MFV Altaire (LK429)

Survey 0322H

Report

4-26 July 2022

Ports

Loading: Ullapool, 4 July 2022
Half Landing: Falmouth 17 July 2022
Unloading: Ullapool, 26 July 2022

Personnel

F. Burns SIC
H. Holah (co-SIC, SIC Part 2)
J Drewery
K McIntosh
J McAllister (Part 1)
M Machairopoulou (Part 1)
S Wells (Part 2)
M Kosecka (Part 2)

Out-turn days per project: 23 days MACEGG/20674

Fishing/Sampling Gear: Gulf VII plankton sampler, RBR Concerto³ CTD, vessels own pelagic midwater trawl

Objectives

1. To carry out Atlantic mackerel (*Scomber scombrus*) and horse mackerel (*Trachurus trachurus*) egg survey (ICES Triennial Survey) within sampling Period 7 of the 2022 PMEGS sampling plan, across the NE Atlantic shelf edge in the area from 46N to 58.5N (Figure 1).

2. To collect ovary and oocyte samples from adult fish, by trawling, for atresia and fecundity analysis back at MSS.

3. Successful retrieval of an acoustic mooring deployed in the Stanton Banks area as part of the INTERREG COMPASS project.

Narrative

This survey is a component part of the international triennial mackerel and horse mackerel egg survey (MEGS). The survey is divided into temporal sampling periods that together span the entire spawning season for NEA mackerel within the southern and western areas and also western horse mackerel. Within these periods individual surveys are allocated a geographic area to cover. Survey 0322H is the last survey within the scheduled 2022 programme and as such it was tasked with capturing and delineating the boundaries of any spawning taking place within this final period. Particular emphasis being placed on providing comprehensive

coverage of the Celtic Sea and Northern Biscay regions where the highest concentrations of horse mackerel spawning were expected to occur. Due to the large area to be sampled it was not possible to survey on every transect however the survey route was designed in order that all the unsampled transects within the survey footprint can then be filled using interpolated mean values from the adjacent observed sampled rectangles.

Altaire arrived in Ullapool at around 1100 on 4 July with MSS staff joining the vessel around midday. Loading of the container together with setting up of the samplers and also the scientific gear was straightforward and completed in good time and *Altaire* was able to depart from Ullapool at 1700. Subsequent to completion of two sets of calibration runs undertaken in Loch Broom, *Altaire* proceeded south and through the Minch and onto the first station west of Donegal at 54°45N 9°15W. Sampling commenced at 2030 on 5 July and from there *Altaire* continued west on the 54°45N transect and over the shelf edge before cutting back southeast to commence a long westerly transect at 54°15N 10°45W. The vessel skirted over the northern edge of the Porcupine Bank (see Figure 1) and as far west as 54°15N 14°45W before dropping down half a degree and returning back East on the 53°45N transect and over and onto Porcupine Bank before dropping down again at 12°45W. This pattern was repeated until finally at just after noon on 9 July and having completed the last station of the transect at 52°45N 12°45W *Altaire* headed SSE before completing a short easterly transect across the Porcupine Seabight at 51°45N before dropping down and surveying eastwards once more, past Fastnet Rock and along the southern coast of Ireland. It was on this long transect at 51°15N 08°45N that the first thermocline was encountered and with settled conditions continuing as *Altaire* surveyed south this pattern continued with the majority of the stations completed on the continental shelf within the Celtic Sea and Northern Biscay area (see Figure 1). Excellent progress was made with further transects completed between the 13-15 July along the edge and continental shelf west of the Brittany Coast with the transect at 48°15N becoming the southern survey boundary. Once completed *Altaire* then completed the 'missed' transects at 47°45N and 48°45N prior to heading into Falmouth during early evening on 17 July for the mid cruise break. *Altaire* departed 24 hours later and headed due west on the 49°45N transect as far as 10°45W. *Altaire* surveyed North from here interlacing with the transects completed during the outbound leg, firstly up and past the West of Ireland and then criss-crossing up and along the edge of the Hebridean shelf whilst taking a short detour to retrieve a COMPASS acoustic mooring located on Stanton Bank. The last station was completed NW of the Butt of Lewis at 52°45N 06°45W on the early evening of 25 July and from here *Altaire* set a course for Ullapool and was alongside by 0800 on 26 July. Unloading of all the scientific equipment including the sampling container and the wire was completed by midday on the same day. All scientific kit plus scientists were transported back to Aberdeen by late afternoon of the same day.

Health and Safety

General

All Scientific staff participating on survey 0322S that were new to the vessel were provided with a familiarisation tour highlighting the muster points and also locations of lifesaving equipment retained onboard. A pre-brief meeting with the scientific staff addressed several pertinent safety related issues including, (and despite relaxation of all Covid 19 related measures aboard) reiterating the continuing need for good hand washing hygiene as well as voluntary LFT testing to continue during the first week of the survey. The scientist in charge (SIC) continued with a brief outline of the forthcoming survey including outlining the survey objectives as well as details regarding protocols/shift times etc. Further to this new members of staff were taken through the appropriate task related SOP, risk and associated COSHH assessments aligned to the various tasks being undertaken as part of the survey. All staff were requested to provide a negative LFT test result for Covid-19 24 hours prior to the surveys departure.

Results

General survey synopsis and trawling

A total of 144 plankton stations (see Figure 1) and eight calibration stations were completed with the Gulf 7 plankton sampler. All samples were sorted for fish eggs during the survey with all the mackerel (*Scomber scombrus*), horse mackerel (*Trachurus trachurus*), hake (*Merluccius merluccius*) and ling (*Molva spp.*) eggs also being successfully identified and staged at sea. In addition all boarfish (*Capros aper*), pearlfish (*Maurolicus muelleri*) and also anchovy (*Engraulis encrasicolus*) eggs were identified and their abundance recorded during the survey. A total of 18389 eggs were sorted and analysed during the survey. Clogging (*meshes of sampler net becoming clogged during deployments)* of the Gulf sampler was observed on 49 occasions. This was almost double the number of instances being recorded during the same survey in 2019. The cause was a combination of gelatinous zooplankton (*salps*) which tend to be encountered in high volumes over deeper water and phytoplankton that were more often observed during the shallower deployments within the continental shelf areas. The majority of stations located over deeper water were affected and in particular around Porcupine Bank and Seabight, Goban Spur as well as those stations located on the slope west and southwest of Barra (see Figure 1). Instances of clogging are reported and the information retained and submitted to the survey coordinator as part of the results submission.

Real time depth and approximate temperature during each deployment were ascertained using SCANMAR depth and temperature units attached to the gulf sampler. An issue encountered with the conductivity sensor on the RBR Concerto[3] CTD resulted in no salinity data being available for 19 plankton stations during the survey. Calibrated flowmeters were used on the sampler to calculate the volume filtered during each deployment. This is an essential component in calculating the density of eggs in the water column. All egg densities reported in all figures have been standardised to numbers recorded per metre squared (m^2). Sampling and processing of samples was undertaken in accordance with the protocols and procedures as described in the MEGS Sampling at Sea manual, SISP 6, V2.3.

The relatively warm, calm and settled conditions experienced during much of the survey resulted in thermoclines being detected within the water column on 38 occasions and within the Celtic Sea and Northern Biscay areas on the continental shelf (see Figure 1). When thermoclines were observed (defined as a temperature change of 2.5°C or greater over a 10 m depth range) the sampler was only required to descend to a depth of 20 metres beneath the recorded base of the thermocline. Stratification ensures that the eggs are kept within the warm surface layers and therefore provides a significant time saving with deployment times typically cut in half on affected stations.

The vessels own pelagic midwater trawl was deployed on eight occasions in order to obtain samples of horse mackerel and mackerel for fecundity analysis. Trawling was generally completed at night and deployed either on or near to the bottom and with a typical duration of 30 minutes. The trawl locations were evenly spread throughout the survey area and often targeted locations where during the previous survey period trawl and plankton deployments had successfully yielded spawning adults or eggs. All eight trawl deployments were successful in catching either or both target species (see Figure 2).

Egg Survey Results

Mackerel (*Scomber scombrus*)

A total of 449 mackerel eggs were analysed and staged during survey 0322H. Of these, 213 were identified as freshly spawned Stage 1 (M1) eggs. Mackerel eggs were encountered in only around 26 percent of the surveyed stations and that drops to less than 20 percent when relating to freshly spawned Stage 1 eggs. Densities of observed mackerel eggs were generally low although several stations provided slightly elevated abundances and they were located around the northwest of Ireland and on the shelf edge to the southwest of Ireland. Boundaries were very well defined as any spawning was contained within the continental shelf. See Figures 3 and 4 for plots of mackerel eggs (all stages plus Stage 1 respectively/m2) recorded during survey.

Horse mackerel (*T. trachurus*)

A total of 1436 horse mackerel eggs were analysed and staged during survey 0322H. Of these, 692 were identified as freshly spawned Stage 1 (H1) eggs. Horse mackerel eggs were present in 43 percent of all the surveyed stations with prevalence dropping to 34 percent when only H1 eggs were included. Densities of observed horse mackerel were generally low to moderate with some notable spawning hotspots located off the SW of Ireland and also on the shelf edge West of Brest. Virtually no horse mackerel spawning was observed north of 55°N. This represented a decrease on results reported from this survey in 2019 within the same period and geographic area. See Figures 5 and 6 for plots of horse mackerel eggs (all stages plus Stage 1 respectively/m2) recorded during survey.

Hake (*M merluccius*) and Ling (*Molva spp.*)

68 hake eggs were recorded and staged during the survey and from 21 stations across the survey area. Majority of these were observed on stations located West of Ireland. See Figure 7 for plot of hake eggs. Eight ling eggs in total were recorded and staged from across three plankton stations during this survey.

Selected Other Species recorded

Others

Several other species of fish eggs were identified and their abundance recorded during survey 0322H. Pearlside (*Maurolicus muelleri)* were recorded at low densities over many of the northern slope stations (see Figure 8) and unsurprisingly the highest densities were located over deepwater and within the continental slope area North of Porcupine Bank and into the Rockall Trough. Anchovy eggs (*E. encrasicolus*) were encountered at moderate to high densities across many of the continental shelf stations located within the Celtic Sea and Northern Biscay component of the survey area with the highest densities being recorded in the shallower stations West of Brest (see Figure 9). Boarfish *(Capros aper)* were by some margin the most prevalent species encountered during the survey with moderate to high densities being observed across the full length and breadth of the survey footprint (see Figure 10).

Adult sampling- results

Mackerel

Mackerel were caught in five of the trawl deployments (from total of eight) undertaken during 0322H for a total catch weight of 77 kgs. From this 155 mackerel were sampled for length, total weight, sex, maturity and age. From these, 21 mackerel were selected for fecundity/atresia sampling. The fish sampled ranged in length from between 28-41 cm with a mean length of 34 cm and an average whole weight of 323 grams. This translated into an age profile that spanned ages 1-12 but where younger cohorts in the age range 2-4 were most prevalent. Of the fish sampled almost 15% were found to be maturity Stage 4 (*spawning*) whilst over 50% were Stage 5 (*partially spent*) and with almost 20% at Stage 6 *(spent/recovering).*

Horse mackerel

Horse mackerel were caught in all eight of the trawl deployments undertaken during 0322H for a total catchweight of 519 kgs. From this 517 horse mackerel that were sampled for length, total weight, sex, maturity and with otoliths also being retained for ageing at a later date. From within this number 191 fish were selected for batch fecundity/atresia sampling. The fish sampled ranged in length from between 28-41 cm with a mean length of 32 cm and an average whole weight of 248 grams. Of those sampled almost 38% were found to be maturity Stage 3 (*pre-spawning*) whilst over 20% were Stage 4 (*spawning*) and 31% found to be at Stage 5 *(post-spawning).*

The fecundity and atresia samples collected from both species will be divided up and sent to several partner institutes involved in the MEGS survey programme (including MSS) for analysis that will be used to generate an estimate of potential fecundity as well as prevalence of atresia, both of which are integral in the creation of the spawning stock biomass estimate that is generated for NEA mackerel. Work is continuing on developing a similar process for western horse mackerel using the daily egg production method (DEPM). Figures 11-17 provide a breakdown of length, sex and maturity statistics for both species by haul as well as age for mackerel.

Marine Mammal and other notable sightings as recorded during the survey

A log of marine mammal sightings as well as other notable species was kept during the survey. The calm and generally settled weather experienced on the survey enabled sightings of several unusual species such as ocean sunfish *(Mola mola)* as well as a Portuguese man o' war *(Physalia physalis)*. All recorded sightings below are arranged according to date and also referenced according to gulf sampler station number from where location can then be traced using stations plotted in Figure 1.

8/7 – common dolphins spotted whilst deploying gulf sampler at station 28 located E of the Porcupine Bank
9/7 - 2 sunfish spotted at start of deployment and then minke whale sighting just after retrieval of sampler at station 36 and just S of Porcupine Bank
11/7 – common dolphin spotted during gulf deployment at station 57
12/7 – common dolphins spotted several times jumping clear between station 64 and 65 and also sunfish spotted just after retrieval of sampler at station 65
13/7 – Portuguese man 'o' war spotted in between gulf stations 70 and 71
14/7 – Small pod of pilot whales spotted at station 78 on deepwater edge W of Brest
19/7 – probable blue shark spotted at night drawn in by lights during retrieval of gulf at station 103, approx. 15nm W of Isles of Scilly
21/7 – small pod of 8 white sided dolphins, and a sunfish spotted prior to deployment at station 121, pod of 20 striped dolphin spotted just prior to retrieval that came in close so good ID
Station 129 – likely bait ball situation suspected as numerous minke whales as well as large number of common dolphins and 3 humpback whales all feeding within same area W of Skelligs
22/7 - 30 common dolphins spotted with several bow riding enroute to station 135 and West of County Mayo
23/7 – 3 pilot whales spotted prior to deploying the gulf sampler at station 139 on the deep edge northwest of Donegal
24/7 – minke whale spotted whilst deploying gulf sampler on station 151

Conclusions/Discussion

The survey was extremely successful in capturing the spawning activity for both mackerel and horse mackerel. These were wholly contained within the continental shelf and shelf edge and as a result the spawning boundaries for both species were extremely well defined with zeros being found on almost all of the margins surveyed. The results for the target species were generally as expected with the mackerel spawning season all but finished with only very low densities being observed during the survey. Significantly less horse mackerel eggs recorded during the Period 7 survey in 2022 compared with the same survey in 2019 and despite much more sampling effort focussed on the core horse mackerel spawning area this time round. With over a 100% increase in the overall numbers of adult fish sampled (compared to same survey in 2019), together with a threefold increase in the fish sampled for fecundity analysis it is also safe to conclude that with regards to the adult sampling perspective survey 0322H was also an overwhelming success. It is important to note that taken in isolation the results from each individual survey provides very little by way of any indication of the overall stock situation for either species. This will only become clear once the full and final results from this as well as the other egg surveys are collated and uploaded into the ICES egg and larval database. Egg production results from this and the other MEGS survey contribute to and will be incorporated into the spawning stock biomass (SSB) estimate for NEA mackerel and annual egg production (AEP) index for western horse mackerel. The provisional estimates were delivered in-year during August 2022 to the Working Group on Widely Distributed Stocks (WGWIDE) with the definitive estimates being presented to the Working Group of mackerel and horse mackerel egg surveys (WGMEGS) in April 2023.

Many thanks to the master and crew of the MFV Altaire for all their help and support during what was an extremely successful but also immensely enjoyable survey.

Submitted: Finlay Burns/Hannah Holah, 9 January2023
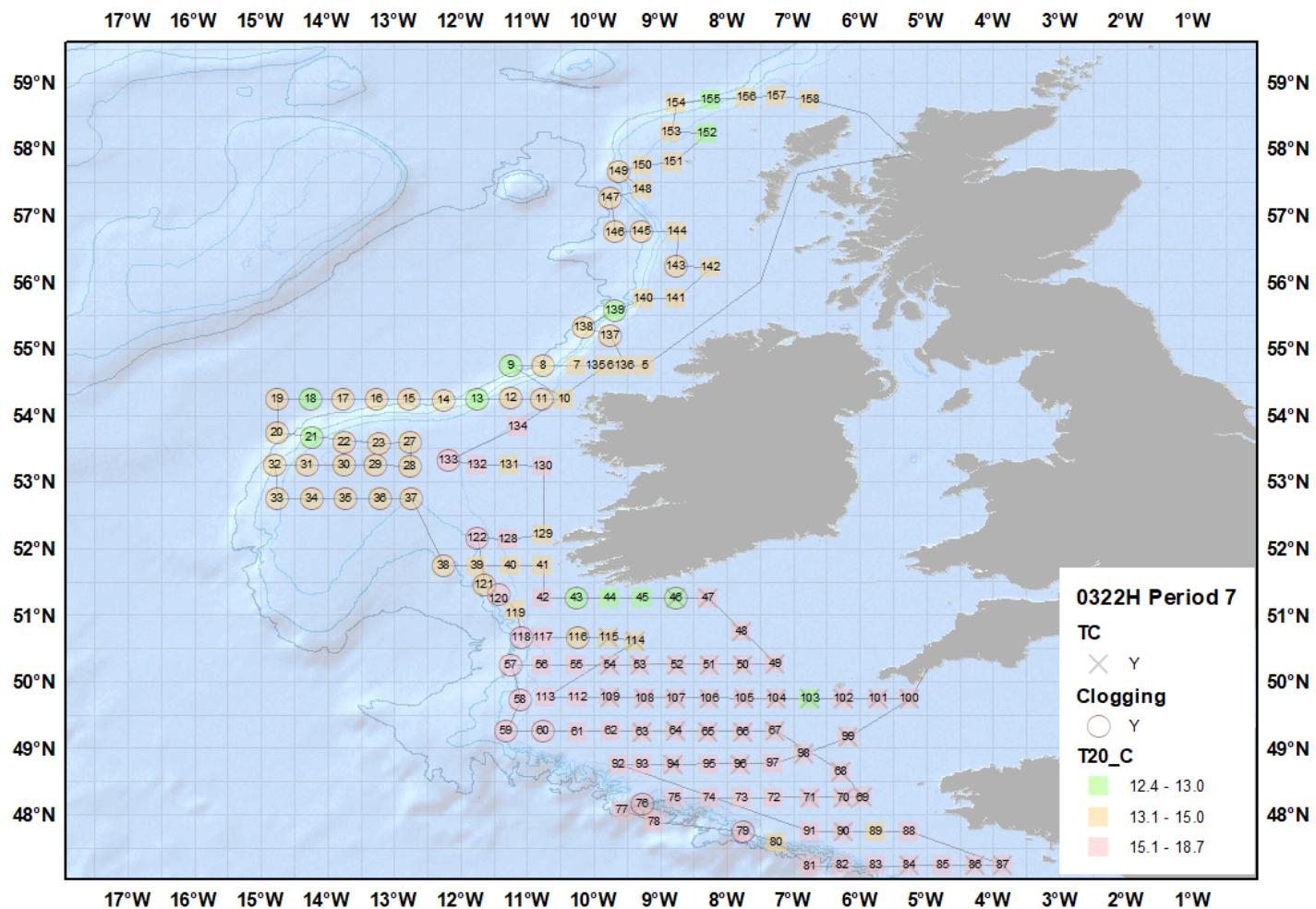
Figure 1: 0322H Map displaying the vessel survey track and Gulf 7 deployment station numbers as well as their clogging and thermocline status(TC). Also included is the temperature profile in Celsius for all plankton stations at 20 m depth. The 200, 500, 1000 and 2000 m isobaths are displayed for reference.
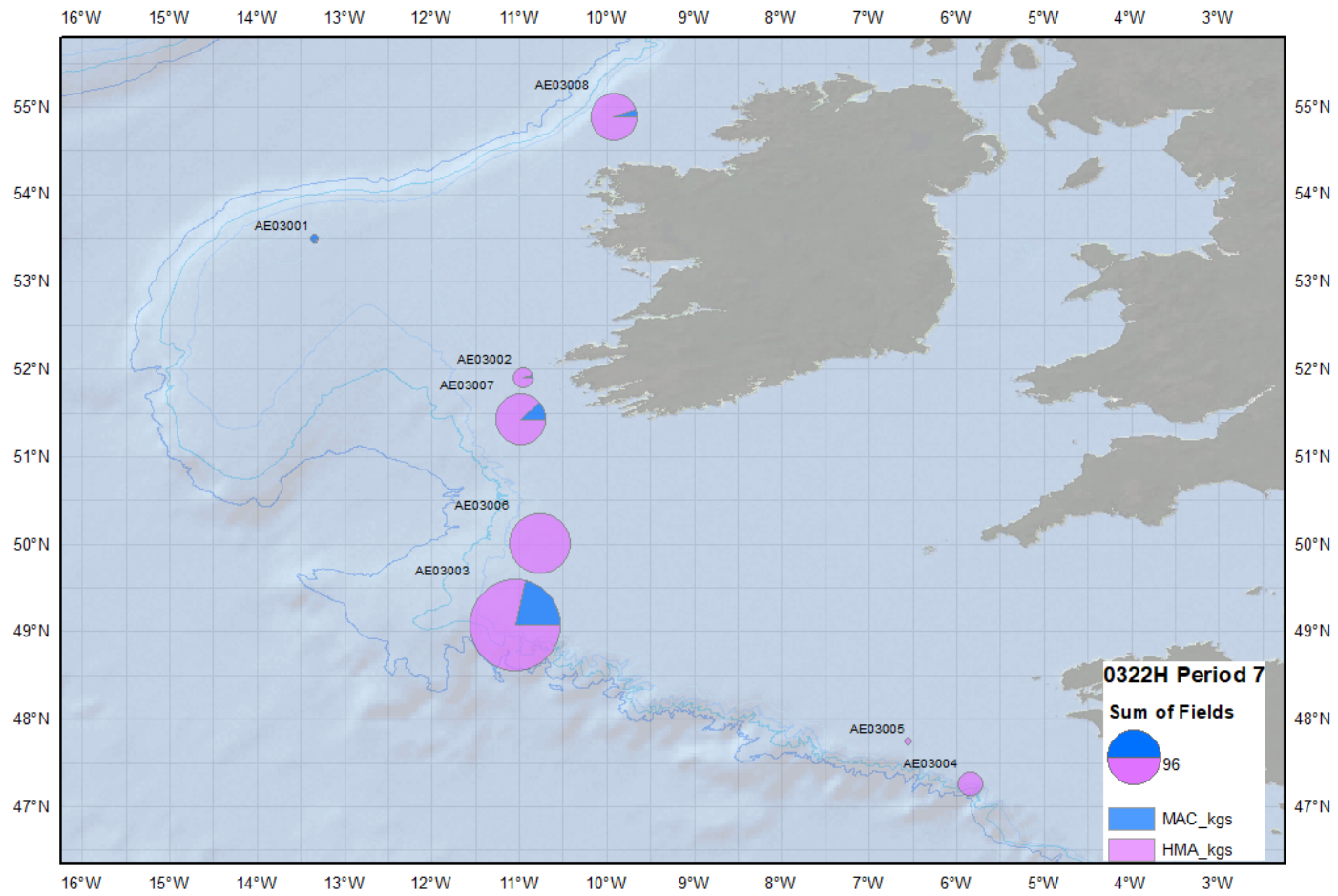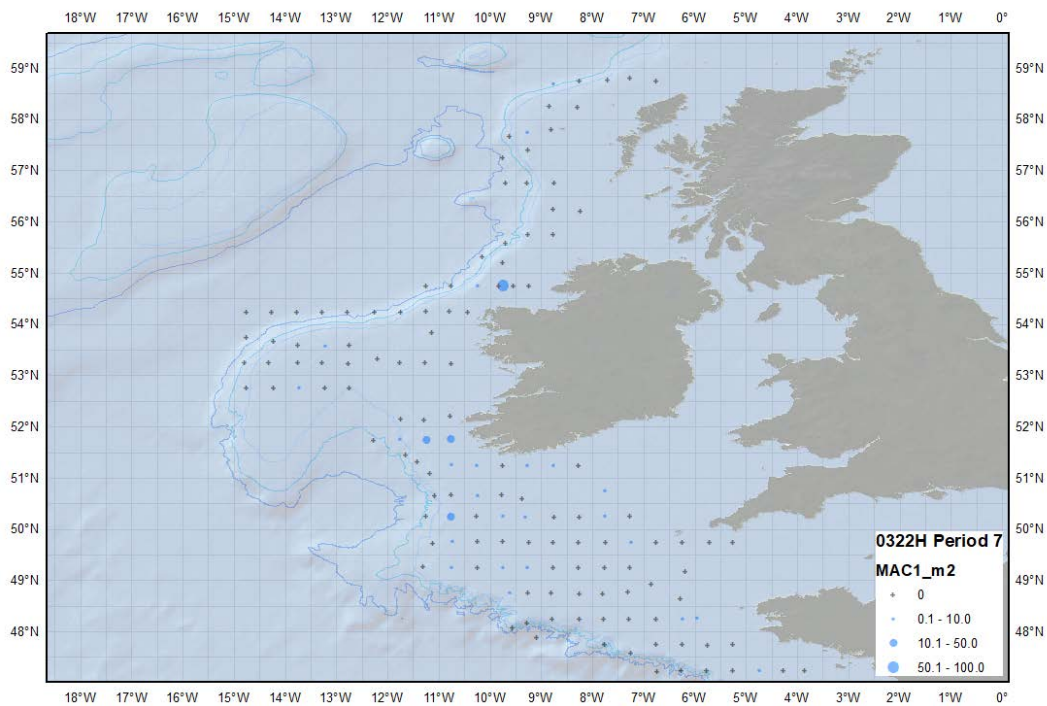
Figure 2: 0322H trawl stations - pie charts present catch weights of adult mackerel and horse mackerel. Plots are scaled relative to combined weight in kilograms of both species.
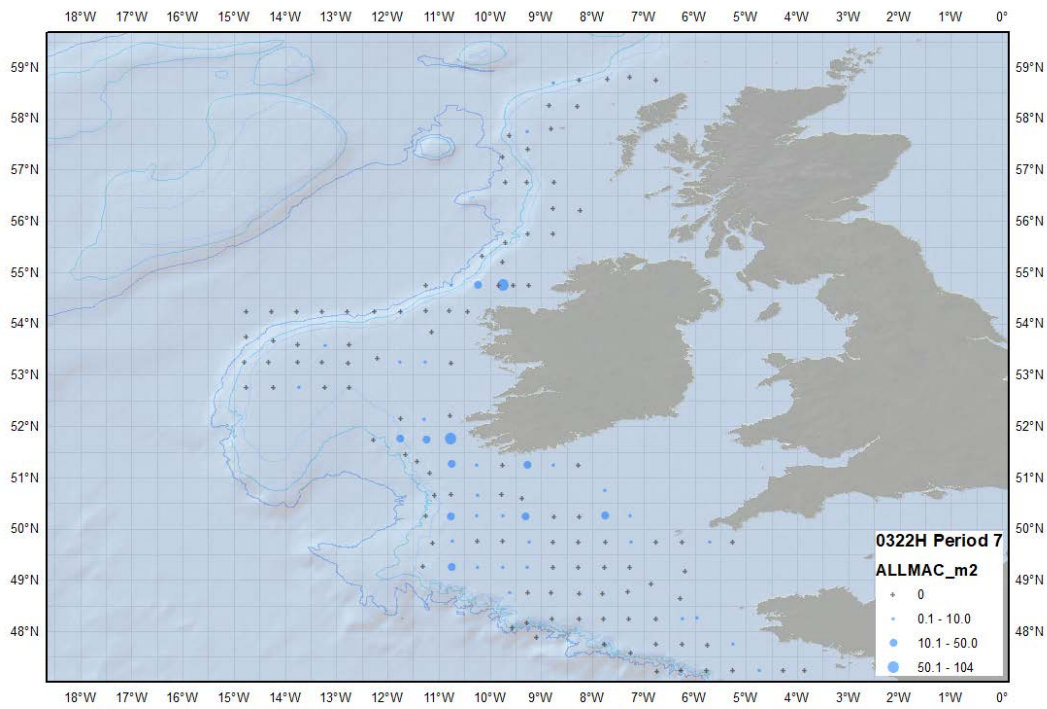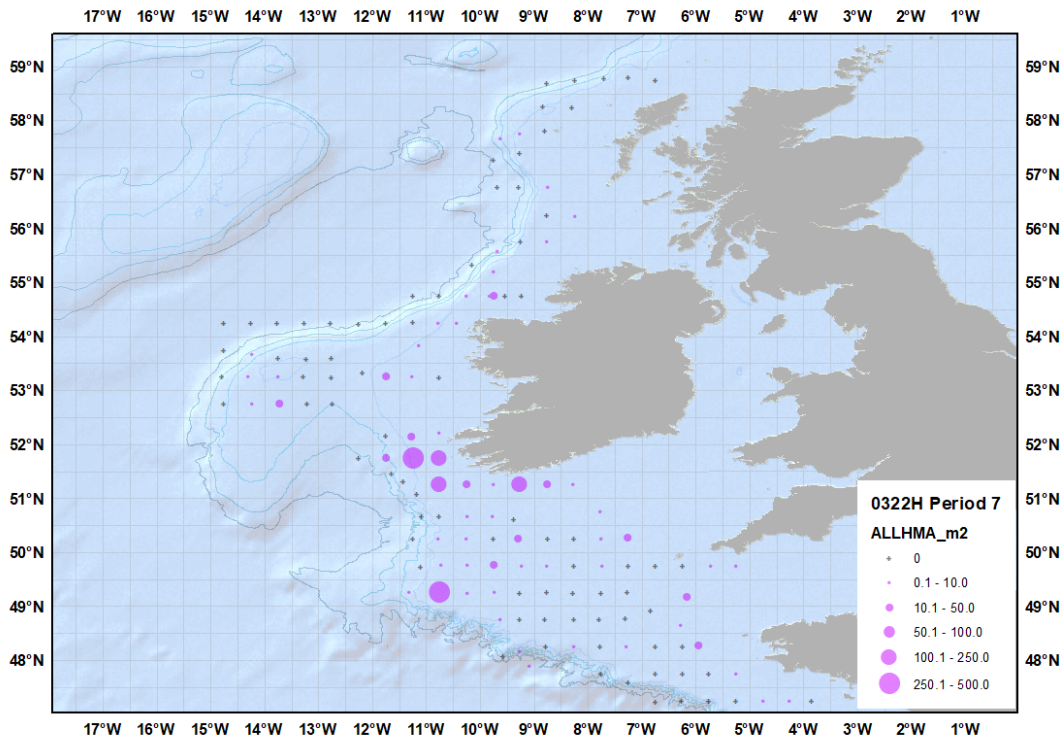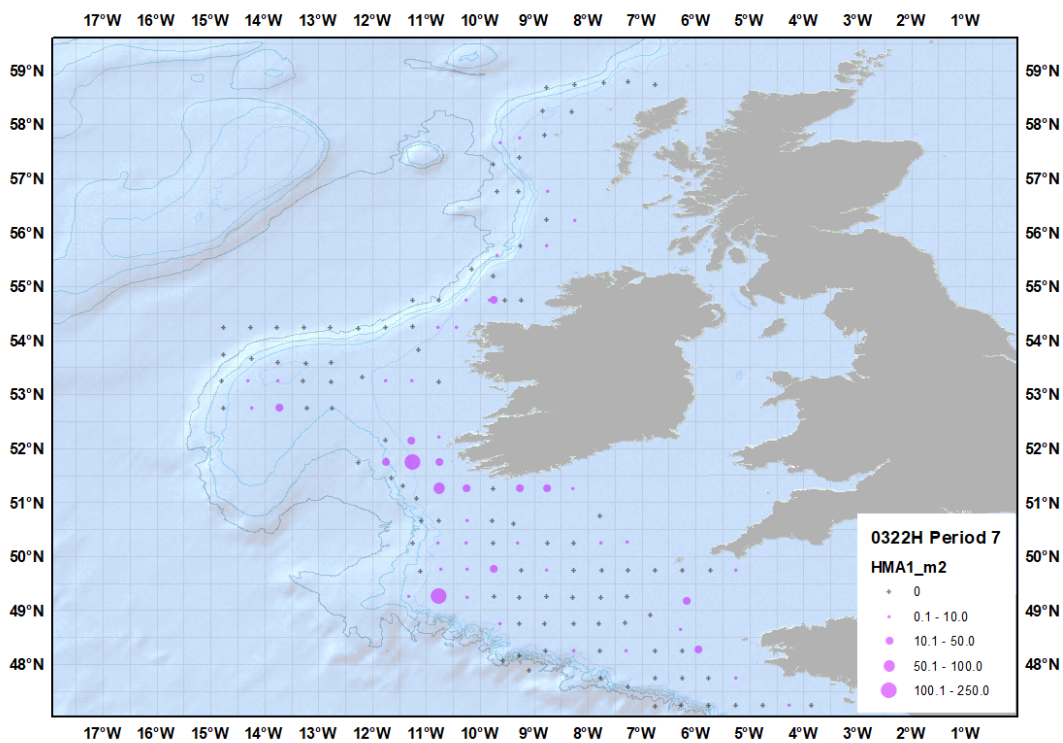
Figure 3: 0322H Map displaying bubble plot for all stages of mackerel egg per m^2 for each station**.**

Figure 4: 0322H Map displaying bubble plot for Stage 1 (M1) mackerel eggs per m^2 for each station**.**

Figure 5: 0322H Map displaying bubble plot for all stages of horse mackerel egg per m^2 for each station.
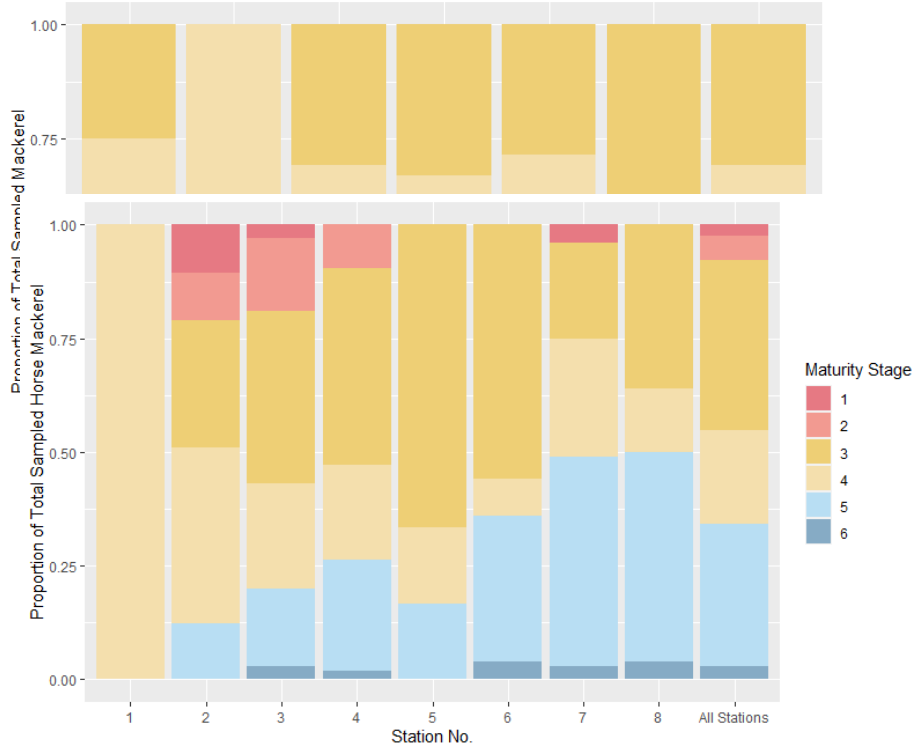

Figure 6: 0322H Map displaying bubble plot for Stage 1 (HMA1) horse mackerel eggs per m^2 for each station.
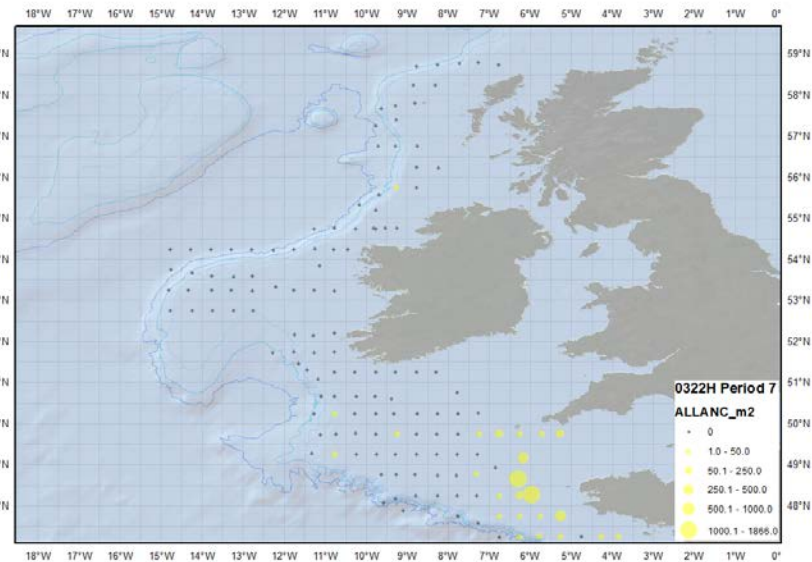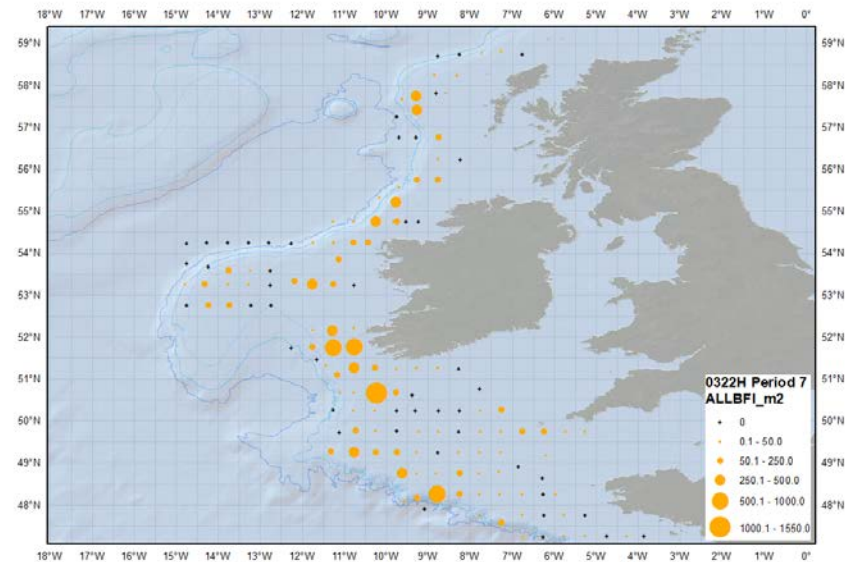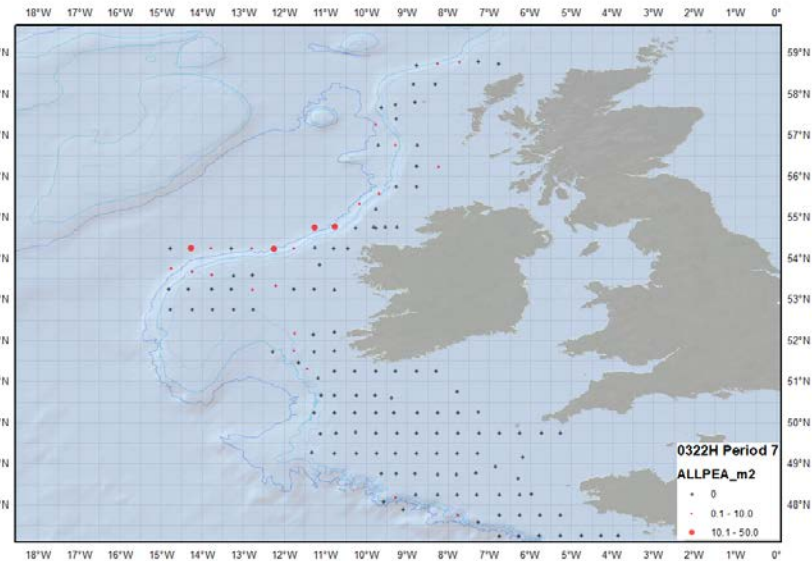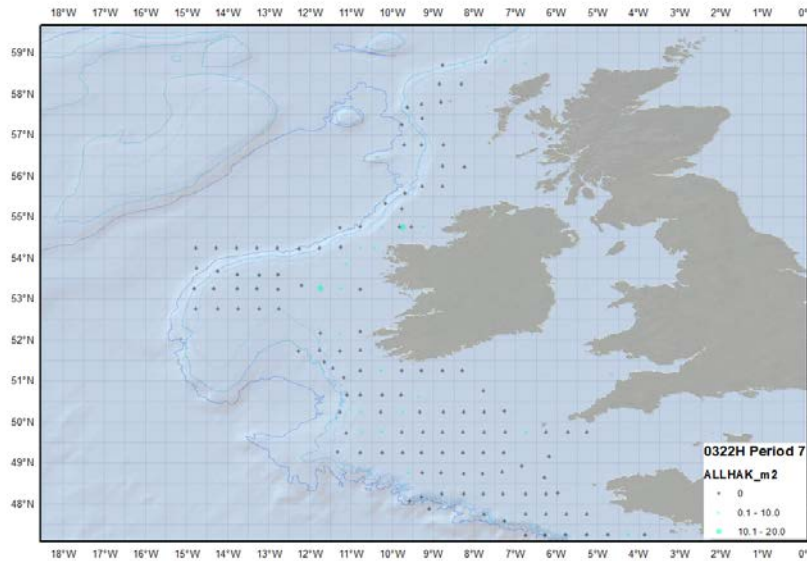
Figures 7-10: Clockwise from top left, 0322H Map displaying abundance bubble plots (all stages) of hake (HAK), pearlside (PEA), anchovy (ANC) and boarfish (BFI) eggs per m² for each station.
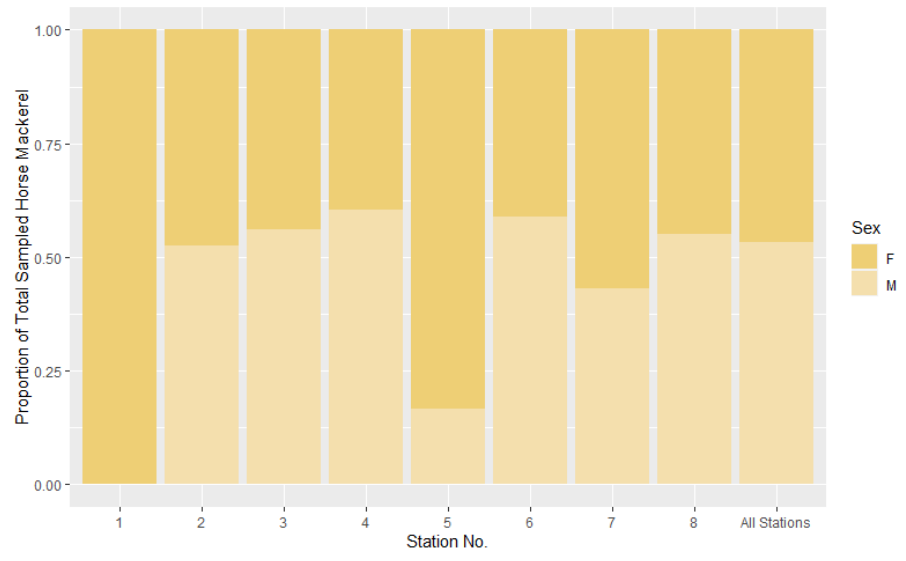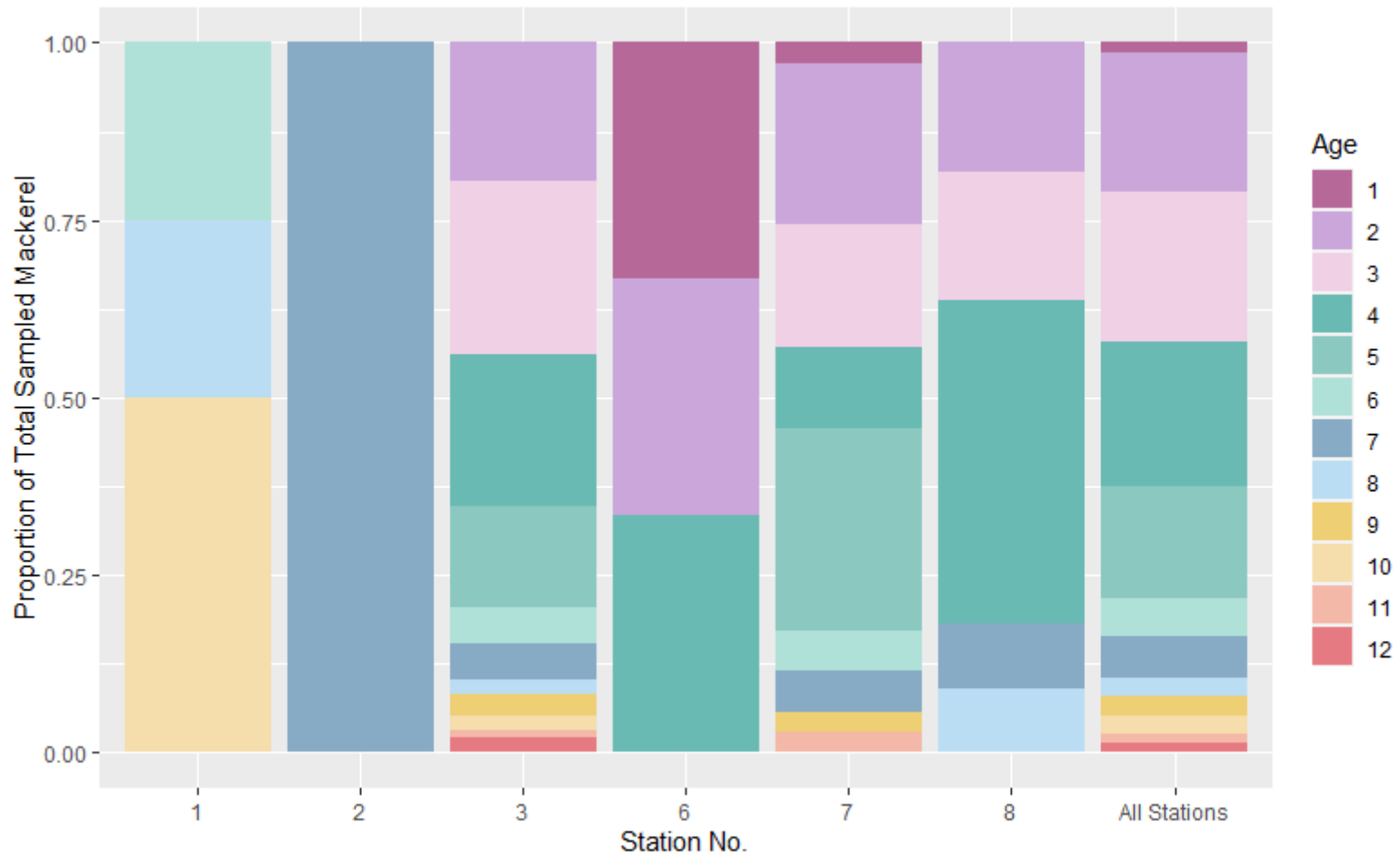
Figures 11-12: Bar charts showing the proportion of female and male horse mackerel (left) and mackerel (right) sampled in each station. An additional column is provided showing the proportions of female and male fish sampled across all stations for each species.
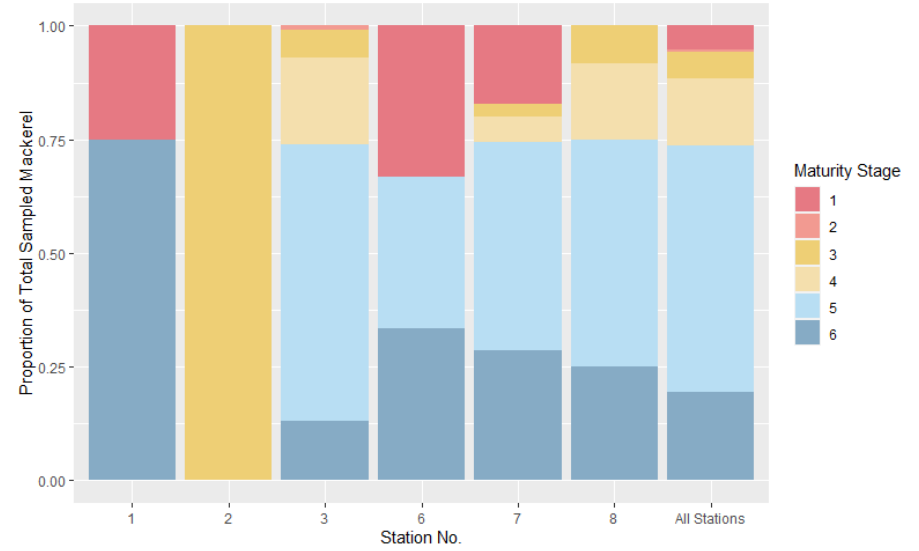
Figures 13-14: Bar charts showing the proportion of horse mackerel (left) and mackerel (right) of each maturity stage (Walsh maturity stages) sampled in each station. An additional column is provided showing the proportions by maturity stage of fish sampled across all stations for each species.

Figure 15: Bar chart showing the proportion of mackerel sampled in each station by age. An additional column is provided showing the proportions by age across all stations.
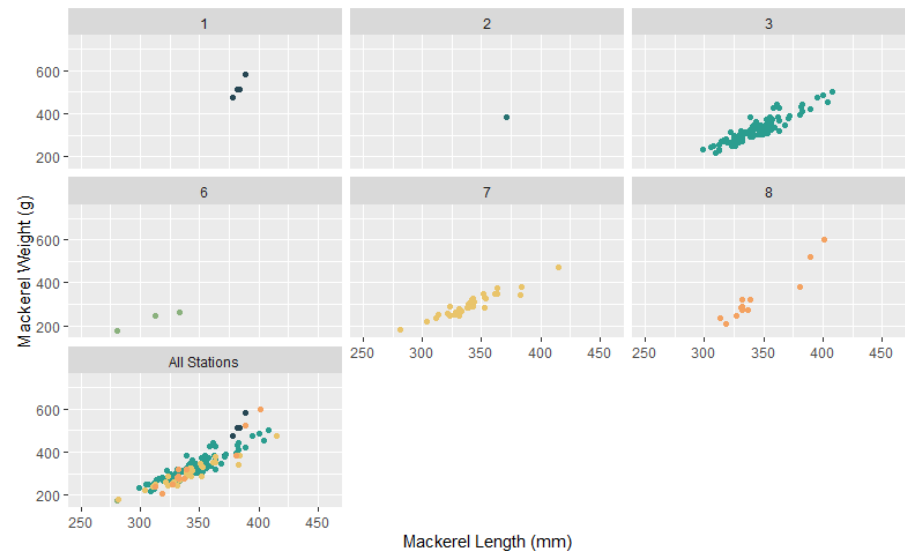
Figures 16-17: Plots showing the length-weight ratios of horse mackerel (left) and mackerel (right) sampled in each station. An additional plot is provided showing the length-weight ratios across all stations.