = na.omit)
anova(fit1e.mas.lme)

fit1e.lus.lme = lme(length~pel.bot, random=~+1|year/station,
                data=lustrafjord.df, na.action = na.omit)
anova(fit1e.lus.lme)

#Weight:
fit1j.mas.lme = lme(weight~pel.bot, random=~+1|year/station,
                data=masfjord.df, na.action = na.omit)
summary(fit1j.mas.lme)

fit1j.lus.lme = lme(weight~pel.bot, random=~+1|year/station,
                data=lustrafjord.df, na.action = na.omit)
summary(fit1j.lus.lme)

#Plot:
length.pel.bot.tot<-ggplot(tot.df, aes(x=pel.bot, y=length, fill=fjord))+
  ylab('Pre-anal fin-length (cm)')+
  geom_boxplot()+
  labs(x="")+
  guides(fill=FALSE)+
  theme_classic()+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+
  theme_classic(base_size=20)+
  stat_summary( fun.data = give.n,
             geom = "text", position=position_dodge(width=0.9), size=6)

weight.pel.bot.tot<-ggplot(tot.df, aes(x=pel.bot, y=weight, fill=fjord))+
  ylab('Weight (g)')+
  geom_boxplot()+
  labs(x="")+
  theme_classic()+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+
```

```
  theme_classic(base_size=20)+
  stat_summary( fun.data = give.n,
                geom = "text", position=position_dodge(width=0.9), size=6)

#Combine plots of day/night and pelagic/bottom trawl:
cowplot::plot_grid(length.pel.bot.tot, weight.pel.bot.tot,
                   plot.length.day.night, plot.weight.day.night, labels=c('a','b', 'c', 'd'))
```

A.4: Gonadosomatic index:

```
#Differences between fjords:
#Import data:
tot.df <- read.table('samplingdata.18.04.csv', header=T, sep=';', dec=',')

#transform GSI and HSI to a binomial distribution
tot.df$gsi.trans<-(tot.df$GSI/100)
tot.df$hsi.trans<-(tot.df$HSI/100)

#Making subset of Lustrafjord and Masfjord
lustrafjord.df<-subset(tot.df, fjord=='Lustrafjord')
masfjord.df<-subset(tot.df, fjord=='Masfjord')

#Loading packages:
library(MASS)
library(ggplot2)

#give.n gives the sample sizes in the figures, beneath the boxplots:
give.n <- function(x){
  return(c(y= c(-1), label = c(length(x))))
}

#Making a model and analyzing it:
fit2.glmm = glmmPQL(gsi.trans~fjord, random=~+1|year/station, family="quasibinomial",
data=tot.df, na.action="na.exclude")
anova.lme(fit2.glmm)
```

```
#Calculating mean, range and sd for Masfjord:
exp(mean(log(masfjord.df$GSI), na.rm=TRUE)) #GSI
sd((masfjord.df$GSI), na.rm=TRUE)
range(masfjord.df$GSI, na.rm=TRUE)
#Calculating mean, range and sd for Lustrafjord:
 exp(mean(log(lustrafjord.df$GSI), na.rm=TRUE)) #GSI
sd((lustrafjord.df$GSI), na.rm=TRUE)
range(lustrafjord.df$GSI, na.rm=TRUE)

#Plot:
plot.gsi.tot<-(ggplot(tot.df, aes(x=fjord, y=GSI, fill=fjord)))+
  ylab('Gonadosomatic index')+
  geom_boxplot()+
  guides(fill=FALSE)+
  labs(x="")+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+
  stat_summary(fun.data = give.n, geom = "text", shape=4, size=6)+
  theme_classic(base_size=20)

#Differences between sex:
#Subset sexes:
female.df<-subset(tot.df, sex=='F')
male.df<-subset(tot.df, sex=='M')

#Making a model of Masfjord and analyzing it:
fit2b.glmm = glmmPQL(gsi.trans~fjord*sex, random=~+1|year/station, family="quasibinomial", data=masfjord.df, na.action="na.exclude")
summary (fit2b.glmm)
#Making a model of Lustrafjord and analyzing it:
fit2.2b.glmm = glmmPQL(gsi.trans~fjord*sex, random=~+1|year/station, family="quasibinomial", data=lustrafjord.df, na.action="na.exclude")
summary (fit2.2b.glmm)
```

```
#Testing between fjords
t.test(gsi.trans~fjord, data=female.df)
t.test(gsi.trans~fjord, data=male.df)
#Testing within fjords
t.test(gsi.trans~sex, data=masfjord.df)
t.test(gsi.trans~sex, data=lustrafjord.df)

#Plot:
plot.gsi.sex.tot<-ggplot(tot.df, aes(x=sex, y=GSI, fill=fjord))+
  ylab('Gonadosomatic index')+
  geom_boxplot()+
  labs(x="")+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+
  stat_summary( fun.data = give.n,
                geom = "text", position=position_dodge(width=0.9), size=6)+
  theme_classic(base_size=20)

#Combine the plots of fjords and sex:
cowplot::plot_grid(plot.gsi.tot, plot.gsi.sex.tot, labels=c('a','b'))

#Annual differences:
#Making a model and analyzing it:
fit2d.glmm = glmmPQL(gsi.trans~year,
                     random=~+1|station, na.action=na.omit,
                     family=quasipoisson, data=masfjord.df)
anova.lme(fit2d.glmm)

#Plot:
plot.gsi.year.tot<-ggplot(masfjord.df, aes(x=as.factor(year), y=GSI, fill=fjord))+
  scale_fill_manual(values=c('skyblue'))+
  ylab('Gonadosomatic index')+
  geom_boxplot()+
  guides(fill=FALSE)+
  labs(x="")+
```

```
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+
  stat_summary( fun.data = give.n,
                geom = "text", position=position_dodge(width=0.9), size=6)+
  theme_classic(base_size=20)

plot.gsi.year.tot
```

A.5: Hepatosomatic index:

#Differences between fjords:

#Import data:

```
tot.df <- read.table('samplingdata.18.04.csv', header=T, sep=';', dec=',')
```

#transform HSI to a bionomial distribution

```
tot.df$hsi.trans<-(tot.df$HSI/100)
```

#make subset of Lustrafjord and Masfjord

```
lustrafjord.df<-subset(tot.df, fjord=='Lustrafjord')
masfjord.df<-subset(tot.df, fjord=='Masfjord')
```

#Loading packages:

```
library(MASS)
library(ggplot2)
```

#Making a model and analyzing it:

```
fit3.glmm = glmmPQL(hsi.trans~fjord, random=~+1|year/station, family="quasibinomial",
data=tot.df, na.action="na.exclude")
anova.lme(fit3.glmm)
```

#Calculating mean, range and sd for Masfjord:

```
exp(mean(log(masfjord.df$HSI), na.rm=TRUE))
sd((masfjord.df$HSI), na.rm=TRUE)
range(masfjord.df$HSI, na.rm=TRUE)
```

#Calculating mean, range and sd for Lustrafjord:

```
exp(mean(log(lustrafjord.df$HSI), na.rm=TRUE))
sd((lustrafjord.df$HSI), na.rm=TRUE)
range(lustrafjord.df$HSI, na.rm=TRUE)
```

#Plot:

```
plot.hsi.tot<-(ggplot(tot.df, aes(x=fjord, y=HSI, fill=fjord)))+
  ylab('Heposomatic index')+
  geom_boxplot()+
  guides(fill=FALSE)+
  labs(x="")+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+
  stat_summary( fun.data = give.n,
               geom = "text", position=position_dodge(width=0.9), size=6)+
  theme_classic(base_size=15)
```

Sex differences:

#Making a model and analyzing it:

```
fit3b.glmm = glmmPQL(hsi.trans~fjord*sex, random=~+1|year/station, family="quasibinomial",
data=tot.df, na.action="na.exclude")
anova.lme(fit3b.glmm)
```

#Subset sex:

```
female.df<-subset(tot.df, sex=='F')
male.df<-subset(tot.df, sex=='M')
```

#Testing between females and males:

```
t.test(hsi.trans~fjord, data=female.df)
t.test(hsi.trans~fjord, data=male.df)
```

#Testing between sex within fjords:

```
t.test(hsi.trans~sex, data=masfjord.df)
t.test(hsi.trans~sex, data=lustrafjord.df)
```

#Plot:

```
plot.hsi.sex.tot<-ggplot(tot.df, aes(x=sex, y=HSI, fill=fjord))+
  ylab('Heposomatic index')+
  geom_boxplot()+
  labs(x="")+
  guides(fill=FALSE)+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+
  stat_summary( fun.data = give.n,
               geom = "text", position=position_dodge(width=0.9), size=6)+
  theme_classic(base_size=15)
```

#Combine the plots of fjords and sex:

```
cowplot::plot_grid(plot.hsi.tot, plot.hsi.sex.tot, labels=c('a','b'))
```

Annual differences:

#Making a model and analyzing it:

```
fit3d.glmm = glmmPQL(hsi.trans~year,
                     random=~+1|station, na.action=na.omit,
                     family=quasipoisson, data=masfjord.df)
anova.lme(fit3d.glmm)
```

#Plot:

```
plot.hsi.year.tot<-ggplot(masfjord.df, aes(x=as.factor(year), y=HSI, fill=fjord))+
  scale_fill_manual(values=c('skyblue'))+
  ylab('Heposomatic index')+
  geom_boxplot()+
  guides(fill=FALSE)+
  labs(x="")+
  stat_summary(fun.y=mean, geom="point", shape=4, size=6)+
  stat_summary( fun.data = give.n,
               geom = "text", position=position_dodge(width=0.9), size=6)+
  theme_classic(base_size=20)
plot.hsi.year.tot
```

B: Raw data:

B1 - Stomach data:

ID	empty.weight	content.weight	digestion	Amphipoda	Copepoda	Euphausiacea	Decapoda	Mollusca	Chaetognatha	Tunicata	Polychaeta	Other Crustaceans	Pisces	Other	stone.mud
M.2015.01	2,58	3,01	4	5	3	5	0	0	0	2	1	0	0	0	0
M.2015.02	3,85	2,83	4	0	1	1	0	0	0	0	0	0	0	0	0
M.2015.03	2,34	1,09	3	9	5	1	1	2	0	0	0	0	0	0	1
M.2015.04	0,81	1,06	4	27	21	10	0	1	0	0	0	0	0	0	0
M.2015.05	1,35	0,8	4	0	3	1	0	1	0	0	0	0	0	0	0
M.2015.06	1,03	NA	4	31	20	1	0	1	0	0	0	0	0	0	1
M.2015.08	3,45	6,05	3	2	0	0	4	0	0	0	0	0	0	0	0
M.2015.10	2,56	1,73	4	2	4	2	0	1	0	0	1	0	0	0	0
M.2015.11	0,32	0,28	4	2	1	0	0	0	0	0	0	0	0	0	0
M.2015.12	0,56	0,96	4	4	8	3	0	0	0	0	0	0	0	0	1
M.2015.13	1,44	0,49	4	3	1	1	0	1	0	0	0	0	0	0	1
M.2015.15	2,01	0,78	4	2	2	1	0	7	0	0	0	0	0	0	0
M.2015.16	1,63	2,01	4	1	4	3	0	19	0	0	0	0	0	0	0
M.2015.17	0,85	1,06	4	8	11	14	0	1	0	0	3	0	0	0	0
M.2015.18	0,91	0,56	4	0	4	0	0	0	0	0	0	0	0	0	0
M.2015.21	2,41	7,69	4	6	0	7	1	0	0	0	0	1	0	0	1
M.2015.22	0,8	0,65	4	2	3	2	0	0	0	1	0	0	0	0	0
M.2015.27	0,17	0,11	4	0	3	1	0	1	0	0	0	0	0	0	0
M.2015.28	3,13	0,79	4	2	0	0	0	1	0	0	0	0	0	0	1
M.2015.31	0,37	0,16	5	0	1	0	1	0	0	0	0	0	0	0	0
M.2015.32	0,5	0,39	4	3	2	3	0	1	0	0	0	0	0	0	1
M.2015.33	0,12	0,2	4	7	10	4	0	0	0	0	0	0	0	0	0
M.2015.35	0,57	0,31	5	1	0	5	0	0	0	0	0	0	0	0	0
M.2015.36	0,48	0,56	4	2	4	3	0	1	0	0	0	0	0	0	0
M.2015.37	1,5	0,88	4	4	5	2	0	1	0	0	0	0	0	0	0
M.2015.38	0,64	2,8	4	258	7	4	0	1	0	0	0	0	0	0	0
M.2015.39	0,59	0,62	4	11	16	4	0	0	0	0	0	0	0	0	0
M.2015.40	1,05	2,08	4	43	11	4	0	9	0	0	0	0	0	0	0
M.2015.41	0,52	0,56	4	13	8	3	0	0	0	0	0	0	0	0	0
M.2015.43	0,23	0,55	4	19	3	6	0	0	0	0	0	0	0	0	0
M.2015.44	0,25	0,45	4	20	18	3	0	0	0	0	0	0	0	0	0
M.2015.45	0,16	0,26	4	14	17	4	0	0	0	0	0	0	0	0	0
M.2015.47	0,71	0,64	4	9	3	2	0	0	0	0	0	0	0	0	0
M.2015.48	0,67	0,35	4	6	14	1	0	8	0	0	0	0	0	0	0
M.2015.49	0,59	0,38	4	4	9	0	0	0	0	0	0	0	0	0	0
M.2015.50	0,3	0,38	4	1	3	4	0	0	0	0	0	0	0	0	0
M.2015.51	0,27	0,35	4	4	0	1	0	1	0	0	0	0	0	0	0
M.2015.52	0,5	0,92	4	25	7	1	0	2	0	0	0	0	0	0	0

M.2015.53	0,59	0,43	4	3	14	3	1	3	0	0	0	0	0	0	0
M.2015.55	0,48	0,85	4	2	7	34	0	0	0	0	0	0	0	0	0
M.2015.56	0,88	0,61	4	0	6	0	0	1	0	0	0	0	0	0	0
M.2015.59	3,62	2,46	4	4	5	8	1	3	0	0	2	0	0	0	1
M.2015.60	3,02	2,42	4	14	2	0	2	4	0	0	0	0	0	0	0
M.2015.61	5,15	8,6	3	1	0	5	0	0	0	0	3	0	0	1	1
M.2015.64	2,29	4,22	4	33	7	0	0	21	0	0	0	0	0	0	0
M.2015.65	1,77	0,47	5	0	0	0	0	1	0	0	0	0	0	0	0
M.2015.66	5,61	4,05	4	5	0	1	0	15	0	0	0	0	0	0	0
M.2015.67	1,74	1,57	4	32	15	6	0	5	0	0	1	0	0	0	0
M.2015.68	7,05	3,57	4	2	0	3	0	0	0	0	0	0	0	0	1
M.2015.69	1,45	2,2	4	40	7	2	0	1	0	0	1	0	0	0	0
M.2015.70	2,67	8,53	3	2	0	3	1	1	0	0	0	0	0	0	1
M.2015.71	1,72	2,31	4	14	23	7	0	0	0	0	0	0	0	0	0
M.2015.73	5,61	2,64	4	17	3	4	0	3	0	0	0	0	0	0	0
M.2015.74	3,16	1,95	4	6	9	3	0	0	2	0	4	1	0	0	0
M.2015.76	1,58	6,66	4	5	1	5	2	57	1	0	0	0	0	0	0
M.2015.77	1,29	1,54	3	24	3	1	0	2	0	0	1	0	0	2	1
M.2015.79	0,85	0,47	4	2	4	2	0	5	0	0	0	0	0	3	0
M.2015.80	0,71	0,52	4	3	7	3	0	7	3	0	0	0	0	1	0
M.2015.82	0,61	2,05	4	0	8	3	1	4	0	1	2	3	0	1	0
M.2015.83	0,66	0,66	4	3	4	0	0	0	0	3	5	1	0	0	0
M.2015.85	0,11	0,24	4	4	0	9	0	0	0	0	0	0	0	0	0
M.2015.88	2,55	0,57	5	1	0	0	0	1	0	0	0	0	0	0	0
M.2015.90	1,77	1,51	4	12	9	11	0	4	1	1	0	0	0	1	0
M.2015.92	1,33	0,96	4	13	6	18	1	0	0	5	0	0	0	0	0
M.2015.93	0,52	0,85	4	25	17	8	0	1	0	0	0	0	0	0	0
M.2015.95	1,11	0,65	4	4	3	1	0	0	0	2	0	0	0	6	0
M.2015.99	2,98	2,26	4	32	13	2	0	8	3	0	0	2	0	0	0
M.2015.100	6,68	5,3	4	163	0	1	1	6	0	6	0	2	0	0	1
M.2015.101	2,07	1,47	4	2	1	2	0	3	3	0	0	0	1	0	1
M.2015.105	1,85	3,11	4	19	19	11	1	7	2	1	1	1	0	0	0
M.2015.107	0,88	2	4	0	7	7	0	0	0	0	1	0	0	0	0
M.2015.108	2,74	3,5	4	4	9	1	0	8	0	0	0	0	0	0	0
M.2015.109	5,36	3,58	4	23	4	2	2	3	0	0	0	0	0	0	0
M.2015.111	2,56	2,36	4	4	0	3	0	0	0	0	0	0	0	0	0
M.2015.114	0,48	0,44	4	2	2	0	1	0	0	1	0	1	0	0	0
M.2015.115	0,32	0,61	4	23	12	0	0	8	0	0	0	1	0	0	0
M.2015.116	0,73	0,48	5	0	0	1	0	0	0	0	0	0	0	0	0
M.2015.117	2,14	2,02	4	1	3	0	0	0	0	3	0	0	0	0	0
M.2015.118	2,35	0,92	4	2	3	0	0	0	0	0	0	0	0	0	0
M.2015.119	2,73	1,83	4	22	5	3	0	71	0	0	0	3	0	0	0
M.2015.120	2,18	3,68	3	12	22	11	1	1	0	0	0	0	2	0	0
M.2015.122	0,81	1,06	4	43	6	7	1	0	0	5	0	0	0	0	0
M.2015.123	1,39	1,91	3	68	18	4	0	4	0	0	2	0	0	0	0

M.2015.125	0,19	0,21	4	8	3	0	0	0	0	1	0	0	0	0	0
M.2015.126	0,51	1,36	4	64	12	27	0	0	0	1	0	0	0	0	0
M.2015.127	5,01	2,25	4	9	2	1	0	1	0	0	2	0	0	0	0
M.2015.128	3,99	4,28	4	14	5	3	1	3	0	0	5	0	0	0	1
M.2015.130	6,62	4,98	4	18	0	17	0	2	0	8	0	0	0	0	0
M.2012.133	0,96	0,56	3	0	3	2	0	7	0	0	0	0	0	0	0
M.2012.134	4,64	7,08	3	0	2	0	1	2	0	0	2	1	0	0	0
M.2012.135	1	0,49	4	2	12	1	0	0	0	2	3	0	0	0	0
M.2012.136	1,91	2,22	3	1	9	5	0	1	0	1	0	0	0	0	1
M.2012.138	3,21	10,22	4	2	1	3	3	8	0	0	0	0	0	0	0
M.2012.140	1,4	0,92	4	1	4	2	0	0	0	0	0	3	0	0	0
M.2012.141	4,24	7,99	3	2	0	2	1	4	0	0	0	0	0	0	0
M.2012.143	1,18	0,85	4	0	8	0	1	0	0	3	0	0	0	1	0
M.2012.145	0,61	0,22	5	0	3	0	0	0	0	0	0	0	0	0	0
M.2012.147	1,06	0,71	4	0	2	1	0	1	0	0	0	0	0	0	0
M.2012.148	0,87	1,26	4	0	2	0	1	2	0	0	0	0	0	0	0
M.2012.149	1,36	0,53	5	0	1	1	0	0	0	0	0	0	0	0	0
M.2012.150	0,84	0,57	5	0	3	0	0	0	0	0	0	0	0	0	0
M.2012.151	1,52	0,95	4	0	4	1	0	2	0	1	1	0	0	1	0
M.2012.152	0,74	0,4	4	1	14	3	0	6	0	0	0	0	0	0	0
M.2012.153	2,98	1,99	4	1	0	4	1	16	0	4	0	2	0	0	1
M.2012.154	1,96	0,66	4	0	1	0	0	0	0	0	0	0	0	1	0
M.2012.156	0,67	0,92	4	0	9	0	0	2	0	0	0	0	0	0	0
M.2012.159	2,93	1,33	4	0	13	1	1	3	0	2	0	0	0	0	0
M.2012.162	5,55	7,35	4	0	2	2	1	0	0	0	0	0	0	0	0
M.2012.163	2,13	6,64	3	0	0	0	4	0	0	0	0	0	0	0	0
M.2012.168	1,89	2,14	4	2	0	3	1	1	0	2	0	0	0	0	1
M.2012.169	1,32	1,32	3	0	6	1	0	1	0	0	0	1	0	0	0
M.2012.170	1,13	2,04	4	2	25	2	0	6	0	0	1	0	0	0	1
M.2012.171	0,15	0,42	4	0	0	8	0	0	0	4	0	0	0	0	0
M.2012.172	1,38	3,18	4	1	5	3	0	5	2	6	1	0	0	0	1
M.2012.173	2,33	0,58	4	0	1	0	0	0	0	0	0	0	0	0	0
M.2012.174	0,79	1,65	3	6	13	5	0	2	0	0	0	0	0	0	1
M.2012.176	1,01	2,37	4	0	6	3	1	3	0	2	1	1	0	0	1
M.2012.177	0,89	0,74	5	0	1	0	0	0	0	0	0	0	0	0	1
M.2012.179	2,28	0,79	5	0	0	0	0	1	0	0	0	0	0	0	0
M.2012.181	1,13	1,49	4	0	3	4	0	0	0	1	0	1	0	0	0
M.2012.183	1,02	0,82	3	0	3	0	0	0	0	1	0	0	0	1	0
M.2012.184	0,54	1,03	4	2	5	5	0	0	0	0	0	0	0	0	0
M.2012.185	0,85	0,29	4	1	3	0	0	0	0	0	0	0	0	0	0
M.2012.186	0,59	0,72	4	0	0	1	0	0	0	18	0	2	0	0	0
M.2012.189	0,55	0,25	5	0	0	0	0	0	0	0	0	2	0	0	0
M.2012.190	0,36	0,23	5	0	0	1	0	0	0	0	0	0	0	0	0
M.2012.192	2,65	4,6	4	0	7	0	1	0	0	0	0	0	0	0	0
M.2012.194	0,87	0,7	3	0	1	0	0	0	0	0	0	1	0	0	0

M.2012.195	0,34	0,18	4	1	2	1	0	0	0	0	0	0	0	0	0
M.2012.196	1,77	2,19	3	1	3	2	0	7	0	1	0	0	0	0	0
M.2012.200	0,72	0,53	4	1	2	0	0	0	0	1	2	0	0	0	1
M.2012.202	0,26	0,23	5	0	0	1	0	0	0	0	0	0	0	0	0
M.2012.203	0,55	0,18	4	1	9	0	0	0	0	0	0	1	0	0	0
M.2012.205	0,44	0,35	5	0	0	1	0	0	0	0	0	0	0	0	0
M.2012.206	0,61	0,47	3	2	4	1	0	1	0	0	0	0	0	0	0
M.2016.207	3,53	1,16	3	2	2	2	0	1	0	0	0	0	0	0	0
M.2016.209	0,58	0,76	3	29	0	0	0	2	0	0	0	0	0	0	0
M.2016.211	0,42	0,61	3	18	4	1	0	1	0	0	0	0	0	0	0
M.2016.212	1,25	9,36	3	7	3	3	2	2	0	0	0	0	0	0	0
M.2016.213	0,81	1,62	4	27	5	3	1	0	0	0	0	2	0	0	0
Sg28	0,06	0,14	4	0	0	3	0	0	0	0	0	2	0	0	0
Sg29	2,99	4,68	4	8	0	5	0	1	0	1	2	0	0	0	1
Sg30	2,82	3,71	3	5	0	2	3	3	0	0	1	0	0	0	0
Sg31	3,63	4,04	3	7	2	1	1	0	0	0	1	0	0	0	0
Sg33	3,56	12,78	2	9	1	2	24	2	0	0	1	2	0	0	0
Sg34	2,06	1,94	3	31	0	0	0	1	0	0	0	0	0	0	0
Sg35	5,11	10,13	3	19	0	0	0	11	0	0	0	0	2	1	0
Sg36	4,34	6,86	2	16	1	2	2	16	0	1	2	0	0	0	0
Sg37	3,29	7,6	2	26	0	0	1	5	0	0	0	0	0	0	0
Sg38	0,11	0,11	4	0	0	1	0	0	0	0	0	0	0	0	0
Sg43	0,21	0,16	4	0	2	1	0	1	0	0	0	0	0	0	0
Sg45	0,18	0,42	4	0	0	0	0	0	0	0	0	3	0	0	0
Sg46	0,14	0,14	4	0	1	1	0	1	0	0	0	0	0	0	0
Sg48	1,24	1	4	18	3	0	0	0	0	0	0	0	0	0	0
Sg51	1,25	0,79	3	7	5	0	0	0	0	0	0	0	0	0	0
Sg52	2,73	0,6	2	4	0	0	0	0	0	0	0	0	0	0	0
Sg54	3,96	11,49	3	10	9	3	8	2	0	0	0	0	0	0	1
Sg59	0,37	0,39	4	0	2	0	0	7	0	0	0	0	0	0	0
Sg60	5,8	9,27	3	11	2	4	2	5	0	0	0	16	0	0	1
Sg61	1,42	0,96	3	4	14	0	0	0	0	5	0	0	0	0	0
Sg64	0,22	0,5	3	3	24	1	0	1	0	0	0	0	0	0	0
Sg65	2,34	3,35	4	4	1	1	0	0	0	0	0	2	0	0	1
Sg66	7,03	4,89	3	2	0	2	2	0	0	12	0	0	0	0	1
Sg68	1,18	1,17	3	2	14	0	0	2	0	0	0	0	0	0	0
Sg70	0,16	0,45	3	9	11	4	0	0	0	0	0	0	0	0	0
Sg71	2,75	8,23	3	2	12	2	0	2	0	8	0	1	0	0	1
Sg72	1,47	1,65	3	3	10	1	1	1	0	0	0	1	0	0	1
Sg74	1,89	10,81	3	2	10	3	2	5	0	2	3	0	0	0	1
Sg78	0,47	0,37	4	3	0	1	0	1	0	0	0	0	0	0	1
Sg80	1,33	8,13	3	3	4	4	2	4	0	0	3	3	0	0	1
Sg81	1,17	2,42	3	7	10	3	1	1	0	0	0	0	0	0	0
Sg83	0,65	0,67	3	5	3	0	0	2	0	0	0	0	0	0	0
Sg84	3,2	0,64	4	1	0	0	0	0	0	1	0	0	0	0	0

Sg85	4,56	3,28	3	1	0	3	1	1	0	0	0	0	0	0	0
Sg86	0,13	0,23	3	14	13	1	0	3	0	0	0	0	0	0	0
Sg87	1,21	1,08	4	2	0	2	0	0	0	1	0	0	0	0	0
Sg89	4,27	4,12	4	3	1	0	2	1	0	0	0	0	0	0	0
Sg90	0,59	0,75	4	1	3	2	0	2	0	0	0	0	0	0	0
Sg91	0,7	2,21	3	3	12	0	1	2	0	0	0	0	0	0	0
Sg92	1,48	5,49	3	13	42	4	0	1	0	0	1	0	1	0	1
Sg94	0,52	0,2	4	0	8	0	0	0	0	0	0	0	0	0	0
Sg95	0,97	0,49	3	5	5	0	0	0	0	0	0	0	0	0	0
Sg96	1,37	0,8	4	2	7	0	0	0	0	0	0	0	0	0	0
Sg97	3,86	7,23	4	8	9	3	4	1	0	0	2	0	0	1	1
Sg100	3,33	1,44	2	2	0	0	1	0	0	1	0	0	0	0	1
Sg101	3,32	0,89	2	0	1	1	0	2	0	0	0	0	0	0	1
Sg102	3,13	1,82	2	7	5	0	0	8	0	0	0	0	0	0	1
Sg104	3,19	10,9	4	4	6	6	6	13	0	8	1	0	0	0	1
Sg105	3,27	0,71	4	0	0	2	0	1	0	1	1	2	0	0	1
Sg106	3,48	0,99	3	6	0	1	0	1	0	0	0	0	0	0	1
Sg107	1,38	1,64	2	4	47	0	0	2	0	0	0	0	0	1	0
Sg108	1,56	5,31	3	0	0	6	1	2	0	0	2	0	0	1	1
Sg109	1,74	3,33	4	2	4	2	0	0	0	0	0	0	0	0	0
Sg111	1,67	2,16	4	9	3	0	0	9	0	0	0	0	0	1	0
Sg112	1,23	1,03	4	3	1	1	0	1	0	0	0	1	0	0	0
Sg113	0,79	0,38	4	1	0	1	0	0	0	2	0	0	0	0	0
Sg114	4,1	5,07	4	9	0	6	1	2	0	0	2	0	0	0	1
Sg115	0,32	0,44	4	0	13	6	0	2	0	1	0	0	0	0	0
Sg116	0,98	0,25	3	12	112	1	0	2	0	0	0	0	0	0	0
Sg117	0,49	1,34	3	55	23	2	0	0	0	2	1	0	0	0	0
Sg118	2,48	6,33	3	16	36	2	2	2	0	0	0	0	0	0	1
Sg119	1,71	5,99	2	0	0	4	0	1	0	10	4	0	1	0	1
Sg120	0,75	0,49	5	0	0	1	0	2	0	0	0	0	0	0	0
Sg121	0,96	1,47	4	11	8	1	0	3	0	2	1	0	0	0	0
Sg123	1,59	0,55	4	0	2	0	0	1	0	9	0	1	0	0	0
Sg124	0,32	0,27	5	0	4	1	0	0	0	1	0	0	0	0	0
Sg125	0,35	0,32	4	6	8	0	0	0	0	1	0	0	0	0	0
Sg127	0,34	0,44	4	2	2	5	0	0	0	2	2	0	0	0	0
Sg128	0,98	1,61	4	3	31	4	0	0	0	0	0	0	0	0	0
Sg129	0,8	3,6	3	3	8	1	0	16	0	0	0	0	0	0	1
Sg130	1,09	3,46	4	2	0	3	0	2	0	0	0	0	0	0	0
Sg131	0,49	0,48	4	0	10	3	0	0	0	2	0	0	0	0	0
Sg132	1,74	1,43	4	0	3	1	0	0	0	0	0	0	0	0	1
Sg134	1,08	5,01	2	2	3	0	3	5	0	0	0	0	0	0	0
Sg136	0,98	1,82	3	7	10	2	0	4	0	0	1	0	0	0	0
Sg137	1,17	2,49	3	59	5	0	0	16	0	0	0	0	2	0	0
Sg138	1,6	3,86	3	11	9	3	0	1	0	0	1	0	0	0	1
Sg139	1,49	4,53	2	6	0	8	1	0	0	0	0	0	0	0	0

Sg140	1,33	0,86	3	7	0	0	1	3	0	1	0	0	0	0	1
Sg141	1,65	3,19	4	6	0	0	1	3	0	0	2	0	0	0	1
Sg142	1,49	4,62	2	3	3	18	2	5	0	0	0	7	0	0	1
Sg145	0,85	2,62	3	2	8	0	0	5	0	0	0	0	0	1	1
Sg147	1,3	0,92	4	0	0	0	0	3	0	0	0	0	0	0	1
Sg148	0,49	0,55	4	7	12	1	0	0	0	1	0	0	0	0	0
Sg149	1,03	1,75	4	3	9	2	0	1	0	0	0	0	0	0	1
Sg150	1,5	1,94	3	24	9	2	0	0	0	1	0	0	0	1	0
Sg151	1,56	3,32	4	6	4	3	0	1	0	1	3	0	0	0	1
Sg152	0,8	0,61	4	2	14	0	0	2	0	0	0	0	0	0	1
Sg153	1,06	2,08	4	6	5	2	0	5	0	0	0	0	0	0	0
Sg155	0,05	0,02	2	0	7	0	0	1	0	0	0	0	0	0	0
Sg156	0,11	0,32	3	0	7	2	0	3	0	0	0	1	0	0	0
Sg157	0,16	0,17	3	3	1	0	0	0	0	0	0	0	0	0	0
Sg161	2,7	4,19	3	6	9	4	3	0	0	0	0	2	0	0	0
Sg162	7,51	37,12	1	1	0	8	4	0	0	1	0	0	1	3	0
Sg163	1,11	5,21	3	0	21	4	0	14	0	3	0	0	0	0	0
Sg164	1,55	0,54	2	0	0	0	0	0	0	8	0	0	0	0	0
Sg165	4,57	10,02	4	10	13	15	2	3	0	0	0	10	0	0	1
Sg166	0,7	0,82	3	5	46	1	0	2	0	1	0	0	0	0	0
Sg167	2,36	3,65	4	4	11	2	1	2	0	0	0	0	0	0	1
Sg168	1,42	1,87	4	3	0	0	0	0	0	1	0	0	0	0	1
Sg169	1,14	0,64	4	2	0	1	0	2	0	0	0	0	0	0	0
Sg170	1,75	5,95	3	13	36	2	0	5	0	0	1	0	0	0	1
Sg171	1,85	6,9	4	1	3	4	0	1	0	0	0	0	0	0	1
Sg172	1,76	2,37	4	7	13	0	1	2	0	0	0	0	0	0	0
Sg173	0,96	0,56	3	2	8	0	0	1	0	0	0	0	0	1	0
Sg174	2,82	7,94	3	9	0	1	1	0	0	0	1	0	0	0	1
Sg175	2,82	1,27	3	13	1	1	0	3	0	0	2	0	0	1	0
Sg176	2,31	6,62	2	3	4	5	1	19	0	1	0	0	0	1	0
Sg177	0,88	2,48	3	11	11	3	1	8	0	0	0	0	0	0	0
Sg179	0,76	2,26	4	1	3	0	0	2	0	0	0	0	0	1	0
Sg180	2,34	7,6	3	2	4	2	3	4	0	2	3	1	0	1	1
Sg182	2,06	4,55	3	13	8	5	0	23	0	0	0	0	0	0	1
Sg183	1,23	1,25	4	0	0	2	0	0	0	0	0	2	0	0	0
Sg184	0,36	0,09	4	0	2	1	0	0	0	0	0	0	0	0	0
Sg185	0,82	0,59	4	6	24	1	0	0	0	1	0	0	0	0	0
Sg186	0,99	2,27	4	8	8	3	0	1	0	0	0	0	0	0	0
Sg187	1	0,57	3	5	2	0	0	0	0	0	0	0	0	0	0
Sg188	0,6	0,35	4	3	0	0	0	3	0	0	0	0	0	0	0
Sg190	1,22	7,93	4	10	4	2	0	9	0	0	0	0	2	0	0
Sg191	1	0,43	4	2	0	0	0	0	0	0	0	0	0	0	0
Sg192	1,77	3,61	4	2	3	5	0	3	0	0	0	3	0	0	0
Sg193	0,53	1,1	4	3	0	2	0	3	0	0	1	0	0	0	0
Sg195	0,21	0,37	4	0	1	2	0	4	0	5	0	0	0	0	0

Sg216	4,51	5,26	3	16	1	0	8	0	0	0	0	0	0	0	0
Sg217	7,32	31,74	2	10	0	0	25	0	0	0	0	0	0	0	0
Sg220	9,87	8,51	3	5	0	16	5	1	0	1	0	0	0	0	0
Sg221	1,52	10,27	3	0	1	18	4	0	0	0	2	2	0	0	0
Sg222	0,13	0,78	4	2	2	0	0	2	0	0	0	0	0	0	0
Sg223	0,15	0,45	4	0	0	6	0	3	0	0	0	0	0	0	0
Sg224	0,09	0,09	5	0	0	2	0	0	0	0	0	0	0	0	0
Sg225	1,35	0,99	3	12	2	0	0	0	0	0	0	0	0	0	0
Sg226	2,93	15,47	2	4	0	9	14	5	0	0	1	0	0	0	0

B2 - Sampling data:

ID	length	weight	sex	stage	HSI	liver	gutted.weight	GSI	gonad.weight
M.2015.1	13,9	642,2	F	4	0,81	5,17	606,4	0,44	2,84
M.2015.2	16,5	1198,5	F	2	0,83	9,89	1143,9	1,26	15,07
M.2015.3	14,3	643,6	F	2	1,14	7,32	574,4	5,84	37,59
M.2015.4	11	287,8	F	1	0,81	2,34	271,1	0,69	1,99
M.2015.5	12,8	429,9	F	1	2,04	8,76	404,9	0,62	2,66
M.2015.6	11,7	337,9	M	1	1,73	5,85	318	0,54	1,82
M.2015.7	16	954,2	F	2	3,24	30,93	886,5	1,18	11,3
M.2015.8	15,8	930,4	F	2	2,26	21,06	814,2	7,47	69,5
M.2015.9	15,7	1011,7	M	U	1,25	12,61	965,7	0,93	9,37
M.2015.10	13,5	985,5	F	4	1,78	17,59	938,3	0,91	8,99
M.2015.11	9	136,3	F	1	1,2	1,64	128,5	0,78	1,06
M.2015.12	8,6	126,5	NA	U	2,67	3,38	113,4	NA	NA
M.2015.13	13,4	481,2	M	4	1,58	7,59	460,9	0,33	1,6
M.2015.14	16,9	831,2	M	4	0,95	7,92	803,2	0,45	3,78
M.2015.15	15,2	916,2	M	4	3,4	31,15	866,6	0,47	4,35
M.2015.16	14,2	734,9	F	2	1,64	12,07	701,9	1,14	8,39
M.2015.17	12,3	358	M	4	0,86	3,08	347,9	0,23	0,81
M.2015.18	12,1	336,7	M	U	1,07	3,59	320,4	1,02	3,43
M.2015.19	10,3	252,7	F	U	1,12	2,84	244,3	0,61	1,55
M.2015.20	11,5	276,8	F	U	1,72	4,76	263,1	0,66	1,82
M.2015.21	14,5	666,7	F	2	1,29	8,59	613,3	3,85	25,66
M.2015.22	10,3	238,4	M	U	0,89	2,13	220,5	0,49	1,18
M.2015.23	9,7	177,6	NA	U	1,17	2,08	170,3	NA	NA
M.2015.24	13,4	417,8	F	2	1,22	5,1	380	5,98	25
M.2015.25	18,9	1139,5	NA	U	1,78	20,25	1101,1	0,67	7,62
M.2015.26	7,7	59,8	NA	U	0,5	0,3	51,6	NA	NA
M.2015.27	7,3	67,3	M	1	1,1	0,74	63,1	0,01	0,01
M.2015.28	14,9	844,5	F	2	1,02	8,63	713,5	12,17	102,78
M.2015.29	19,7	1386,1	F	2	0,4	5,54	1318,1	1,51	20,95

M.2015.30	16,8	970	M	U	2,45	23,74	924,2	0,9	8,69
M.2015.31	9	143,5	M	U	1,3	1,87	133,8	1,1	1,58
M.2015.32	10	201,6	M	U	1,33	2,68	182,2	0,53	1,06
M.2015.33	4	15,8	NA	U	0,44	0,07	13,8	NA	NA
M.2015.34	9,7	178,5	M	U	0,86	1,54	169,4	0,26	0,46
M.2015.35	11,1	261,2	M	U	1,45	3,78	251	0,68	1,78
M.2015.36	9,9	157,8	F	U	2,21	3,48	149,1	0,29	0,45
M.2015.37	13,5	446,3	F	2	1,84	8,19	418,2	1,89	8,43
M.2015.38	10,3	223,2	M	U	0,8	1,78	204,8	0,39	0,86
M.2015.39	9,4	156,9	M	U	1,41	2,21	148,3	0,04	0,07
M.2015.40	12	364,5	NA	U	1,86	6,78	641	NA	NA
M.2015.41	9,5	153,1	F	U	1,4	2,15	141,1	0,49	0,75
M.2015.42	9,4	142,8	F	U	1,28	1,83	135,1	0,25	0,35
M.2015.43	7	58,4	NA	U	0,67	0,39	52,4	NA	NA
M.2015.44	5,2	24,7	NA	U	0,89	0,22	22,3	NA	NA
M.2015.45	4,9	26	NA	U	0,77	0,2	24,4	NA	NA
M.2015.46	4,4	11,9	NA	U	0,59	0,07	10,4	NA	NA
M.2015.47	9,4	144,7	F	U	1,64	2,37	133	0,26	0,38
M.2015.48	10,7	220,2	M	U	1,17	2,58	207,9	0,3	0,67
M.2015.49	10,3	187,2	M	U	2,58	4,83	171,8	0,33	0,61
M.2015.50	6,4	43,3	NA	U	2,31	1	40	NA	NA
M.2015.51	7,8	61,5	NA	U	0,83	0,51	57,9	NA	NA
M.2015.52	9,6	173,5	NA	U	0,95	1,65	162,9	NA	NA
M.2015.53	9,9	181,3	F	U	2,17	3,93	168,8	0,11	0,2
M.2015.54	16,5	814,5	F	2	1,08	8,82	754,1	5,31	43,26
M.2015.55	10,1	201,4	F	U	0,71	1,44	187,4	0,14	0,28
M.2015.56	10,8	215,4	F	U	1,12	2,41	204,5	0,16	0,34
M.2015.57	11	182,7	F	U	0,71	1,3	177,1	0,27	0,49
M.2015.58	16,1	839,5	M	U	1,04	8,73	782	0,51	4,28
M.2015.59	17,9	897,7	F	2	0,94	8,43	811,3	5,54	49,7
M.2015.60	19	1055,7	F	2	1,03	10,85	967,4	5,24	55,29
M.2015.61	20,4	1305,6	F	2	1,35	17,62	1182,3	4,86	63,49
M.2015.62	18,4	1537,5	M	U	3,2	49,21	1444,5	1,27	19,56
M.2015.63	18,6	1067,9	M	U	0,51	5,42	1018,4	0,69	7,38
M.2015.64	15,3	763,2	M	U	3,36	25,62	717,5	0,7	5,34
M.2015.65	14,6	590,1	F	2	1,06	6,27	539,4	4,9	28,89
M.2015.66	21,5	1662,8	F	4	0,73	12,08	1577,6	0,92	15,38
M.2015.67	18	919,7	M	U	2,01	18,52	882,9	0,43	3,92
M.2015.68	22	1468,7	F	2	0,67	9,89	1351	3,05	44,85
M.2015.69	15,9	699,3	M	U	1,13	7,9	667,9	0,61	4,28
M.2015.70	16,5	687	F	2	1,72	11,85	613,2	4,37	30,04
M.2015.71	13,1	559,1	F	U	1,48	8,3	518,8	0,18	0,99
M.2015.72	13,3	428,6	F	2	0,99	4,24	409,1	2,11	9,06
M.2015.73	19,4	1182	F	2	2,1	24,88	1050,9	5,96	70,45
M.2015.74	11,6	362,8	F	U	2,06	7,48	344,1	0,31	1,13

M.2015.75	16,5	887	M	U	0,35	3,09	862,7	0,79	7,01
M.2015.76	13,5	484,4	F	U	0,77	3,72	446,4	0,45	2,17
M.2015.77	10,1	266,4	NA	U	1,05	2,81	248,1	NA	NA
M.2015.78	10,4	212,5	M	U	1,22	2,6	202,4	0,66	1,41
M.2015.79	11,6	267,6	F	U	2,18	5,84	251	0,26	0,7
M.2015.80	9,8	192,3	F	U	1,9	3,66	181,1	0,16	0,3
M.2015.81	13,7	389,1	F	2	2,23	8,66	353,4	5,53	21,52
M.2015.82	10,2	209,5	M	U	1,39	2,92	192,2	0,64	1,34
M.2015.83	9,9	204,3	F	U	0,85	1,74	192,3	0,21	0,43
M.2015.84	9,6	169,8	F	U	1,37	2,32	164,5	0,46	0,78
M.2015.85	4,6	17	NA	U	NA	NA	15,1	NA	NA
M.2015.86	12,7	430,2	M	U	1,37	5,88	416,4	0,52	2,25
M.2015.87	17,1	1082,2	M	U	4,99	54,04	1002,2	0,76	8,27
M.2015.88	14,8	680	M	U	1,48	10,08	644,3	0,72	4,87
M.2015.89	13,9	449,4	M	U	2,7	12,13	420,7	1,06	4,77
M.2015.90	14	668,1	F	2	1,58	10,58	608,8	3,77	25,2
M.2015.91	16,4	684,7	F	2	2,02	13,8	623,8	5,15	35,25
M.2015.92	12,1	372,5	M	U	1,29	4,8	353,3	0,48	1,8
M.2015.93	8	115,9	M	U	0,91	1,06	107,2	0,53	0,61
M.2015.94	13,5	368,6	M	U	0,68	2,52	353,9	0,65	2,41
M.2015.95	11,7	331	M	U	1,82	6,04	312,5	0,18	0,6
M.2015.96	10,9	236,9	M	U	0,65	1,54	226,6	0,6	1,41
M.2015.97	18,3	1084,8	M	U	5,25	56,9	1001	1,37	14,85
M.2015.98	16,4	743	F	2	2,95	21,89	682,8	3,48	25,84
M.2015.99	18,5	1017,4	F	2	1,5	15,27	919,2	6,31	64,21
M.2015.100	19,6	1388,6	F	U	1,65	22,88	1303,7	0,83	11,5
M.2015.101	16,2	731	F	2	2,28	16,64	665,8	3,82	27,91
M.2015.102	19,7	1254,9	M	U	2,51	31,47	1201	0,92	11,5
M.2015.103	17,3	999,5	M	U	4,17	41,66	937,5	0,49	4,87
M.2015.104	20,5	1393,9	F	2	1,97	27,46	1271,2	5,26	73,35
M.2015.105	15,2	591,1	F	U	3,21	19	538,4	0,61	3,6
M.2015.106	15,7	914,3	M	U	6,11	55,88	839,3	0,57	5,2
M.2015.107	10,4	186,1	M	U	1,48	2,76	171	0,44	0,82
M.2015.108	16,8	934,2	F	2	1,95	18,21	850,8	4,51	42,12
M.2015.109	19,7	1456,4	F	2	1,08	15,75	1337,6	4,71	68,55
M.2015.110	16,1	907,3	M	U	3,3	29,91	846,9	0,94	8,51
M.2015.111	17,6	1022,6	M	U	1,86	18,99	950,4	0,88	8,95
M.2015.112	15	743,8	M	U	2,59	19,28	698,7	0,96	7,13
M.2015.113	12,7	366,5	M	U	0,65	2,4	359,2	0,33	1,22
M.2015.114	8,5	95,3	NA	U	0,68	0,65	89,9	NA	NA
M.2015.115	7,7	71,5	NA	U	1,45	1,04	67	NA	NA
M.2015.116	10,6	222,4	M	U	2	4,45	209,9	0,64	1,42
M.2015.117	16	940,8	M	U	2,47	23,28	881,2	1,66	15,6
M.2015.118	17,2	777,5	F	2	2,44	18,94	702,8	4,66	36,2
M.2015.119	17,9	1299,1	M	U	6,17	80,11	1190,5	0,65	8,39

M.2015.120	16,2	764,4	F	2	1,23	9,44	705,2	3,66	28
M.2015.121	18,8	1269,8	M	U	3,37	42,76	1197,1	7,11	90,24
M.2015.122	10,6	170,3	NA	U	1,37	2,33	161,9	NA	NA
M.2015.123	12,3	286,1	M	U	1,34	3,83	270,9	0,28	0,81
M.2015.124	11,9	241,9	NA	U	0,93	2,24	230,5	0,38	0,92
M.2015.125	5,6	24,1	NA	U	1,66	0,4	21,8	NA	NA
M.2015.126	9,9	153,2	M	U	1,25	1,91	142,7	0,44	0,68
M.2015.127	21,1	1333,6	F	2	2,4	32	1176,8	6,25	83,38
M.2015.128	18,5	1095,8	F	2	1,2	13,15	1007,6	4,34	47,59
M.2015.129	18,7	1187,9	M	U	2,65	31,5	1097,4	1,11	13,14
M.2015.130	23,2	1617,4	F	4	0,47	7,58	1552,5	1,06	17,2
M.2015.131	16,2	760,9	M	U	2,32	17,62	724,6	0,36	2,74
M.2012.132	18,1	1285,8	M	U	4,49	57,73	1187,4	1,08	13,94
M.2012.133	11,1	199,6	F	U	2,86	5,71	184,5	0,46	0,92
M.2012.134	16,6	1021,2	F	2	3,02	30,83	901,7	5,53	56,43
M.2012.135	10,4	223,1	F	U	2,25	5,02	208,7	0,22	0,48
M.2012.136	13,5	467,5	M	U	3,16	14,78	432,6	0,43	2,03
M.2012.137	10,3	188,3	M	U	2,98	5,62	176,9	0,69	1,3
M.2012.138	17	809,5	F	2	1,67	13,51	717,9	5,33	43,15
M.2012.139	11,9	336,2	M	U	0,95	3,18	326,5	0,73	2,45
M.2012.140	13,7	459,5	F	2	3,3	15,16	409	5,48	25,2
M.2012.141	16,7	898,9	F	U	3,22	28,96	818,5	1,57	14,09
M.2012.142	8,9	134	M	U	2,19	2,93	126,6	0,18	0,24
M.2012.143	12	346,6	M	U	3,67	12,72	317,3	0,67	2,31
M.2012.144	9,2	133,6	F	U	3,79	5,06	122,8	0,25	0,33
M.2012.145	9,8	169	M	U	1,63	2,76	160,4	0,18	0,31
M.2012.146	16,7	1004,7	M	U	6,53	65,57	909,6	9,64	96,9
M.2012.147	12,8	330	M	U	5,53	18,24	299,4	0,62	2,06
M.2012.148	9,5	185,9	M	U	3,57	6,63	169,4	0,34	0,63
M.2012.149	11,7	296,5	M	U	2,09	6,2	275,5	0,75	2,23
M.2012.150	8,9	162,3	M	U	2,01	3,27	152,2	0,54	0,88
M.2012.151	11,6	334,2	F	U	2,79	9,31	311,4	0,17	0,58
M.2012.152	10	178	NA	U	2,44	4,34	152,9	NA	NA
M.2012.153	16,3	813,5	F	2	3,04	24,75	703,2	5,12	41,68
M.2012.154	13,4	541,9	M	U	3,91	21,17	494,8	0,77	4,19
M.2012.155	12,5	350,7	M	U	3,44	12,07	320,3	0,6	2,11
M.2012.156	9,3	144,1	F	U	1,51	2,17	123,5	0,1	0,15
M.2012.157	10,8	239,2	F	U	2,64	6,32	215,3	0,2	0,49
M.2012.158	14,7	641,4	M	U	0,88	5,65	606,8	0,75	4,84
M.2012.159	14,4	620,1	NA	U	1,95	12,1	550,3	2,43	15,09
M.2012.160	18	1033,8	M	U	4,41	45,56	949,3	0,58	5,96
M.2012.161	12,6	400,8	M	U	5,14	20,62	374,3	0,45	1,79
M.2012.162	19	1272,5	F	2	1,48	18,81	1092,6	7,01	89,14
M.2012.163	13,6	565,8	M	U	3,84	21,75	502,3	1,37	7,75
M.2012.164	15,8	981,8	M	U	4,27	41,91	889,4	0,64	6,31

M.2012.165	15,6	789,2	M	U	3,46	27,31	728,4	0,68	5,35
M.2012.166	17,5	1063,5	M	U	5,45	57,98	963,9	1,19	12,66
M.2012.167	17,1	1141,5	M	U	3,53	40,25	1045,2	1,17	13,32
M.2012.168	12,6	428,4	F	U	4,02	17,23	380,7	0,37	1,58
M.2012.169	12,2	384,3	F	U	3,61	13,88	349,8	0,35	1,36
M.2012.170	12,1	286,8	F	U	3,7	10,61	255,3	0,37	1,06
M.2012.171	4,6	14,8	NA	U	1,08	0,16	12,9	NA	NA
M.2012.172	14,2	442,5	F	2	3,08	13,63	381,6	5,97	26,42
M.2012.173	14,4	685,7	M	U	3,97	27,22	626,7	0,47	3,22
M.2012.174	10,5	245,4	F	U	2,34	5,74	223,3	0,24	0,59
M.2012.175	15,7	867,5	M	U	1,8	15,58	811,4	1,52	13,19
M.2012.176	11,7	252,5	F	U	3,58	9,03	226,4	0,38	0,97
M.2012.177	11,1	296,1	M	U	3,07	9,08	269,4	0,74	2,2
M.2012.178	16,3	981,6	M	U	4,78	46,96	896	0,89	8,73
M.2012.179	14	674	M	U	4,14	27,89	603,3	1,68	11,34
M.2012.180	8,1	116,4	F	U	1,81	2,11	100,7	0,44	0,51
M.2012.181	9,8	191,2	F	U	1,54	2,95	173,2	0,22	0,43
M.2012.182	10,8	272,7	M	U	1,47	4	256,4	0,28	0,76
M.2012.183	11,5	268,8	F	2	1,94	5,21	228,2	7,77	20,88
M.2012.184	8,9	164,4	F	1	1,76	2,89	148,2	0,31	0,51
M.2012.185	10,1	205,2	M	U	3,34	6,86	183,3	0,54	1,11
M.2012.186	9,6	156,4	M	U	1,87	2,93	143,2	0,72	1,12
M.2012.187	13,7	579,1	F	U	3,25	18,84	534,9	0,57	3,32
M.2012.188	8,2	111,4	M	U	2,25	2,51	99,8	0,53	0,59
M.2012.189	10,2	172,7	M	U	2,03	3,51	156,4	0,98	1,7
M.2012.190	6,3	43	NA	U	1,49	0,64	36,6	NA	NA
M.2012.191	18,2	1344,5	M	U	1,76	23,72	1269,7	1,61	21,59
M.2012.192	15,3	919,1	M	U	5,59	51,38	817,7	0,64	5,92
M.2012.193	9,7	156	F	U	2,26	3,53	135,8	0,51	0,8
M.2012.194	11,1	293,6	M	U	2,37	6,96	264,9	0,69	2,02
M.2012.195	7,6	87,8	F	U	2,44	2,14	74,7	0,28	0,25
M.2012.196	10,5	373,4	M	U	2,86	10,68	336,8	0,51	1,9
M.2012.197	16,4	1171,8	M	U	1,33	15,62	1100,4	0,86	10,03
M.2012.198	17,3	1523,4	M	U	7,11	108,28	1374,6	1,36	20,68
M.2012.199	17,5	1337	M	U	0,22	2,89	1256,1	1,15	15,39
M.2012.200	9,8	243,5	M	U	3,03	7,37	215,2	1,29	3,15
M.2012.201	16	1127,1	M	U	3,94	44,46	1059	0,38	4,28
M.2012.202	7,4	89,8	F	U	1,69	1,52	74,2	0,56	0,5
M.2012.203	9	173,8	F	U	1,66	2,88	155,5	0,54	0,94
M.2012.204	7,8	101,6	NA	U	1,41	1,43	86,5	NA	NA
M.2012.205	7,2	77,1	NA	U	1,18	0,91	62,7	0,05	0,04
M.2012.206	9,7	173,4	NA	U	2,03	3,52	149,2	0,31	0,53
M.2016.207	13,4	491,6	F	2	2,82	13,85	435	5,91	29,03
M.2016.208	9,3	165,8	F	1	2,58	4,27	154,4	0,02	0,04
M.2016.209	9,1	125,3	F	1	1,05	1,32	116,5	0,12	0,15

M.2016.210	10,7	278,3	M	1	1,83	5,09	267,2	0,42	1,18
M.2016.211	8,5	95,2	M	1	2,52	2,4	88,7	0,14	0,13
M.2016.212	11,9	359,4	M	1	2,21	7,96	328,6	0,21	0,77
M.2016.213	9,8	153	M	1	1,35	2,07	142,9	0,21	0,32
Sg28	4,6	17,4	NA	1	0,86	0,15	15,7	NA	NA
Sg29	14,8	599,2	F	1	1,23	7,35	565,6	0,19	1,16
Sg30	14,1	510,8	F	1	2,38	12,18	476	0,25	1,26
Sg31	15,8	835	F	4	4	33,39	770,5	0,54	4,5
Sg32	5,5	30,1	NA	1	0,53	0,16	28,2	NA	NA
Sg33	15,4	861,5	M	4	3,12	26,91	793	0,62	5,3
Sg34	13,3	402,2	M	4	0,92	3,71	379,2	0,42	1,69
Sg35	19,4	1420	F	2	2,42	34,43	1280	3,51	49,78
Sg36	18,2	1180	M	4	1,85	21,84	1108	0,96	11,37
Sg37	15,9	878,5	M	4	0,83	7,25	824	0,46	4,01
Sg38	5	22,3	NA	1	0,63	0,14	19,7	NA	NA
Sg39	6,2	33,2	NA	1	0,96	0,32	30,8	NA	NA
Sg40	4,9	17,2	NA	1	0,52	0,09	15,3	NA	NA
Sg41	5,6	25,8	NA	1	0,81	0,21	24,5	NA	NA
Sg42	4,9	21,5	NA	1	0,74	0,16	20,2	NA	NA
Sg43	5,4	21,8	NA	1	1,15	0,25	20,1	0,09	0,02
Sg44	5,5	25,9	NA	1	0,66	0,17	24,1	NA	NA
Sg45	5,3	21,8	NA	1	1,19	0,26	19,6	NA	NA
Sg46	5	19,8	NA	1	0,35	0,07	18,5	NA	NA
Sg47	10,5	210,9	M	1	1,3	2,75	198,4	0,18	0,39
Sg48	10,1	130,3	NA	1	1,18	1,54	122,5	0,21	0,27
Sg49	20,5	1370	F	4	0,39	5,28	1315	0,71	9,71
Sg50	17,2	773,5	F	4	0,92	7,09	733,5	0,61	4,72
Sg51	12,1	241,3	F	1	0,62	1,5	230,1	0,16	0,39
Sg52	14,5	456	F	2	0,68	3,09	431,2	1,45	6,6
Sg53	6,1	34,9	NA	1	1,12	0,39	32,6	NA	NA
Sg54	14	556,8	F	1	0,86	4,77	515	0,21	1,16
Sg55	14,2	453,2	F	4	1,23	5,58	435	0,47	2,11
Sg56	12	291,6	F	1	0,51	1,5	272,3	0,14	0,42
Sg57	13,1	420	F	4	0,81	3,39	390,6	0,29	1,22
Sg58	10,2	224,6	M	1	0,41	0,93	210,5	0,17	0,38
Sg59	6,9	51,7	NA	1	0,64	0,33	48,2	NA	NA
Sg60	18,5	1065	F	4	1,15	12,25	1005	0,68	7,27
Sg61	10	196,5	F	1	0,55	1,09	185,5	0,2	0,4
Sg62	11,5	232,9	F	1	0,82	1,92	228,5	0,32	0,74
Sg63	11,8	258,3	F	1	0,54	1,4	246	0,15	0,39
Sg64	5,6	37,1	NA	1	0,43	0,16	33,6	NA	NA
Sg65	11,7	281	F	1	0,2	0,56	263	NA	NA
Sg66	18,1	1051	F	4	0,46	4,82	986,5	1,94	20,34
Sg67	12	285,2	F	1	0,37	1,06	272,4	0,16	0,45
Sg68	10,5	230	M	1	2,48	5,71	216,3	0,03	0,08

Sg69	9	103	NA	1	1,19	1,23	95,6	NA	NA
Sg70	5,2	22,5	NA	1	0,62	0,14	20,6	NA	NA
Sg71	15,5	688	F	4	1,5	10,32	640,5	0,28	1,95
Sg72	12	291,7	F	1	0,37	1,08	274,9	0,25	0,72
Sg73	15	584,2	M	4	0,32	1,89	556,8	0,6	3,48
Sg74	13	165	F	1	0,35	0,57	339,2	0,48	0,8
Sg75	13	314	F	1	0,64	2	298	0,28	0,89
Sg76	10,6	206,4	M	1	1,67	3,44	188,5	0,29	0,59
Sg77	11,9	279,3	F	1	0,32	0,9	267,1	0,09	0,26
Sg78	8,8	102	F	1	0,61	0,62	94,7	0,14	0,14
Sg79	18,3	978	F	4	0,53	5,22	923,5	0,44	4,35
Sg80	12,5	309	F	1	0,8	2,46	286,1	0,26	0,79
Sg81	11,9	265,5	F	1	0,67	1,78	252	0,23	0,61
Sg82	9	106,5	F	1	2,1	2,24	99,5	0,16	0,17
Sg83	9,2	137,8	F	1	0,46	0,64	128	NA	NA
Sg84	13,9	514,6	M	4	0,69	3,53	492,6	0,35	1,81
Sg85	13	374,2	F	1	0,63	2,37	351,6	0,28	1,03
Sg86	6,1	35,2	NA	1	0,54	0,19	30,3	NA	NA
Sg87	12	262,3	F	1	0,47	1,23	244,5	0,14	0,38
Sg88	6,9	49,3	NA	1	1,08	0,53	46	NA	NA
Sg89	17,6	794	F	4	1,63	12,98	739	1,38	10,97
Sg90	8,5	105	NA	1	0,7	0,74	96,4	NA	NA
Sg91	8	96,1	NA	1	0,42	0,4	89,8	NA	NA
Sg92	11,8	251,5	F	1	0,49	1,23	228,1	0,21	0,54
Sg93	5,7	29	NA	1	0,66	0,19	27,1	NA	NA
Sg94	8	77	NA	1	0,7	0,54	72,7	NA	NA
Sg95	11,2	226,3	M	1	3,45	7,8	208,8	0,24	0,55
Sg96	11,7	273,3	F	1	0,42	1,14	257,3	0,28	0,77
Sg97	15	603,5	F	4	0,63	3,79	557,5	0,54	3,27
Sg98	16,3	793	F	4	0,91	7,19	749	0,38	3,02
Sg99	17,1	901,5	F	4	3,22	29,02	842,5	0,27	2,47
Sg100	16	619,5	F	4	0,67	4,15	577,8	2,16	13,37
Sg101	15,3	590,4	F	2	0,98	5,79	549	2,03	11,98
Sg102	14,6	606,5	F	4	4,9	29,7	552,6	0,37	2,26
Sg103	15	558,2	F	4	1,4	7,82	521	0,19	1,06
Sg104	14,8	554	F	4	0,48	2,64	513,4	0,26	1,46
Sg105	14,5	516	F	4	0,39	2,01	478,4	1,7	8,75
Sg106	14,8	565,8	F	4	0,6	3,38	522,8	0,57	3,24
Sg107	11,6	259,9	F	1	1,35	3,5	245,3	0,12	0,3
Sg108	12,5	370	F	1	1,47	5,45	347,4	0,29	1,09
Sg109	11	266,5	M	1	1,52	4,04	249,5	0,11	0,29
Sg110	12	259	F	1	0,37	0,97	245,8	0,26	0,67
Sg111	13,3	306,2	F	1	0,57	1,74	289,1	0,26	0,8
Sg112	12,3	316,2	F	1	0,91	2,89	305,6	0,15	0,49
Sg113	9,2	159,5	F	1	1,22	1,94	149,8	0,06	0,09

Sg114	15,8	671	F	4	0,99	6,67	637	0,55	3,66
Sg115	7,3	59,3	NA	1	0,46	0,27	55	NA	NA
Sg116	10,5	222,4	M	1	0,83	1,85	209,8	0,33	0,73
Sg117	9,2	113,9	F	1	0,56	0,64	107,4	0,19	0,22
Sg118	14,7	609,5	F	2	1,15	6,99	561,2	3,09	18,85
Sg119	12,4	385	F	1	0,45	1,73	355,2	0,13	0,51
Sg120	9,5	150,2	M	1	0,67	1,01	142,8	0,2	0,3
Sg121	10,5	193,4	F	1	1,45	2,8	181,3	0,26	0,5
Sg122	10,2	174,5	M	1	2,14	3,74	161	0,19	0,34
Sg123	10,7	224,3	NA	1	1,78	3,99	208,3	NA	NA
Sg124	6,1	35,2	NA	1	0,8	0,28	31,3	NA	NA
Sg125	6,5	45,6	NA	1	0,96	0,44	41,2	NA	NA
Sg126	13,6	395	F	4	1,1	4,34	382,2	0,25	1
Sg127	7,1	56,2	NA	1	1,03	0,58	51,5	NA	NA
Sg128	9,9	198,3	NA	1	1,19	2,35	183,5	NA	NA
Sg129	9,8	151	F	1	0,44	0,67	143,4	0,2	0,3
Sg130	10,3	226,8	M	1	0,9	2,04	214,3	NA	NA
Sg131	7,4	79,1	NA	1	0,81	0,64	74,3	NA	NA
Sg132	10,7	248,6	F	4	1,6	3,97	236,5	0,25	0,62
Sg133	10,9	155,6	M	1	1,65	2,57	241,4	0,15	0,23
Sg134	10,2	168,3	M	1	0,47	0,79	155,8	0,02	0,03
Sg135	12,1	321,4	F	4	0,37	1,2	299,8	0,25	0,79
Sg136	10,6	190,7	NA	1	0,46	0,88	180	NA	NA
Sg137	9,6	158,7	NA	1	0,58	0,92	147,7	NA	NA
Sg138	12,8	274,5	M	4	1,21	3,33	258,5	0,13	0,37
Sg139	11,3	268,9	F	4	0,15	0,41	249,8	0,23	0,62
Sg140	11,9	278,2	F	4	0,55	1,54	264,7	0,13	0,37
Sg141	13,3	250,4	F	4	1,69	4,22	236,4	0,32	0,8
Sg142	12,5	345,8	F	4	0,43	1,48	324,8	0,26	0,9
Sg143	10,5	262,9	M	4	0,55	1,44	244	0,31	0,81
Sg144	10,8	203,2	M	1	0,43	0,87	190,1	0,02	0,05
Sg145	11,2	233,4	F	4	0,77	1,79	222,2	0,38	0,88
Sg146	5,7	32,8	NA	1	1,25	0,41	29,3	NA	NA
Sg147	11,7	278,6	F	4	1,19	3,32	260,2	0,41	1,13
Sg148	7,9	91,1	NA	1	2,04	1,86	85,9	NA	NA
Sg149	12,2	302,2	F	4	0,83	2,51	289	0,31	0,94
Sg150	10,3	214,7	M	1	3,28	7,04	192,8	0,26	0,56
Sg151	12,5	349,8	F	4	0,51	1,77	324,6	0,21	0,75
Sg152	9,6	158,2	F	1	0,32	0,5	150,4	0,29	0,46
Sg153	11,4	305,8	F	4	1,99	6,08	207,6	0,2	0,62
Sg154	4,4	10,5	NA	1	0,19	0,02	8,5	NA	NA
Sg155	5,1	18,6	NA	1	0,65	0,12	16,9	NA	NA
Sg156	5	15,7	NA	1	0,32	0,05	14,3	NA	NA
Sg157	5,5	24,5	NA	1	1,55	0,38	22,5	NA	NA
Sg158	17,1	890,5	F	4	1,36	12,09	828,5	1,84	16,39

Sg159	13,5	441,4	F	4	1,41	6,24	415,6	0,36	1,57
Sg160	11,9	251,3	F	1	0,59	1,49	238,8	0,21	0,54
Sg161	14,8	509	M	4	1,94	9,9	476,6	0,61	3,12
Sg162	18,7	1240	F	4	1,99	24,71	1130	0,66	8,17
Sg163	11,4	259,4	F	1	0,34	0,89	243,3	0,3	0,77
Sg164	11,5	296,5	M	1	1,03	3,06	281,5	0,08	0,23
Sg165	17	805,5	F	2	0,71	5,68	731,5	4,44	35,76
Sg166	9,5	129,7	F	1	1,73	2,24	120,8	0,24	0,31
Sg167	13,6	424,4	F	4	0,28	1,17	403	0,94	3,98
Sg168	11,8	304	M	4	2,62	7,96	281	0,26	0,8
Sg169	11,1	230,5	F	1	0,61	1,41	219	0,15	0,34
Sg170	12,6	319,2	F	1	0,69	2,2	303,6	0,3	0,96
Sg171	13	418,8	F	4	0,45	1,87	389,2	0,21	0,87
Sg172	12,3	325,6	F	1	0,96	3,11	311,2	0,28	0,9
Sg173	11,2	203,5	F	1	1,23	2,51	205,6	0,39	0,79
Sg174	12,6	337,4	F	1	0,92	3,09	314,2	0,43	1,45
Sg175	13,5	394	F	4	0,97	3,84	373,8	0,42	1,66
Sg176	14,1	457,4	F	1	0,35	1,59	425,4	0,31	1,43
Sg177	11,7	229,9	F	1	0,24	0,56	214,8	0,27	0,62
Sg178	16,5	744,5	M	4	2,97	22,11	684	0,43	3,22
Sg179	10,2	193	M	4	0,82	1,58	180,4	NA	NA
Sg180	13,6	464,6	F	1	1,82	8,45	423,8	0,26	1,21
Sg181	19	1165	F	4	0,69	8,04	1095	0,66	7,66
Sg182	13,9	441	F	1	0,42	1,87	414,2	0,22	0,98
Sg183	10,3	213,4	NA	NA	1,39	2,96	199,9	NA	NA
Sg184	6,4	36,5	NA	1	NA	NA	33,4	NA	NA
Sg185	9,6	131,6	F	1	0,93	1,22	123,9	NA	0,21
Sg186	10,6	178,2	F	1	0,48	0,86	168,2	NA	0,5
Sg187	11,2	230,5	M	1	2,39	5,52	216,3	NA	NA
Sg188	9,5	139	M	1	0,19	0,27	130,3	NA	0,12
Sg189	15	627	M	4	1,43	8,96	601	NA	3,74
Sg190	11,5	265,4	F	1	0,53	1,4	243,2	NA	0,49
Sg191	10,2	189,5	M	1	1,22	2,32	170,3	NA	0,29
Sg192	12,9	356,4	F	1	0,4	1,44	336,4	NA	0,91
Sg193	8,5	97,6	F	1	1,5	1,46	91,2	NA	0,26
Sg194	9,1	125	F	1	0,78	0,97	115,1	NA	0,4
Sg195	6,1	33,6	NA	1	1,07	0,36	31,5	NA	NA
Sg196	12,9	382,6	NA	NA	NA	NA	NA	NA	NA
Sg197	12,8	419,4	NA	NA	NA	NA	NA	NA	NA
Sg198	14,2	466,6	NA	NA	NA	NA	NA	NA	NA
Sg199	6,1	45,7	NA	NA	NA	NA	NA	NA	NA
Sg200	10	168,6	NA	NA	NA	NA	NA	NA	NA
Sg201	8,3	87,8	NA	NA	NA	NA	NA	NA	NA
Sg202	8,5	102,1	NA	NA	NA	NA	NA	NA	NA
Sg203	8,1	87,3	NA	NA	NA	NA	NA	NA	NA

Sg204	5,4	23,9	NA	NA	NA	NA	NA	NA	NA
Sg205	11,5	240,4	NA	NA	NA	NA	NA	NA	NA
Sg206	12,1	303,4	NA	NA	NA	NA	NA	NA	NA
Sg207	14,3	565,2	NA	NA	NA	NA	NA	NA	NA
Sg208	10	194,4	NA	NA	NA	NA	NA	NA	NA
Sg209	17,5	833	NA	NA	NA	NA	NA	NA	NA
Sg210	12	336,4	NA	NA	NA	NA	NA	NA	NA
Sg211	9,9	132,9	NA	NA	NA	NA	NA	NA	NA
Sg212	8	77,3	NA	NA	NA	NA	NA	NA	NA
Sg213	6,1	31,9	NA	NA	NA	NA	NA	NA	NA
Sg214	5,6	29,7	NA	NA	NA	NA	NA	NA	NA
Sg215	7,5	59,4	NA	NA	NA	NA	NA	NA	NA
Sg216	16,8	825,5	F	4	2,69	22,18	770,5	1,06	8,71
Sg217	19	1125	F	2	1,73	19,46	1005	2,57	28,96
Sg218	5,4	25,4	NA	1	0,59	0,15	23,8	NA	NA
Sg219	5,3	22,8	NA	1	0,96	0,22	21,5	NA	NA
Sg220	20,6	1805	F	2	4,01	72,4	1580	4,68	84,45
Sg221	12,7	437,4	M	4	2,37	10,38	402,2	0,3	1,33
Sg222	5,5	27,1	NA	1	1,4	0,38	24	NA	NA
Sg223	4,8	23,3	NA	1	0,64	0,15	21,4	NA	NA
Sg224	4,7	18,4	NA	1	0,71	0,13	16,3	NA	NA
Sg225	13,4	444	M	4	1,3	5,78	423,6	0,33	1,47
Sg226	15,9	615,5	F	2	2,75	16,95	558	1,67	10,25
Sg227	4,4	12,8	NA	1	0,31	0,04	11,8	NA	NA

B3 - Station data:

ID	fjord	year	station	pel/bot	day.or.night	start.depth	end.depth	mean.depth	bottom.depth
M.2015.1	Masfjord	2015	116	pelagic	day	430	300	365	NA
M.2015.2	Masfjord	2015	117	pelagic	day	400	200	300	NA
M.2015.3	Masfjord	2015	116	pelagic	day	430	300	365	NA
M.2015.4	Masfjord	2015	116	pelagic	day	430	300	365	NA
M.2015.5	Masfjord	2015	119	pelagic	night	440	280	360	NA
M.2015.6	Masfjord	2015	119	pelagic	night	440	280	360	NA
M.2015.7	Masfjord	2015	119	pelagic	night	440	280	360	NA
M.2015.8	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.9	Masfjord	2015	121	pelagic	night	420	250	335	379
M.2015.10	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.11	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.12	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.13	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.14	Masfjord	2015	121	pelagic	day	420	250	335	379

M.2015.15	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.16	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.17	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.18	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.19	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.20	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.21	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.22	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.23	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.24	Masfjord	2015	121	pelagic	day	420	250	335	379
M.2015.25	Masfjord	2015	136	pelagic	night	410	300	355	447
M.2015.26	Masfjord	2015	136	pelagic	night	410	300	355	447
M.2015.27	Masfjord	2015	136	pelagic	night	410	300	355	447
M.2015.28	Masfjord	2015	120	bottom	day	NA	NA	NA	425
M.2015.29	Masfjord	2015	135	pelagic	night	390	290	340	451
M.2015.30	Masfjord	2015	135	pelagic	night	390	290	340	451
M.2015.31	Masfjord	2015	135	pelagic	night	390	290	340	451
M.2015.32	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.33	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.34	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.35	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.36	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.37	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.38	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.39	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.40	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.41	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.42	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.43	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.44	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.45	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.46	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.47	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.48	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.49	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.50	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.51	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.52	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.53	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.54	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.55	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.56	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.57	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.58	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.59	Masfjord	2015	111	bottom	night	NA	NA	NA	400

M.2015.60	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.61	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.62	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.63	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.64	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.65	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.66	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.67	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.68	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.69	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.70	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.71	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.72	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.73	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.74	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.75	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.76	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.77	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.78	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.79	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.80	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.81	Masfjord	2015	111	bottom	night	NA	NA	NA	400
M.2015.82	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.83	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.84	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.85	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.86	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.87	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.88	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.89	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.90	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.91	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.92	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.93	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.94	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.95	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.96	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.97	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.98	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.99	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.100	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.101	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.102	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.103	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.104	Masfjord	2015	115	bottom	day	NA	NA	NA	340

M.2015.105	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.106	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.107	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.108	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.109	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.110	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.111	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.112	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.113	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.114	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.115	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.116	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.117	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.118	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.119	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.120	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.121	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.122	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.123	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.124	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.125	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.126	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.127	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.128	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.129	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.130	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2015.131	Masfjord	2015	115	bottom	day	NA	NA	NA	340
M.2012.132	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.133	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.134	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.135	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.136	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.137	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.138	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.139	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.140	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.141	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.142	Masfjord	2012	357	pelagic	day	347	0	174	484
M.2012.143	Masfjord	2012	357	pelagic	day	347	0	174	484
M.2012.144	Masfjord	2012	357	pelagic	day	347	0	174	484
M.2012.145	Masfjord	2012	357	pelagic	day	347	0	174	484
M.2012.146	Masfjord	2012	357	pelagic	day	347	0	174	484
M.2012.147	Masfjord	2012	357	pelagic	day	347	0	174	484
M.2012.148	Masfjord	2012	357	pelagic	day	347	0	174	484
M.2012.149	Masfjord	2012	357	pelagic	day	347	0	174	484

M.2012.150	Masfjord	2012	357	pelagic	day	347	0	174	484
M.2012.151	Masfjord	2012	357	pelagic	day	347	0	174	484
M.2012.152	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.153	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.154	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.155	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.156	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.157	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.158	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.159	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.160	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.161	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.162	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.163	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.164	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.165	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.166	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.167	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.168	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.169	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.170	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.171	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.172	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.173	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.174	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.175	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.176	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.177	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.178	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.179	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.180	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.181	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.182	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.183	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.184	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.185	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.186	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.187	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.188	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.189	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.190	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.191	Masfjord	2012	354	bottom	night	469	430	450	469
M.2012.192	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.193	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.194	Masfjord	2012	358	pelagic	day	400	35	218	479

M.2012.195	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.196	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.197	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.198	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.199	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.200	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.201	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.202	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.203	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.204	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.205	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2012.206	Masfjord	2012	358	pelagic	day	400	35	218	479
M.2016.207	Masfjord	2016	153	pelagic	night	450	350	400	425
M.2016.208	Masfjord	2016	153	pelagic	night	450	350	400	425
M.2016.209	Masfjord	2016	154	pelagic	night	464	350	407	445
M.2016.210	Masfjord	2016	151	pelagic	day	NA	NA	NA	NA
M.2016.211	Masfjord	2016	152	pelagic	day	460	350	405	436
M.2016.212	Masfjord	2016	152	pelagic	day	460	350	405	436
M.2016.213	Masfjord	2016	152	pelagic	day	460	350	405	436
Sg28	Lustrafjord	2016	155	bottom	day	650	620	NA	646
Sg29	Lustrafjord	2016	155	bottom	day	650	620	NA	646
Sg30	Lustrafjord	2016	157	bottom	day	377	370	NA	374
Sg31	Lustrafjord	2016	157	bottom	day	377	370	NA	374
Sg32	Lustrafjord	2016	157	bottom	day	377	370	NA	374
Sg33	Lustrafjord	2016	157	bottom	day	377	370	NA	374
Sg34	Lustrafjord	2016	157	bottom	day	377	370	NA	374
Sg35	Lustrafjord	2016	160	bottom	night	375	370	NA	374
Sg36	Lustrafjord	2016	160	bottom	night	375	370	NA	374
Sg37	Lustrafjord	2016	160	bottom	night	375	370	NA	374
Sg38	Lustrafjord	2016	160	bottom	night	375	370	NA	374
Sg39	Lustrafjord	2016	160	bottom	night	375	370	NA	374
Sg40	Lustrafjord	2016	160	bottom	night	375	370	NA	374
Sg41	Lustrafjord	2016	163	bottom	day	375	373	NA	376
Sg42	Lustrafjord	2016	163	bottom	day	375	373	NA	376
Sg43	Lustrafjord	2016	163	bottom	day	375	373	NA	376
Sg44	Lustrafjord	2016	163	bottom	day	375	373	NA	376
Sg45	Lustrafjord	2016	163	bottom	day	375	373	NA	376
Sg46	Lustrafjord	2016	163	bottom	day	375	373	NA	376
Sg47	Lustrafjord	2016	164	bottom	day	652	650	NA	652
Sg48	Lustrafjord	2016	164	bottom	day	652	650	NA	652
Sg49	Lustrafjord	2016	164	bottom	day	652	650	NA	652
Sg50	Lustrafjord	2016	164	bottom	day	652	650	NA	652
Sg51	Lustrafjord	2016	164	bottom	day	652	650	NA	652
Sg52	Lustrafjord	2016	164	bottom	day	652	650	NA	652
Sg53	Lustrafjord	2016	164	bottom	day	652	650	NA	652

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Sg82	Lustrafjord	2016	164	bottom	day	652	650	NA	652
Sg83	Lustrafjord	2016	165	pelagic	day	610	0	305	651,05
Sg84	Lustrafjord	2016	165	pelagic	day	610	0	305	651,05
Sg85	Lustrafjord	2016	164	bottom	day	652	650	NA	652
Sg86	Lustrafjord	2016	164	bottom	day	652	650	NA	652
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Sg216	Lustrafjord	2016	180	bottom	day	373	370	NA	375
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Sg227	Lustrafjord	2016	180	bottom	day	373	370	NA	375