**An Bord Achomharc Um Cheadúnais Dobharshaothraithe**
**Aquaculture Licences Appeals Board**

CEO Bord Iascaigh Mhara
Crofton Road
Dun Laoghaire
Co Dublin

16 April 2021

Our Refs: AP12/2019. AP13/2019, AP14/2019, AP15/2019, AP16/2019, AP17/2019 and AP18/2019
Site Refs: T06/364A, T06/35A, T06/106, T06/254A, T06/495A, T06/513A and T06/360A

**Re: Appeals against the decisions of the Minister for Agriculture, Food and the Marine to refuse to grant Aquaculture and Foreshore Licences for the cultivation of mussels using longlines on the foreshore on the above Site references, Kilmakilloge harbour, Co. Kerry.**

Dear CEO

I refer to Appeals received by Aquaculture Licences Appeals Board (**Board)** against the decisions of the Minister for Agriculture, Food and the Marine (**the Minister**) being Appeal References AP12/2019, AP13/2019, AP14/2019, AP15/2019, AP16/2019, AP17/2019 and AP18/2019 (**Appeals**) accessible via the following link:

http://alab.ie/boarddeterminations/2019/

Pursuant to Section 47(1)(a) of the Fisheries (Amendment) Act, 1997, as amended, ("the Act"), where the Board is of the opinion that any document, particulars or other information is or are necessary for the purposes of enabling the Board determine the Appeal, it may serve a notice on a party requiring that party to submit to the Board such documents, particulars or other information as are specified in the Notice.

Having considered the appeals and the information provided to it, the Board has determined that further documents are necessary for the purposes of enabling the Board determine the Appeals.

As part of its consideration of the Appeals the Board is seeking the most up to date information available in relation to the productivity and water flow regime of Kilmakilloge Harbour for the cultivation of mussels on longlines. To assist the Board in this regard the Board seeks following:

1) Details of the overall production volumes of mussels from Kilmakilloge Harbour for the past 10 years;
2) Details of the tonnages of mussels harvested by from individual sites (and not just the sites under appeal) within Kilmakilloge Harbour for the past 10 years;
3) Any reports compiled on productivity or water flow regimes in Kilmakilloge Harbour by or on behalf of, or available to, BIM;
4) Any additional information on the food resource, productivity and any modelling carried out relating to Kilmakilloge Harbour by or on behalf of, or available to, BIM.

5) Any other information which BIM believe is relevant to the licencing and good management of aquaculture at Kilmakilloge Harbour of an economic, environmental, ecological or societal nature.

In accordance with section 47 (1) (a) of the Act, the Board requires this information within **30 days** of receipt of this letter. Please note that if the documents, particulars or other information specified above are not received before the expiration of the period specified above, or such later period as may be agreed by the Board, the Board will, without further reference to you, determine the appeal.

Please also note that a person who refuses or fails to comply with a requirement under section 47 (1)(a) shall be guilty of an offence.

Yours sincerely

Mary O'Hara

Mary O'Hara
Secretary to the Board

# Addendum Report
# to the original draft
# Kilmakilloge Harbour 2017
# Report

**Date: 04.07.19**

**Report By:**

**Dr. Gary R. McCoy & Dr. Terence O'Carroll**

**Bord Iascaigh Mhara,**

**Crofton Road,**

**Dun Laoghaire,**

**Co. Dublin,**

**A96 E5A0**

**Additional Kilmakilloge Harbour Information**

On the 31st October 2018, BIM was made aware by DAFM that three aquaculture licence applications [redacted] which were not included in the original list for the Kilmakilloge Harbour 2017 carrying capacity study. According to the licence applications these sites were all applied for before or on the 18/04/95, except for two new applications [redacted] (Table 1). These applications have been reviewed and BIMs recommendations are drafted in this addendum report to the original Kilmakilloge Harbour 2017 Report.

In the Kilmakilloge Harbour 2017 report several recommendations on application and renewal licences were based on the historical, environmental and survey data carried out. The recommendations for the applications listed in Table 1 below are also based on this same information.

The applications listed in Table 1 are highlighted in orange in Figure 1 and 2 below, giving their intended locations in the Harbour. Three application sites [redacted] and [redacted] were applied for before or on the 18/04/95 and are additional sites which were not previously included in Figure 3, in the original Kilmakilloge Hr. 2017 Report (see, original Kilmakilloge Hr. 2017 Report). All five applications sites [redacted] listed in Table 1 were also not previously included in Figure 4, 5, 16,18a, 18b, and 18c of the original Kilmakilloge Hr. 2017 Report.

Additionally, in Appendix A, Table A3 of the original Kilmakilloge Hr. 2017 Report, the total hectares of new mussel longlines applications were 32 hectares (see, original Kilmakilloge Harbour 2017 Report, Appendix A, Table A3). With the addition of the new mussel longlines applications from Table 1 above, the total new application hectares are now 51.66.

In Appendix A, Table A7 of the original Kilmakilloge Hr. 2017 Report, indicated that 14 hectares were recommended to be granted from the new application mussel longline sites out of a total of 32 hectares originally applied for (see, original Kilmakilloge Hr. 2017 Report, Appendix A, Table A7).

It is still the case that BIM recommends 14 hectares could be potentially granted from the new application mussel longline sites out of a total of 51.66 hectares as per the evidence gathered in the original Kilmakilloge Harbour 2017 Report (Table 2 & 3).

**Table 1.** Three applications previously not included on the Kilmakilloge report list [redacted] with additional new applications [redacted] Applicant and site reference, Co-ordinates (Irish National Grid), size of site and date applied are recorded.

| Applicant | Site ref. | Date (Originally submitted) | Date (Replace original) | Co-ordinates (meters) | Co-ordinates (meters) | Site size (hectares) |
|---|---|---|---|---|---|---|
| [redacted] | [redacted] | 05/11/91 | 09/05/18 | 75,500.000 | 59,250.000 | 6 |
| | | | | 75,700.000 | 59,200.000 | |
| | | | | 75,700.000 | 59,100.000 | |
| | | | | 75,650.000 | 58,900.000 | |
| | | | | 75,500.000 | 58,900.000 | |
| [redacted] | [redacted] | 24/05/92 | 14/05/18 | 74,900.000 | 59,200.000 | 3 |
| | | | | 75,200.000 | 59,200.000 | |
| | | | | 75,200.000 | 59,100.000 | |
| | | | | 74,900.000 | 59,100.000 | |
| [redacted] | [redacted] | 18/04/95 | 08/05/18 | 74,100.000 | 59,100.000 | 2 |
| | | | | 74,300.000 | 59,100.000 | |
| | | | | 74,300.000 | 59,000.000 | |
| | | | | 74,100.000 | 59,000.000 | |
| [redacted] | [redacted] | 08.05.18 | 29.05.18 | 73,320.000 | 59,900.000 | 2.5 |
| | | | | 73,400.000 | 59,900.000 | |
| | | | | 73,500.000 | 59,800.000 | |
| | | | | 73,200.000 | 59,800.000 | |
| [redacted] | [redacted] | 14.05.18 | 29.05.18 | 74,225.000 | 59,600.000 | 6.16 |
| | | | | 74,445.000 | 59,560.000 | |
| | | | | 74,445.000 | 59,300.000 | |
| | | | | 74,225.000 | 59,300.000 | |
| **Total Hectares** | | | | | | **19.66** |

**Table 2.** Recommended hectares to be granted for the new application mussel longline sites. (Note: amended from original Kilmakilloge Harbour 2017 Report, Appendix A, Table A7).

| Type | Mussel | Mussel | Mussel | Mussel | Mussel | Mussel | Mussel | Mussel | Mussel | Total Hectares (Mussel longline sites) |
|---|---|---|---|---|---|---|---|---|---|---|
| Operator | [redacted] | | | | | | | | | |
| Status | Application | Application | Application | Application | Application | Application | Application | Application | Application | |
| Licence Ref. | [redacted] | | | | | | | | | |
| Originally | New | New | [redacted] | | | | | | | |
| [redacted] | | | | | | | | | | |
| [redacted] | | | | | | | | | | |

**Table 3.** Recommended hectares to be granted for the new application mussel longline sites as per Table 1.

| Type | Mussel | Mussel | Mussel | Mussel | Mussel | Total Hectares (Mussel longline sites) |
|---|---|---|---|---|---|---|
| Operator | [redacted] | | | | | |
| Status | | | | | | |
| Licence Ref. | | | | | | |
| Originally | | | | | | |
| [redacted] | | | | | | |
| [redacted] | | | | | | |

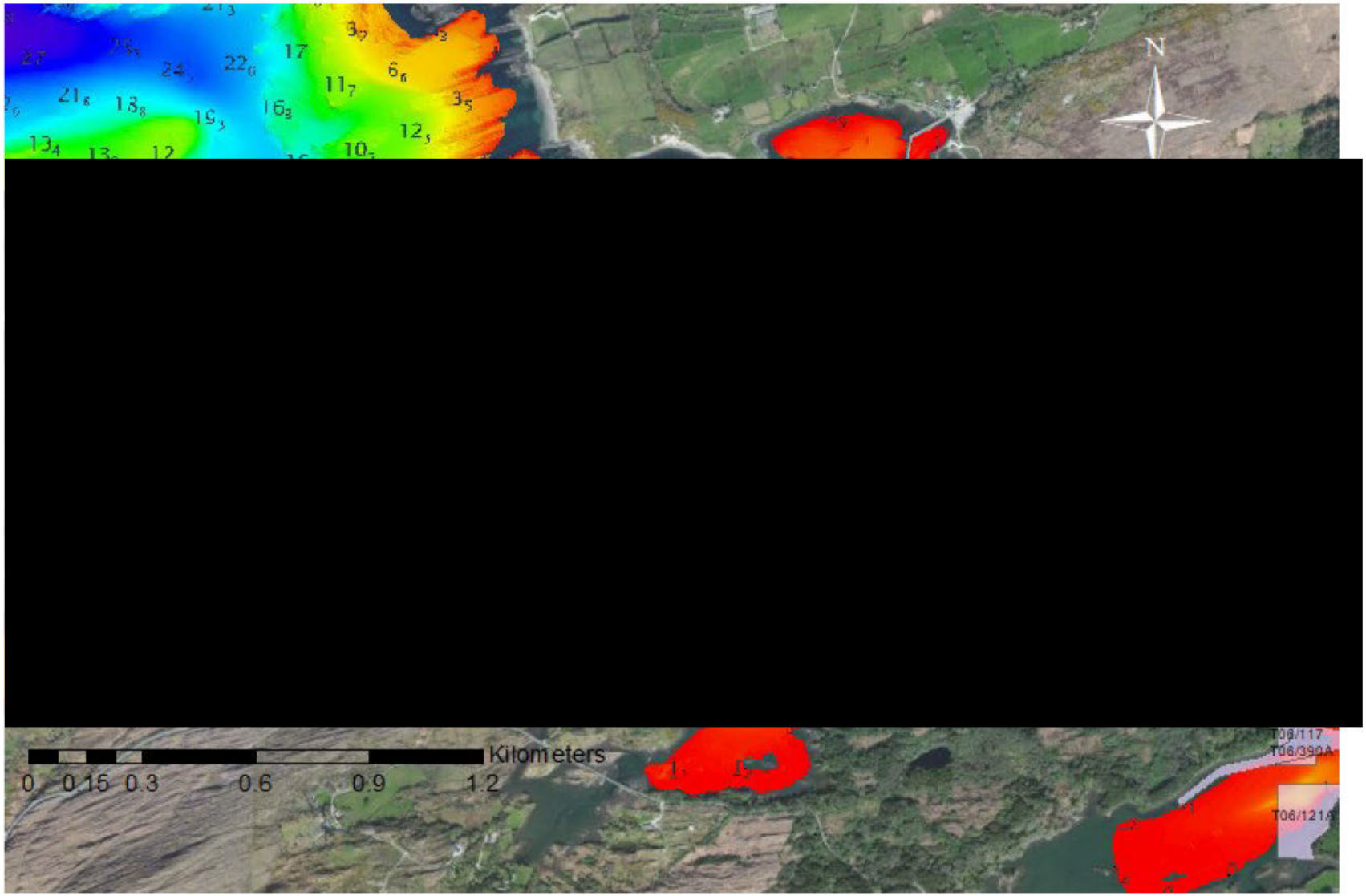


**Figure 1.** Additional site applications made by [redacted] highlighted in orange of sites [redacted] (2.5 hectares) and [redacted] (6.16 hectares) T[redacted] (2 hectares), [redacted] (3 hectares) and [redacted] hectares). BIM were not originally made aware of these applications for the Kilmakilloge Harbour 2017 report. Longlines highlighted in green were from a November 2016 survey.

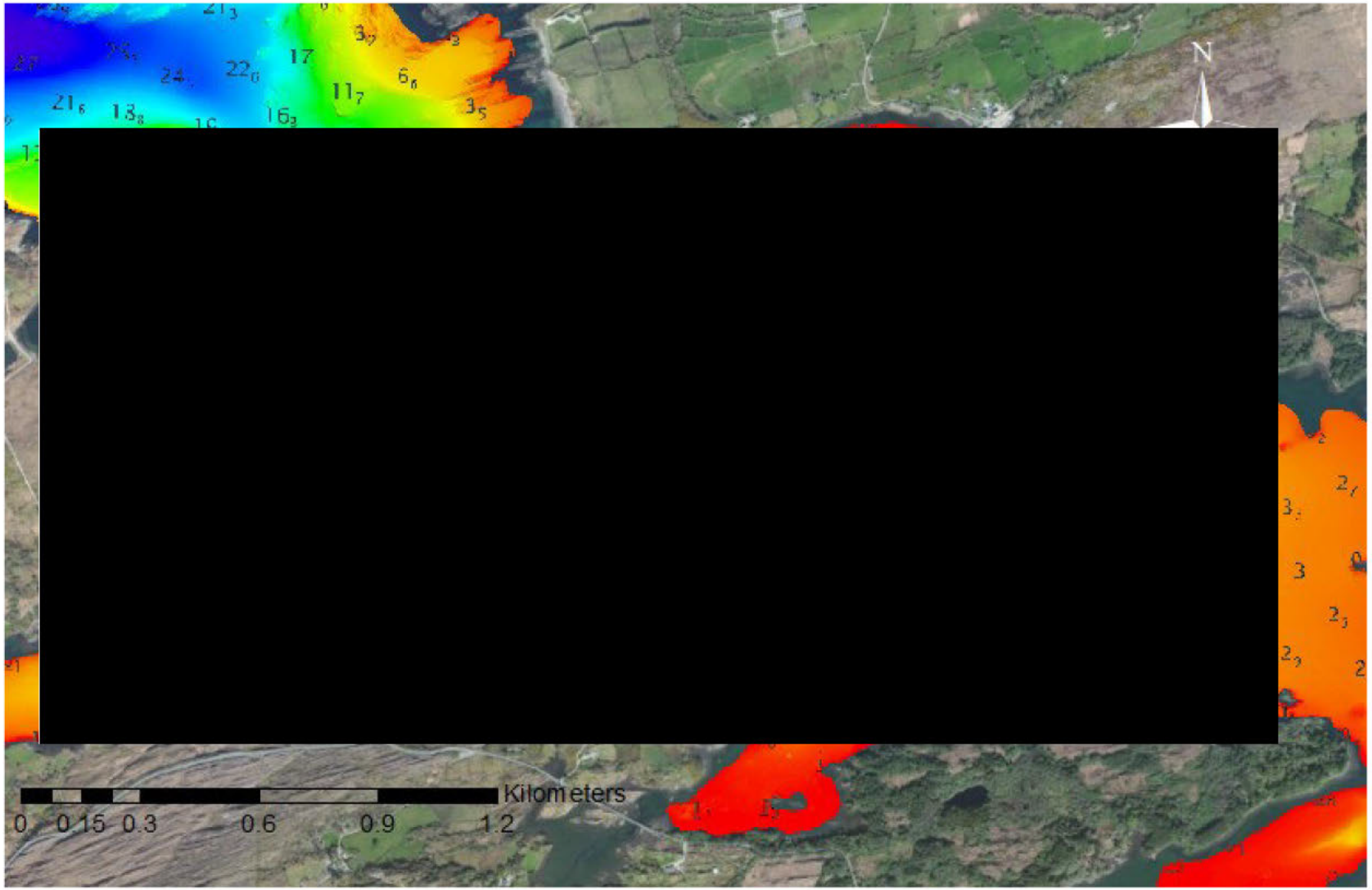


**Figure 2.** Additional site applications made by Shamrock Shellfish highlighted in orange with the recommended re-drawn existing sites (purple) with extra anchorage (blue) for mussel longline applications and licences (Kilmakilloge Report 2017). Longlines highlighted in green were from a November 2016 survey.

**Recommendations:**

- Application [redacted] could negatively impact and impede food availability to existing [redacted] (Table 1 and Figure 1 & 2). Due to the east/west current flow in the harbour this application could further negatively impact on remaining active sites, particularly [redacted] Further impediment due to its location would occur due to blocking of access to and anchorage location south of Eskadawer Point.
- [redacted] South of existing sites [redacted] and directly east of the [redacted] could negatively impact and impede water flow east/west of the mentioned sites and inadvertently application [redacted] would sub-sequentially be negatively impacted from the existing active mussel longline sites (Figure 1 & 2).
- [redacted] Currents are relatively stronger in this area of the bay. However, to prevent potential negative impacts east and west of the site, [redacted], anything above this could potentially cause significant effect on the existing longlines operating in the area. BIM originally recommended a [redacted] the same will apply for the preceding application [redacted] in the same location (Figure 1 & 2).
- [redacted] BIM have recommended application [redacted] as having no significant impact on existing sites in the Harbour. However, [redacted] have a potential negative impact on the application [redacted] it is in a more exposed location.
- Site application [redacted] potentially cause negative impact on existing sites [redacted] and site [redacted] does not recommend this [redacted] application. Bathometry data also show [redacted] (Figure 1 & 2).

# Kilmakilloge Harbour Study

# 2017

## Appendix A

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## 1. Surveys Carried Out

**November 22nd – 24th 2016:** Mussel Biomass Survey in Kilmackillogue Harbour. There were a total of six participants taking part in the sampling survey which included Ben Dallaghan, David Millard, Pete Donlon, Mary Hannan, Patricia Daly and Gary McCoy.

Kilmakilloge Harbour

**December:** Returned to Castletownbere and finished analysing the mussel samples for measurements and meat yield which has been completed for samples taken from each mussel farmer's site back in November 2016.

**February 15th -16th 2017:** Successfully deployed a total of six STAR ODDI temperature and salinity loggers in Kilmakilloge Harbour and deployed the new EXO2 Sonde which was used to collect environmental parameters throughout the water column at varies sites in the Harbour.

**April 4th - 6th 2017:** Cleaned and downloaded the six STAR ODDI temperature and salinity loggers in Kilmakilloge Harbour on 4th April and redeployed them on the 5th April.

Collected mussels from top and bottom of each of the three droppers which have loggers attached for measurements. Tested the pump system for the Exo 2 Sonde and collected Lugols fixed Phytoplankton sample, chlorophyll and nutrient samples. Deployement of the EXO2 Sonde at fixed positions around the mussel longline farms covering the inner, middle and outer parts of Kilmakilloge Harbour. The environmental parameters were measured at fixed depths ranging from surface, 1, 3, 5, 7, 9 and 11 meters depending on the station depth profiles. On the 5th the survey followed the outgoing tide from an East to West direction. On the 6th the survey followed the incoming tide from a West to East direction.

**June 28th 2017:** Successfully deployed three Acoustic Doppler Current Profiler (ADCP) units at the following locations: mouth of harbour (ADCP 0617; 51°46' 27.16917"N; 9°49' 45.35347"W), behind Spannish Island (ADCP 0614; 51°46' 13.20687"N; 9°49' 14.78757"W) and in the inner harbour area (ADCP 0615; 51°46' 16.57102"N; 9°47' 51.87912"W)

**July 18th 2017:** Retrieved three ADCP units and six STAR ODDI temperature and salinity loggers. Collected mussels from top and bottom of each of the three droppers which have loggers attached for measurements.

**August 1st 2017:** Redeployed six STAR ODDI temperature and salinity loggers in the same locations on Carl Daly, Paddy Cronin and Ray Ross farm. 1m and 6m depths on the same dropper marked with a small buoy.

**August 1st – 3rd 2017:** Biomass Survey carried out in four mussel farm sites in Kilmakilloge Harbour.

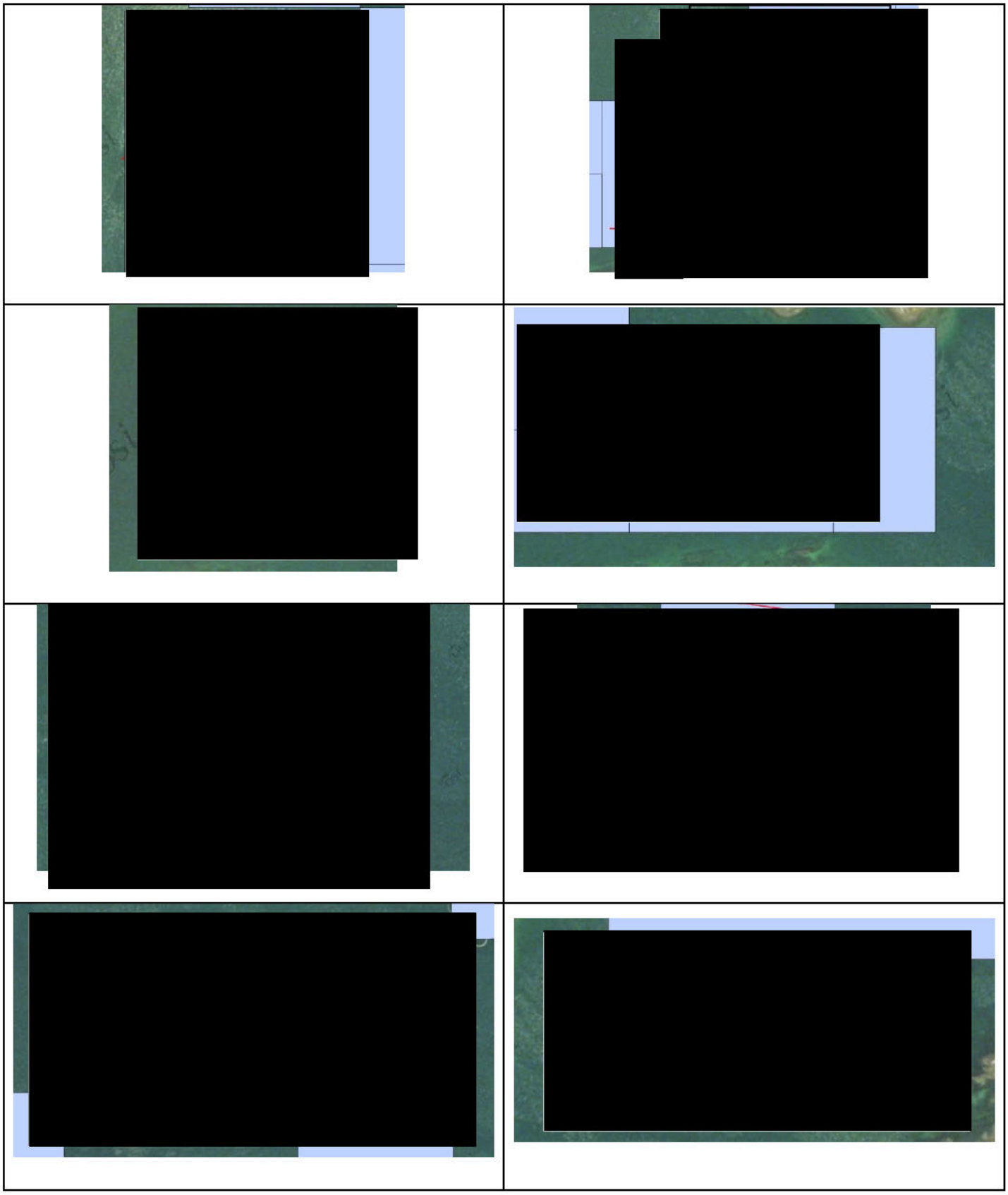
**October 18th – November 1st 2017:** Successfully deployed and retrieved two ADCP units at the following locations: [redacted] (ADCP 0614; 51° 46' 042 N; 9° 50' 302 W) and [redacted] with Spannish island (ADCP 0614; 51° 46' 219 N; 9° 49' 609 W).

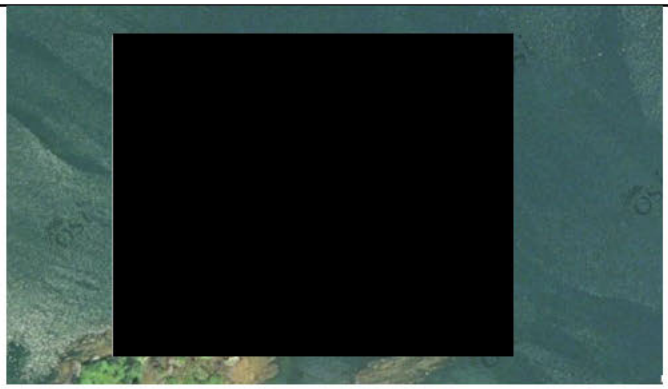
**October 18th 2017:** Collected mussels from top and bottom of each of the three droppers which have loggers attached for measurements.

**November 1st 2017:** EXO2 Sonde which was deployed to collect environmental data through the water column following an East to West direction at high tide from ADCP 0615 to ADCP 0614.

**November 23rd 2017:** Retrieved and redeployed six STAR ODDI temperature and salinity loggers to obtain previous few months data.

## 2. Longline Survey November 2016



| | |
|---|---|
| **Figure A1**. Mapped images of each active sites and surveyed longline locations relative to their licensed boundaries or application site during the November 2016 survey. Note: Areas marked with a heavy black outlined are the longlines encroaching on other licensees sites. |  |

## 3. Mussel measurements November 2016

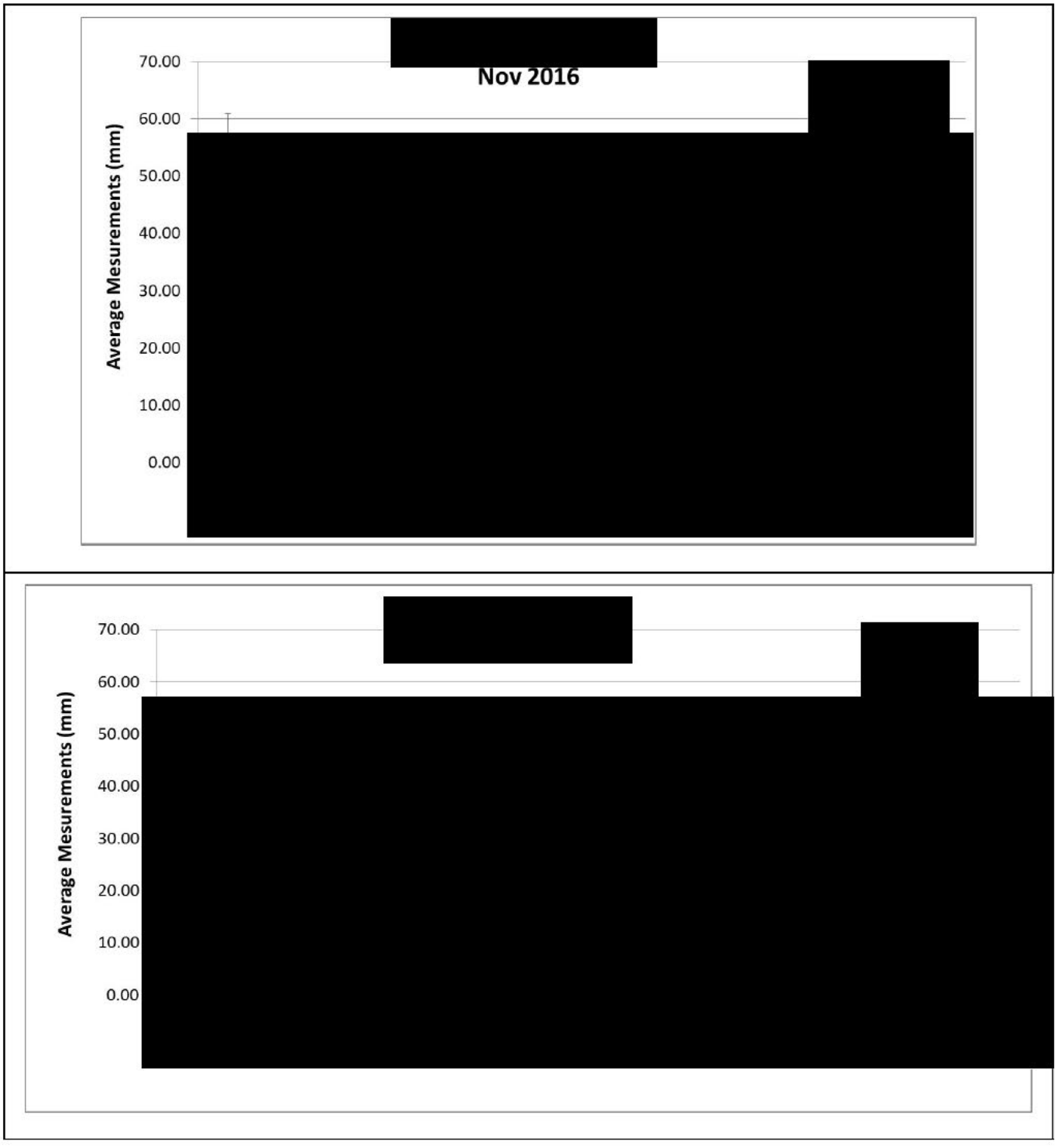
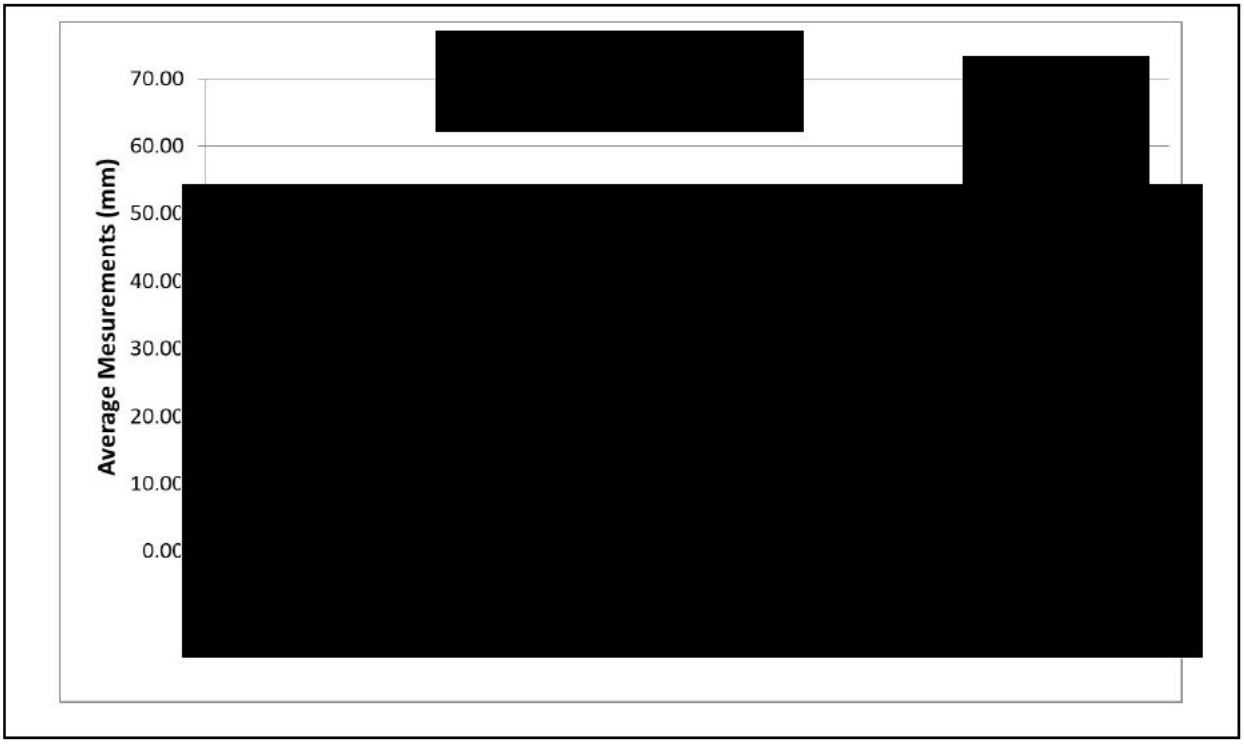



**Figure A2.** Average mussel measurements from sites [redacted] 4 [redacted] of Kilmakilloge Harbour taken during the November 2016 Survey.



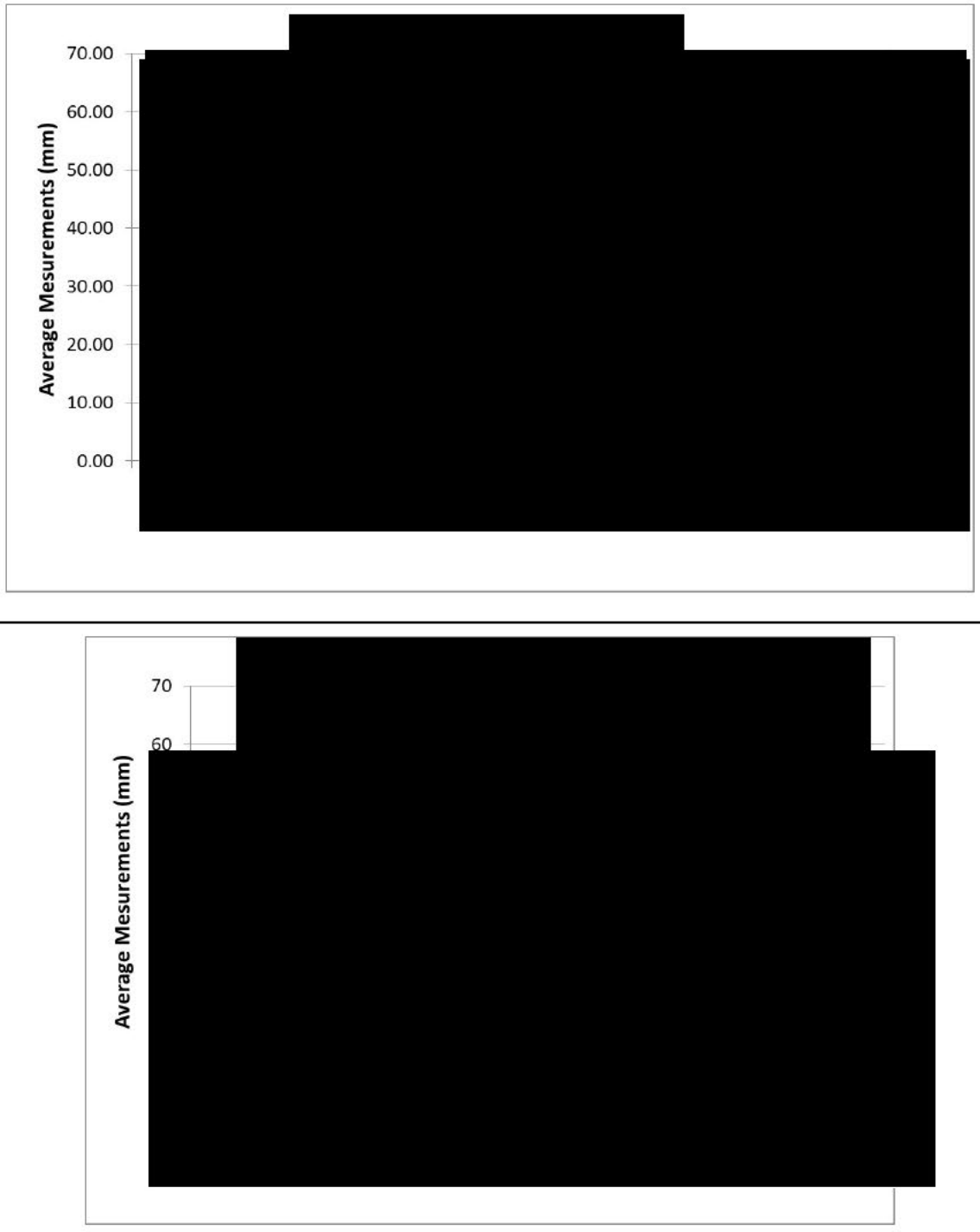



**Figure A3.** Average mussel measurements from sites [redacted] and [redacted] of Kilmakilloge Harbour taken during the November 2016 Survey.

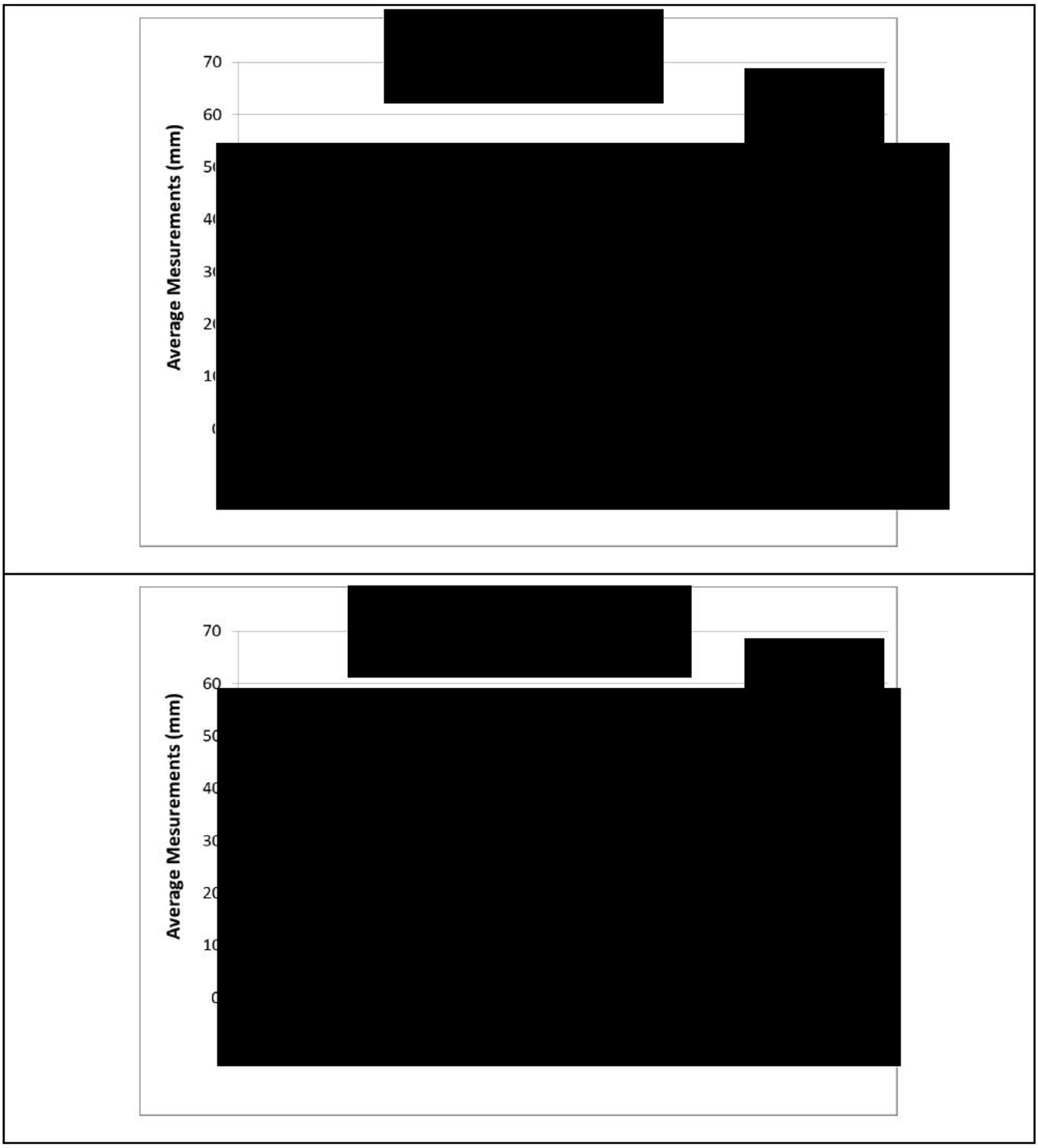

70
60
Average Mesurements (mm)
70
60
Average Mesurements (mm)


**Figure A4.** Average mussel measurements from sites [redacted] of Kilmakilloge Harbour taken during the November 2016 Survey.

## 4. Average Kilos and Pieces per Meter

*4.1.November 2016*

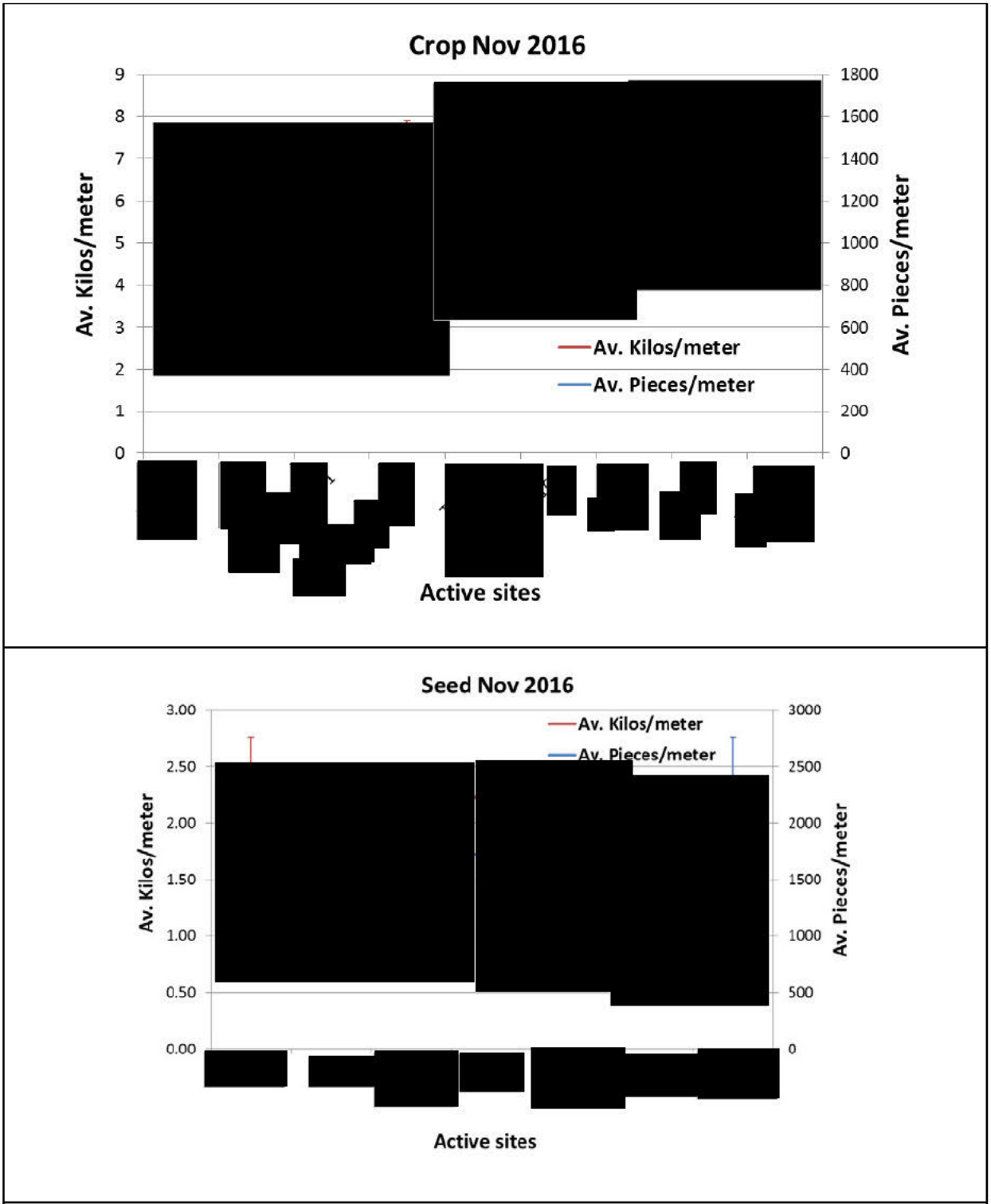
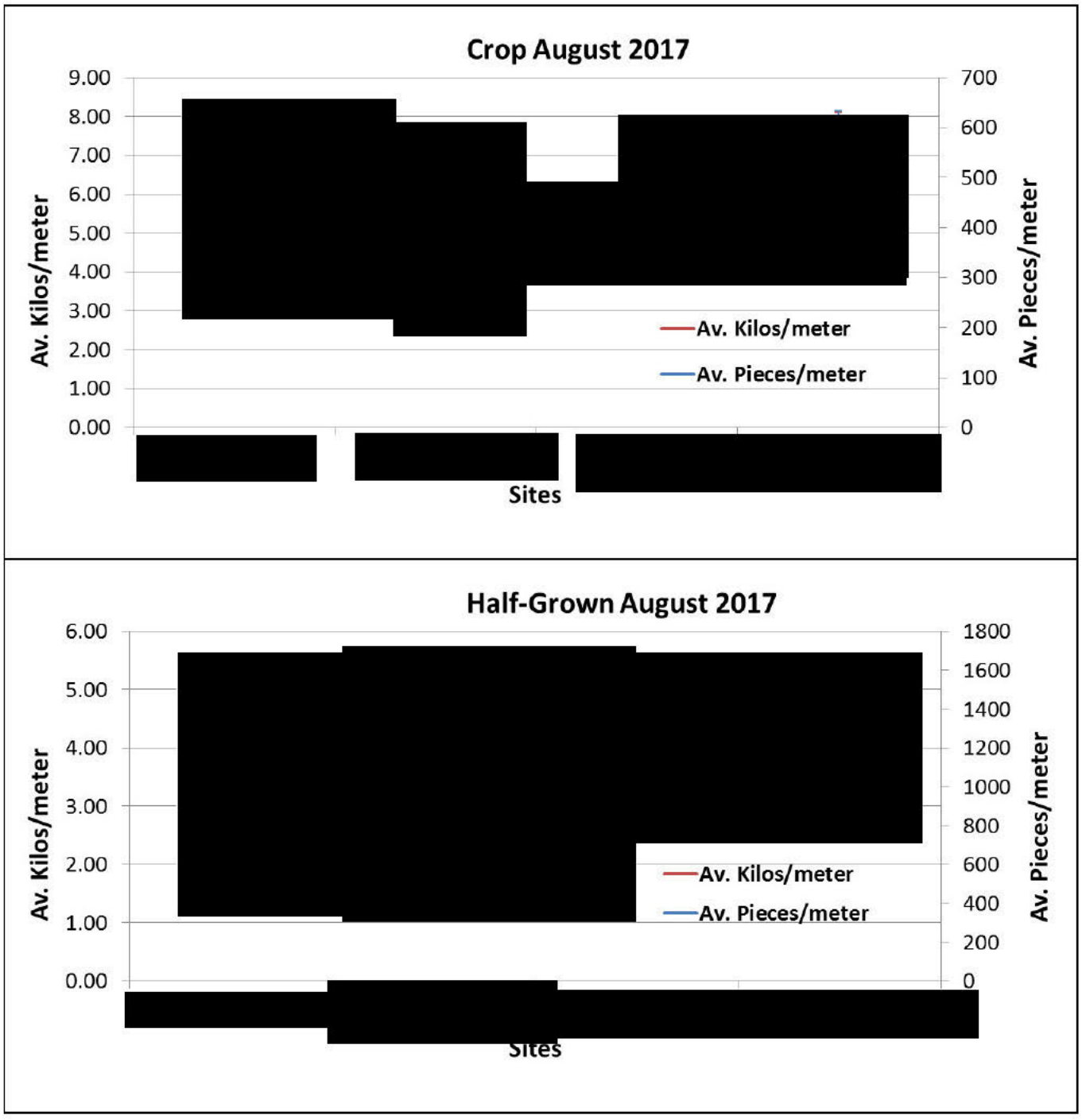



**Figure A5.** Average kilos and pieces per meter for mature crop (top) and seed (bottom) during the November 2016 Survey. Site locations are from a general West to East sequence throughout Kilmakilloge Harbour.

*4.2.August 2017*



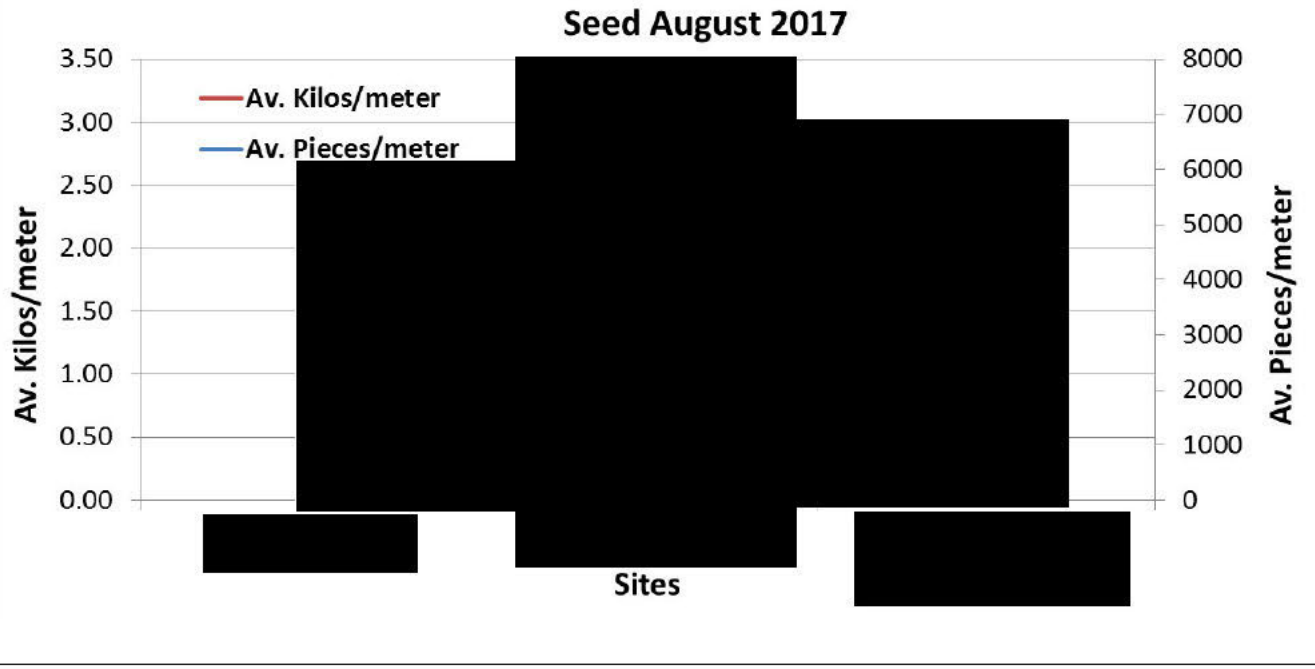



**Figure A6.** Average kilos and pieces per meter for mature crop (top), half-grown (middle) and seed (bottom) droppers from [redacted] and [redacted] locations in Kilmakilloge Harbour during the August 2016 Survey. **Note:** seed measurements where not taken from [redacted]

## 5. Current Direction and Velocity

### *5.1. June/July 2017 ADCP deployments*

The bins/depths at which current velocities and directions were measured was every 0.8 m. The first bin 0 was recorded at 1.11 m from the bottom (seabed) and every 0.8 m there after additional all the way to the surface i.e. 0_Mag = 1.11 m, 1_Mag =1.91 m, 2_Mag = 2.71…..etc.

Kilmakilloge Harbour direction and velocity data is presented for bottom, middle and surface at ADCP 0614 & ADCP 0617 and for bottom and surface at ADCP 0615 (see Appendix B, Figures B1 to B4).

The surface for ADCP 0614, ADCP 0615 and ADCP 0617 was recorded at depths 9.11 m (bin 10), 4.31 m (bin 4) and 10.70 m (bin 12) from the bottom, respectively. However this is not the true surface as during the tidal cycle this varies by up to 3 m around these depths. These ADCP profile bin/depths were chosen to eliminate the effect of backscatter.

The Eastern and most inner deployment site, ADCP 0615, was in the [redacted] see main report Figure 5 and 16). The depth range at ADCP 0615 site was between 4.9 to 7.5 m. The bin layer 4 which corresponds to a depth of 4.313 m was chosen to represent the current and velocity readings near the surface of his site; because of the shallow depth of the site it was not considered necessary to represent a middle bin layer (Appendix B, Figures B1 to B4).

The distribution of current direction at ADCP 0615 was consistently higher from the East South East (ESE)/ South East (SE) to West North West (WNW)/North West (NW) direction from both bottom and surface depths with minimal current coming from the North and South directions (Appendix B, Figure B1 and B2). The distribution of current speed classes indicates the main current speed over the 21 day period was predominantly between 0.01 <= cs < 0.05 m/s for both bottom and surface, with an expected higher number of current speed events occurring near the surface. The highest average current speeds at the bottom (0.054 m/s) correlated well with the highest number of current direction distribution events discussed above for ADCP 0615. However, the highest average current speeds at the surface did not automatically follow these patterns for ENE and South (S) directions, recording 0.223

m/s and 0.140 m/s, respectively (Appendix B, Figure B3). This is likely due to other environmental variables such as wind speeds and obstruction from mussel longlines.

ADCP 0614, which was placed directly south of Spannish Island, showed a current distribution of predominantly East (E) / East South East (ESE) and West (W) direction (Figure B1 and B2). As expected the current speed classes events shifted to higher velocity ranges closer to the surface. The average current speeds were similar for the bottom (ESE; 0.051 m/s and W; 0.053 m/s) and middle (E; 0.055 m/s and W; 0.055 m/s) of the water column and followed the predominant current direction. However, the average current speed near the surface was from a NE / ENE (0.308 / 0.351 m/s) and SW (0.21 m/s) direction. This may be explained by the mussel longlines in [redacted] being directly East of the ADCP 0614 and the outgoing tidal flow moving faster around these obstacles (Appendix B, Figure B3).

The main current flow at ADCP 0617, deployed near the mouth of Kilmakilloge Harbour showed a South East (SE) / South South East (SSE) and North West (NW) / North North West (NNW) direction at the middle and surface (Appendix B, Figure B1 and B2). The higher average current speeds near the middle came from the North / NNE (0.074 / 0.065 m/s) and SE / SSE (0.093 / 0.099 m/s) and near the surface from SE/ SSE (0.079 / 0.082 m/s) and NW/ NNW (0.075 / 0.070 m/s). This can be seen in Figure B3. A stronger current distribution from the North East (NE) and NW at the bottom may be due to the fork shaped channels on the seabed just off Collorus point from the bathymetry observations (see main report Figure 16). Complicated bathymetry at the bottom of ADCP 0617 deployment site may also be the cause of the higher average current speed ranging between 0.074 to 0.111 m/s in all directions creating an almost neutrally circular flow compared to the middle and surface depths (Appendix B, Figure B3).

### *5.2. October/November 2017 ADCP deployments*

ADCP 0615 and 0614 showed the distribution of current speeds to be predominantly between 0.01 <= cs < 0.05 m/s at the middle and surface although there were significantly higher current speed class events between 0.05 and 1.0 m/s at the surface compared to the middle (see Appendix B; Figure B8).

The highest average current speed in the middle of the water column at ADCP 0615 (6.7 m from the bottom) were recorded from a S/SSW direction (0.064 m/s) however the remaining current flow from all other directions was relatively uniform with between 0.024 and 0.039 m/s (Appendix B, Figure B5 and B7). The distribution of current direction events peaked from NE, S and NW with the dominant distribution of current from the South (Appendix B, Figure B6). At the surface (11.5 m from the bottom) the distribution of current direction was also uniform with event peaks from a similar direction (Appendix B, Figure B6) however, the highest average current speeds where recorded between a NNE to ESE direction (0.176 to 0.258 m/s) with significantly lower average current speeds from SE to NNW direction (0.053 to 0.091) m/s; Figure B7). This indicates the longline structures in sites [redacted] (see main report Figure 5 and 16).

The main distribution of current directions and highest average current speeds at the ADCP 0614 location, [redacted] were from a ENE and WSW direction at both the middle (4.3 m from the bottom) and surface (7.5 m from the bottom). The highest average speed recorded at the middle of the water column was 0.041 m/s from a WSW direction while at the surface it was from a ENE and NNE direction (0.337 and 0.320 m/s, respectively; Figure B7). This is discussed further in Section 7 of the main report.

## 6. Tables Section

*Appendix Tables*

**Table A1.** Total hectares licensed in Kilmakilloge Harbour up to the year 1999.

| Site | AQ | Licensee | Date of Licence | Date Expires | Area Licensed | Note made 1996 |
|---|---|---|---|---|---|---|
| **T06/020** | 250 | Gulf Stream Mussels Ltd. (Luke Griffin) | 25.11.92 | 24.11.02 | 6 | Harnett working site |
| **T06/021** | 141 | Elizabeth Comerford | 07.05.92 | 06.05.02 | 4 | Harnett working site |
| **T06/024** | 142 | Muskerry Seafoods | 25.04.90 | 25.04.00 | 8 | Operated by Finbarr Daly of Muskerry Seafoods |
| **T06/029** | 144 | Mark Smith | 01.05.90 | 02.05.00 | 2 | Harnett working site 02.05.97 |
| **T06/033** | 145 | Carl Daly | 29.08.89 | 28.08.99 | 4 | Carl Daly worked site |
| **T06/035** | 143 | Joseph O'Sullivan | 13.01.93 | 12.01.03 | 2 | now taken over by Sean McCarthy |
| **T06/105** | 444 | Alex McCarthy (Westward Seafarms Ltd) | 25.07.94 | 24.07.04 | 2 | Harnett worked site |
| **T06/106** | 155 | Shamrock Shellfish Ltd | 01.05.90 | 02.05.00 | 4 | Sean McCarthy worked site |
| **T06/114** | 157 | Austin Collins | 25.04.90 | 25.04.01 | 3 | Renewal 2001, Now operated by John Harrington |
| **T06/121A** | 146 | Vincent Kinsella | 01.05.90 | 02.05.00 | 4 | Harnett working site |
| **T06/121B** | 305 | Vincent | 26.04.93 | 25.04.03 | 4 | Harnett site. Note: 2 hectares |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Kinsella | | | | of license on land |
| **T06/131** | 173 | Declan Browne | 25.04.90 | 25.04.00 | 3 | Paddy Cronin applied to take over site |
| **T06/133** | 441 | John Harnett | 16.06.94 | 15.06.04 | 2 | Harnett working site |
| **T06/154** | 159 | Paul Kelly | 25.04.91 | 24.04.01 | 1.5 | Original licence 03.02.88 |
| **T06/155** | 160 | Peter Stone | 26.07.91 | 25.07.01 | 2 | Paul Kelly applied for take over |
| **T06/149** | 167 | Raymond Ross | 23.11.99 | 23.11.09 | 6.5 | Original licensed 26.05.88 |
| **T06/190** | 166 | Michael O'Sullivan | 23.11.99 | 23.11.09 | 3 | Originally applied on 15.02.93 |
| **Total hectares Pre 1995** | | | | | **58** | Excludes T06/190 |
| **Total hectares 1999** | | | | | **61** | Includes T06/190 |

**Table A2.** Currently the total hectares of renewal applications mussel longline sites in Kilmakilloge Harbour is 37 hectares. [redacted] as his is currently an application [redacted]

| **Operator / Producer** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | **Total Hectares** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Licence Ref.** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | |
| **WebGIS (ha)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | |
| **Licence Area (ha)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | |
| **Renewal (ha)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | **37.00** |

**Table A3.** New Applications for mussel, finfish and oyster farm sites in Kilmakilloge Harbour. Note: some new applications are taken from pre-existing licences. Total hectares of mussel longlines is 32 hectares.

| **Type** | Mussel | Mussel | Mussel | Mussel | Mussel | Mussel | Mussel | Mussel | Mussel | Total Hectares | Finfish | Finfish | Oysters | Scallops |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Operator** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | | [redacted] | [redacted] | [redacted] | [redacted] |
| **Status** | Application | Application | Application | Application | Application | Application | Application | Application | Application | | Licensed | Licensed | Application | Application |
| **Licence Ref.** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | | [redacted] | [redacted] | [redacted] | [redacted] |
| **Originally** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | | [redacted] | [redacted] | [redacted] | [redacted] |
| **WebGIS (ha)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | **32.0** | [redacted] | [redacted] | [redacted] | [redacted] |
| **Original Licence (ha)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | | [redacted] | [redacted] | [redacted] | [redacted] |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **New Application (ha)** | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ |

**Table A4.** Total hectares of Kush Seafarms application sites is 24 hectares. Total hectares (minus T05/540) that could be potentially reallocated to existing farmer sites waiting renewal is 18 hectares.

| **Type** | Mussel | Mussel | Mussel | Mussel | Mussel | Mussel | Mussel | Total hectares of Kush Seafarms applications | Total hectares of Kush Seafarms reallocation |
|---|---|---|---|---|---|---|---|---|---|
| **Operator** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | | |
| **Status** | Application | Application | Application | Application | Application | Application | Application | | |
| **Licence Ref.** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | | |
| **Originally** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | | |
| **WebGIS (ha)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | | |
| **New Application (ha)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | **24.00** | **18.00** |

**Table A5.** Each active mussel farmers site with current number of longlines per hectare, total number of longlines on farm (110 m length), number of longlines per hectare and total number of longlines (110 length) that would be required to remove if licence sites were stipulated to 3 longlines per hectare. **Note**: only three sites have 3 longlines per hectare stipulated in their licence terms and conditions.

| **Licensee** | **Carl Daly** | **Finbarr Daly** | **Paul Kelly** | **Paul Kelly** | **Kieran Lyons** | **Patrick Cronin** | **Sean McCarthy** | **Sean McCarthy** | **John Harrington** | **Declan Sullivan** | **Raymond Ross** | **Total in Harbour** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Licence Ref.** | [redacted] | | | | | | | | | | | |
| **No. of longlines per licensed ha** | [redacted] | | | | | | | | | | | **47** |
| **No. of longlines 110 m length** | [redacted] | | | | | | | | | | | **173** |
| **No. of longlines to remove per ha** | [redacted] | | | | | | | | | | | **14** |
| **No. of longlines 110 m length to remove** | [redacted] | | | | | | | | | | | **55** |
| **Stipulated in licence at present** | [redacted] | | | | | | | | | | | |

*Values with (+) sign is the number of longlines required to increase site to 3 longlines per hectare

**Table A6**. Each active mussel farmers site with current number of floats per hectare, total number of floats on farm, total number of flotation per hectare and total flotations on farm that would require removal if licence sites were stipulated to 18,000 Litres per hectare. Note: only three sites have 3 longlines per hectare stipulated in their licence terms and conditions.

| Licensee | Carl Daly | Finbarr Daly | Paul Kelly | Paul Kelly | Kieran Lyons | Patrick Cronin | Sean McCarthy | Sean McCarthy | John Harrington | Declan Sullivan | Raymond Ross | Total in Harbour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Licence Ref. | [redacted] | | | | | | | | | | | |
| No. floats on farm | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 4395.00 |
| Av No. of floats per 110 m longline | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 25.94 |
| No. floats per ha | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 1204.94 |
| Total flotation (220 L) on farm | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 966900.00 |
| Total flotation (220 L) per ha | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 265087.03 |
| Total flotation L reduction (18,000 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 67087.03 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **L per ha)** | | | | | | | | | | | | |
| **Total No. of floats to remove (18,000 L per ha)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 1163.18 |
| **No. of floats to remove per hectare** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 304.94 |

**Table A7**. Each active mussel longline farmer's site with the total number and flotation types located on each farm as per the November 2016 survey.

| Licensee | Carl Daly | Finbarr Daly | Paul Kelly | Paul Kelly | Kieran Lyons | Patrick Cronin | Sean McCarthy | Sean McCarthy | John Harrington | Declan Sullivan | Raymond Ross | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Licence Ref. | [redacted] | | | | | | | | | | | |
| Gem | [redacted] | | | | | | | | | | | 3016 |
| Blue/Green | [redacted] | | | | | | | | | | | 1276 |
| Rom | [redacted] | | | | | | | | | | | 56 |
| JFC | [redacted] | | | | | | | | | | | 84 |
| Total No. of floats on farm | [redacted] | | | | | | | | | | | 4432 |

# Kilmakilloge Harbour Study

# 2017

## Appendix B

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## 1. Current profile data

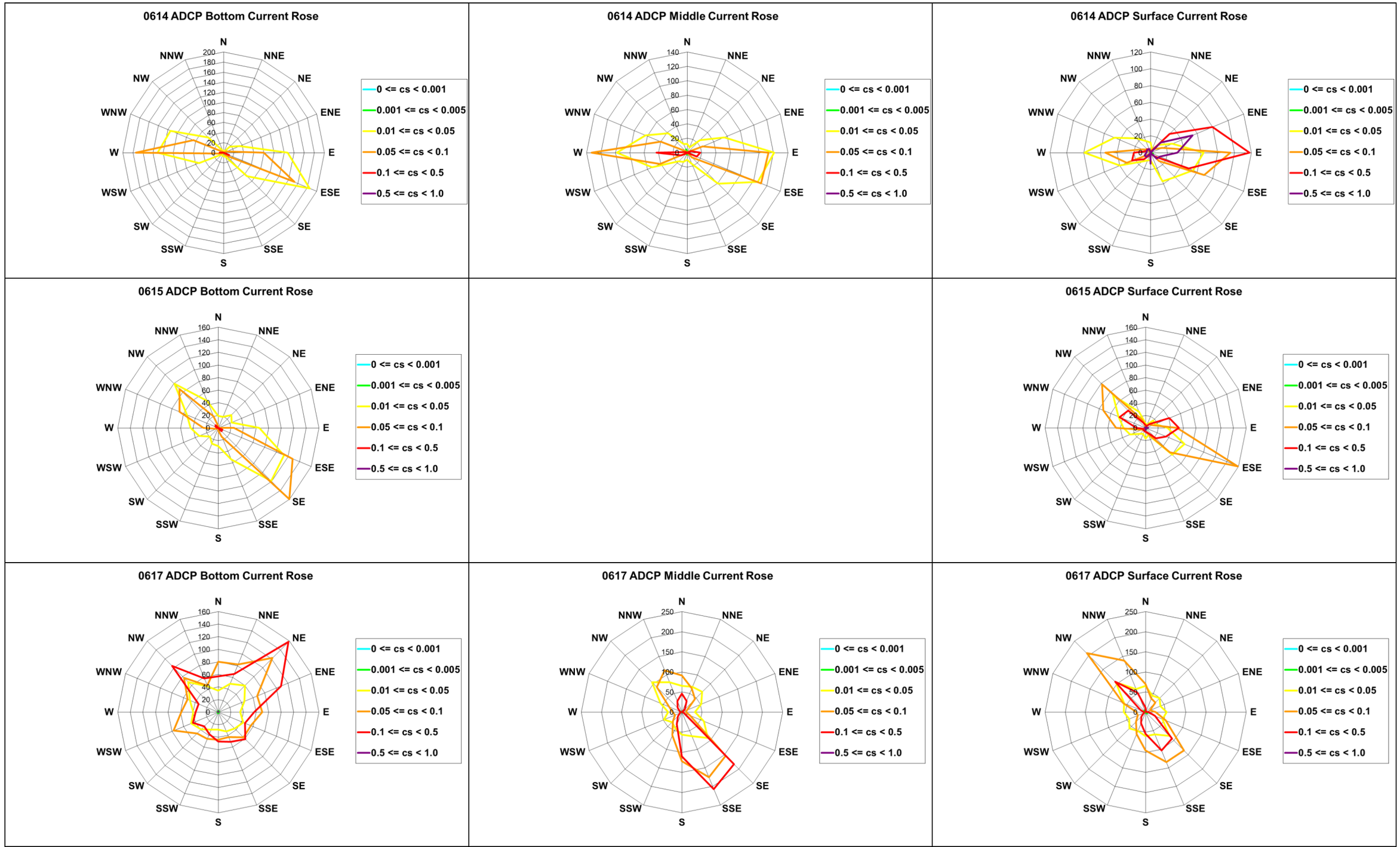



**Figure B1.** Current Rose of Bottom (ADCP 0614, 0615 & 0617; 1.11m from Bottom), Middle (ADCP 0614, 5.91m & 0617, 5.90m from Bottom) and Surface (ADCP 0614, 9.11m; 0615, 4.31m; & 0617, 10.70m from Bottom) ADCP XNorth bin layers from the June/July 2017 deployment. Each graph represents the main current direction and velocity frequency's ranging between 0 <= cs <= 1.0 meters per second (m/s).

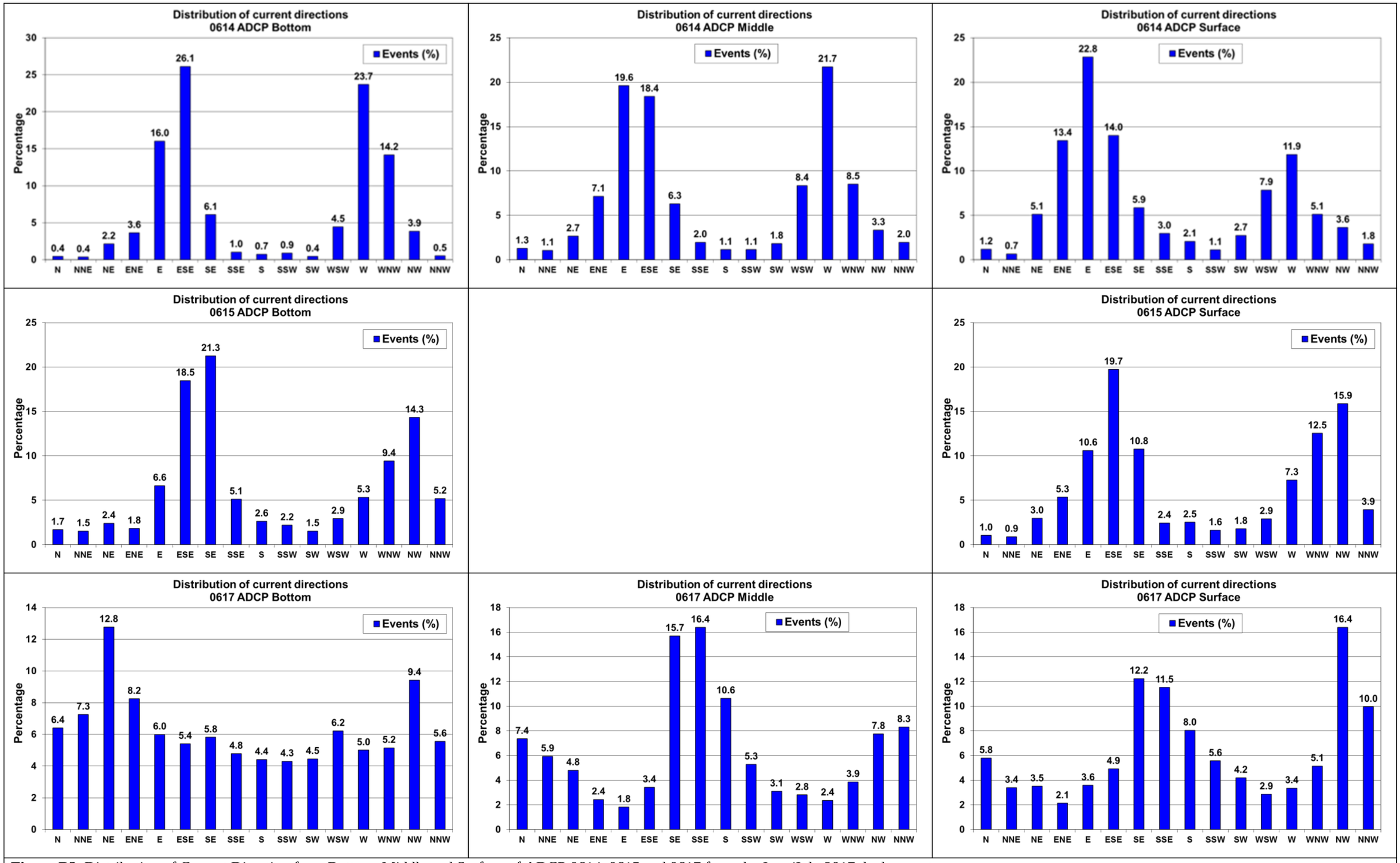



**Figure B2.** Distribution of Current Direction from Bottom, Middle and Surface of ADCP 0614, 0615 and 0617 from the June/July 2017 deployment.

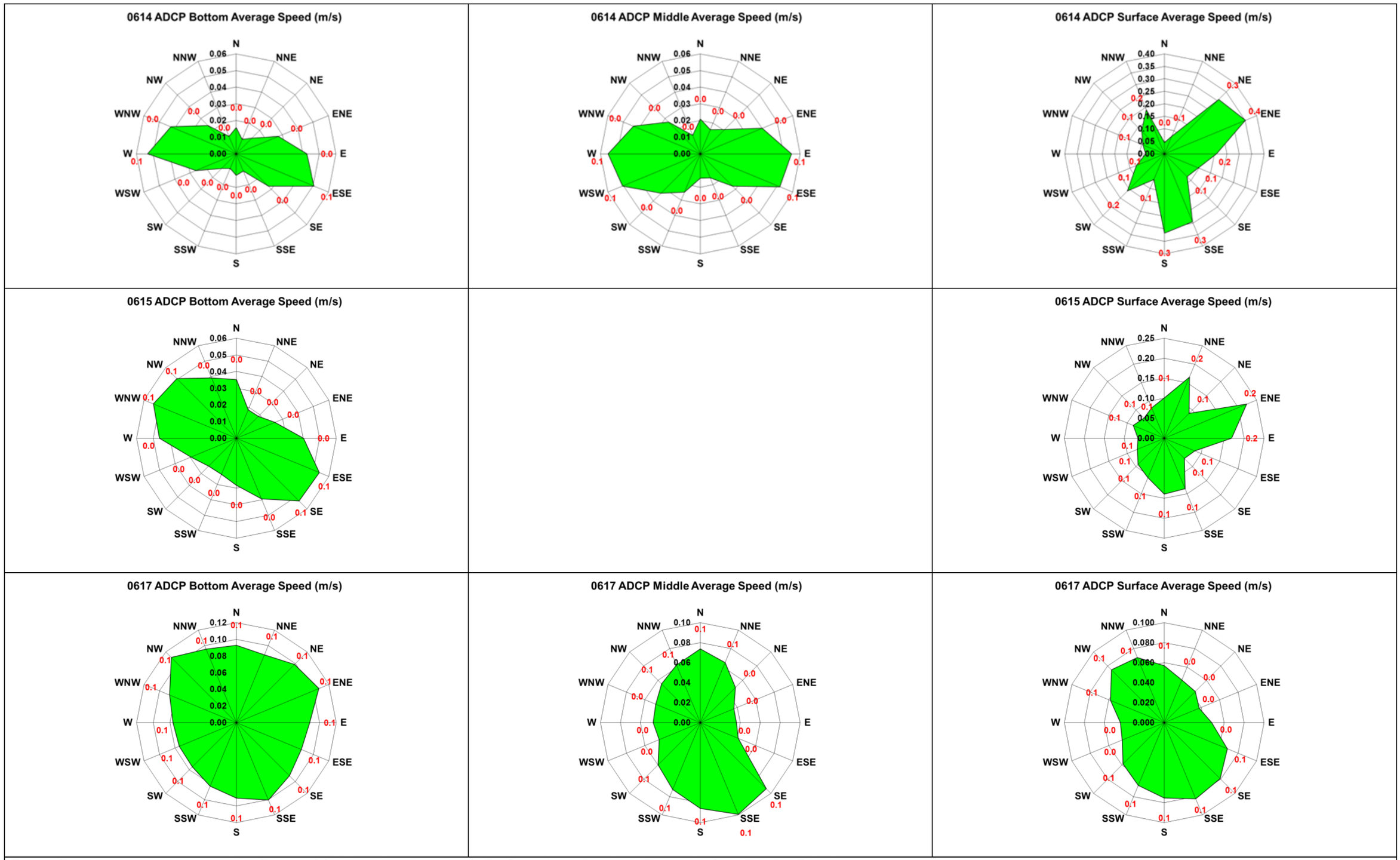
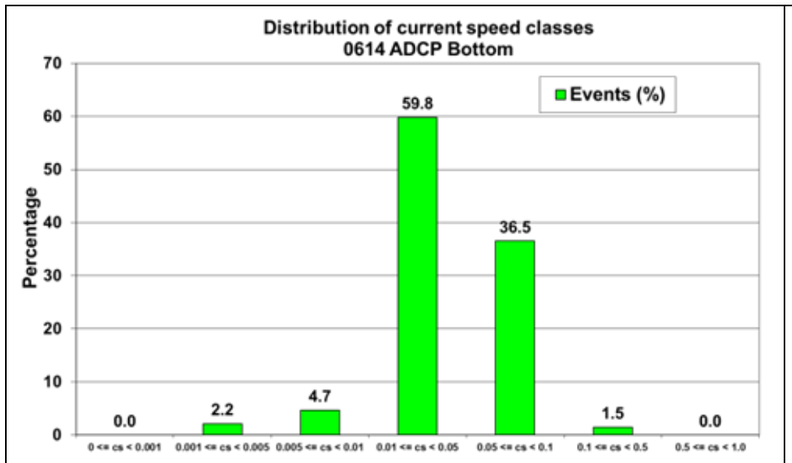
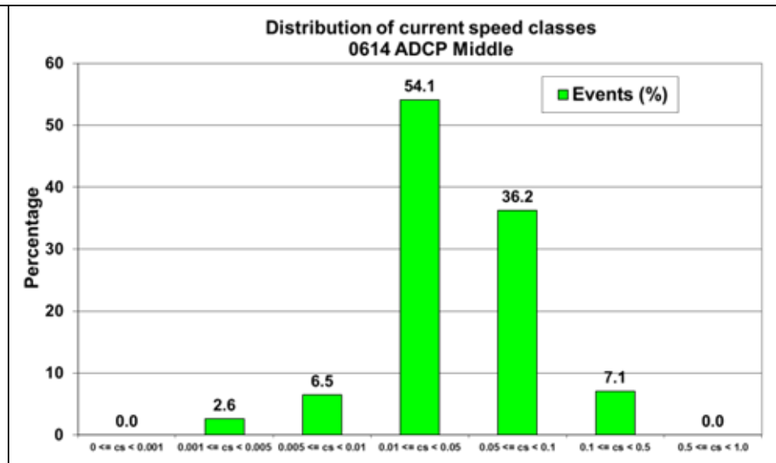
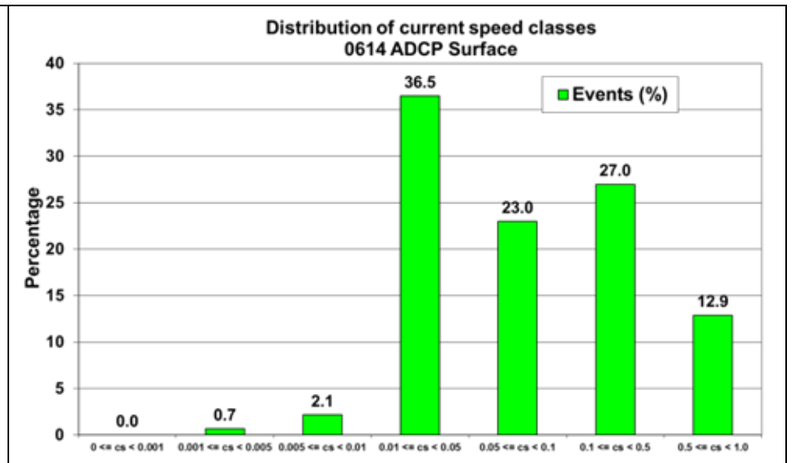
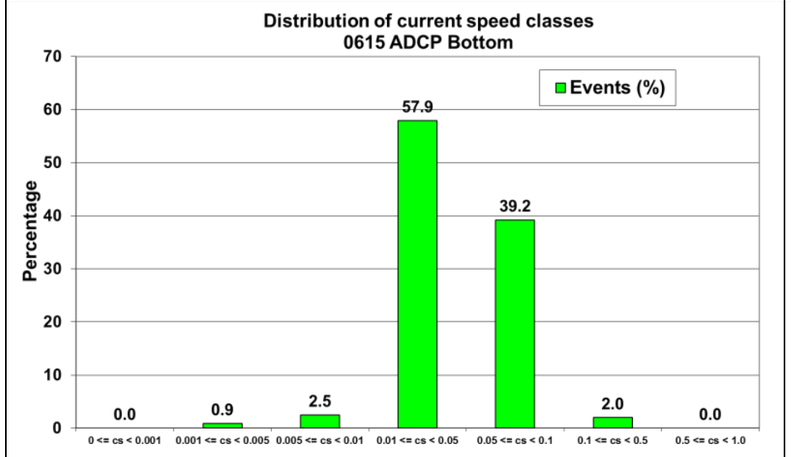


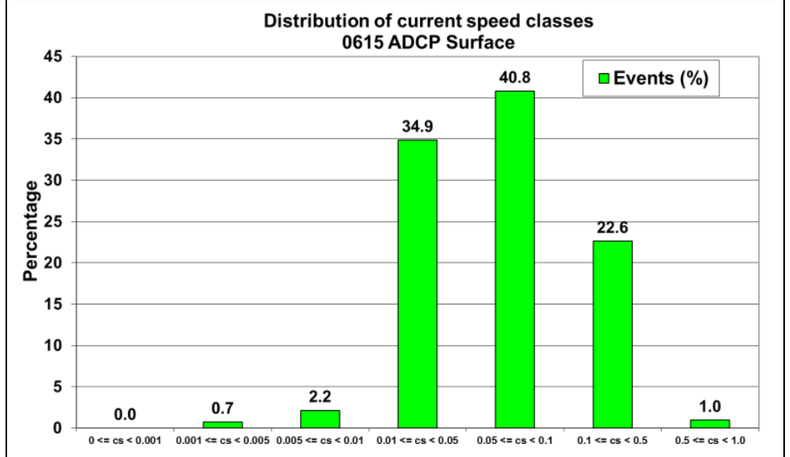

**Figure B3.** Average Current Speed for Bottom, Middle and Surface from ADCP 0614, 0615 and 0617 from the June/July 2017 deployment.

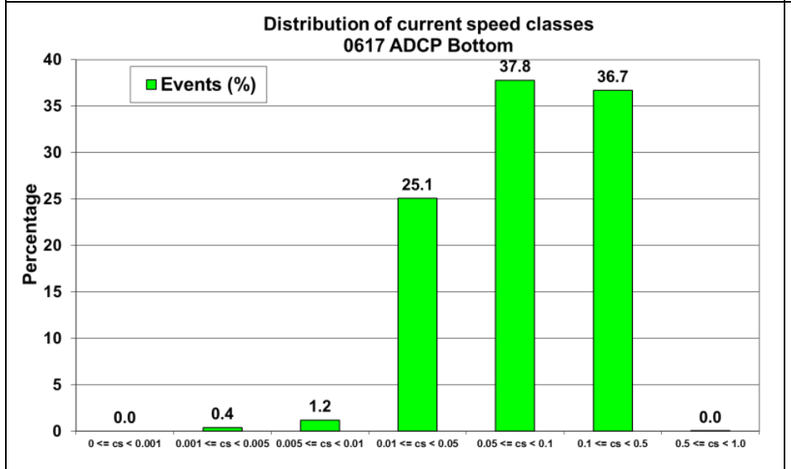


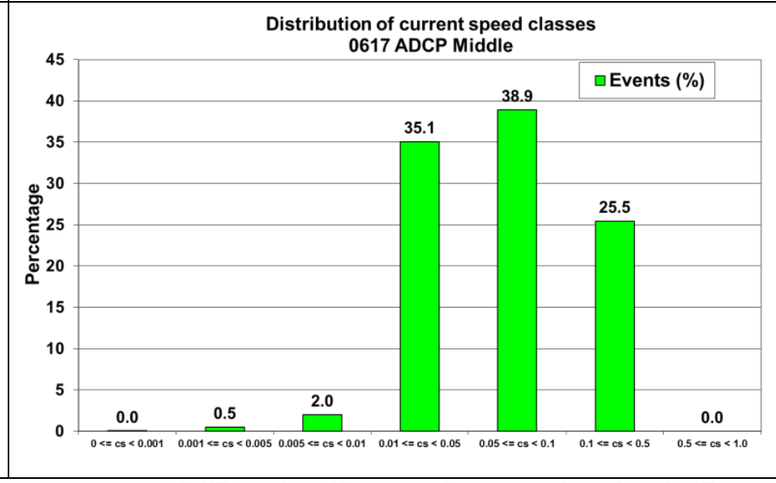



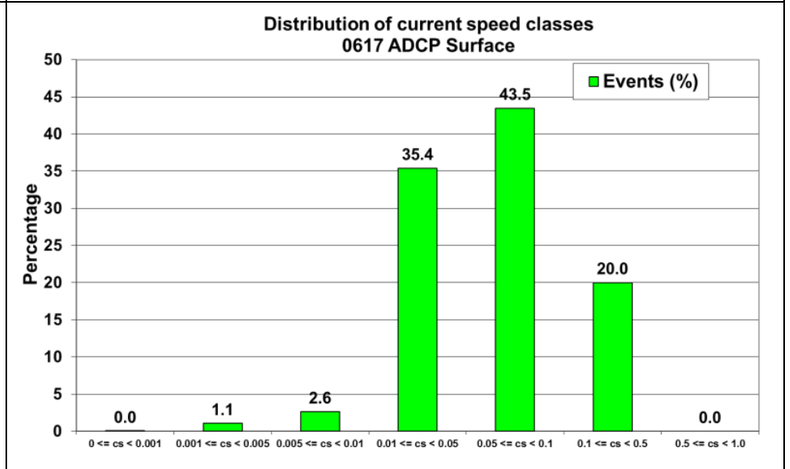
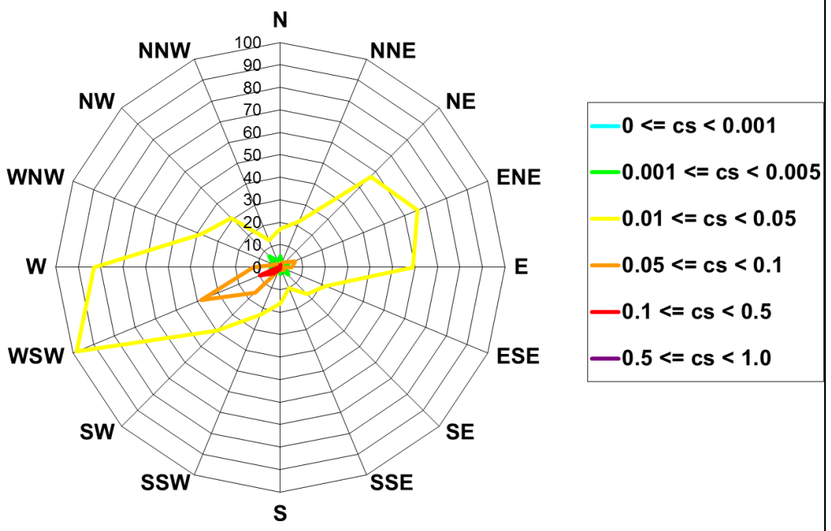
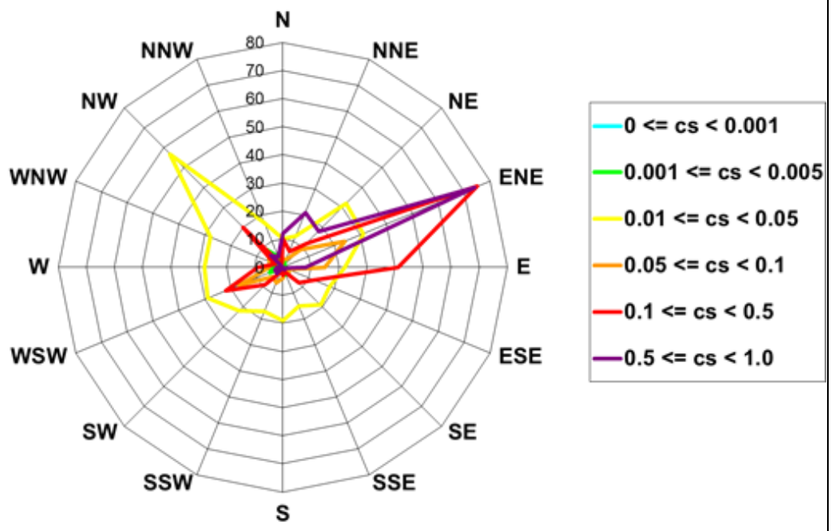
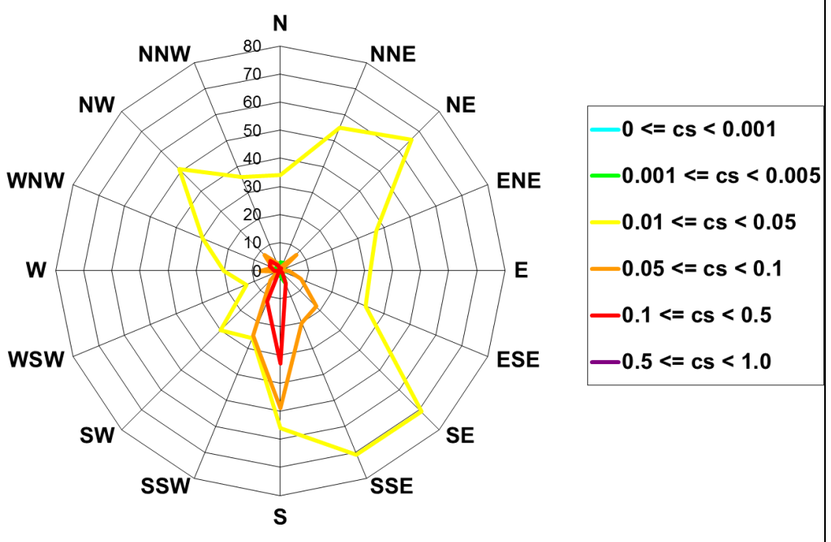




**Figure B4.** Distribution of current Speed Classes for Bottom, Middle and Surface from ADCP 0614, 0615 and 0617 from the June/July 2017 deployment.



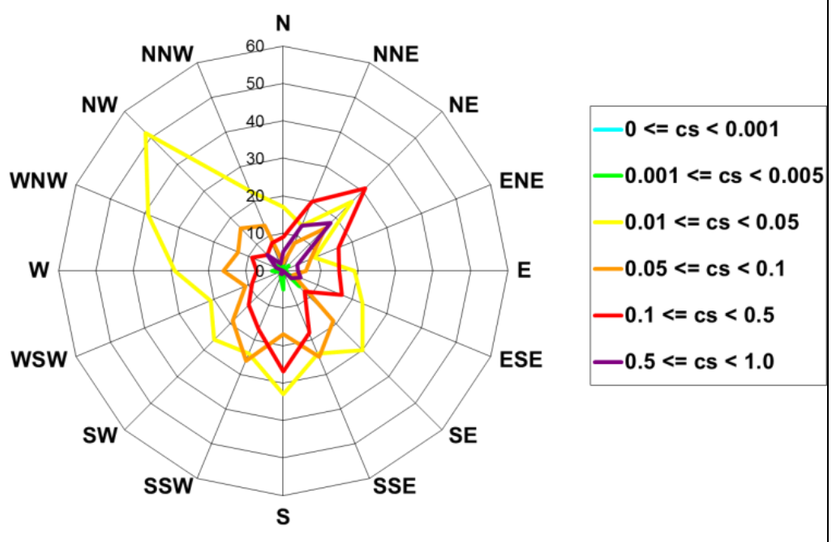
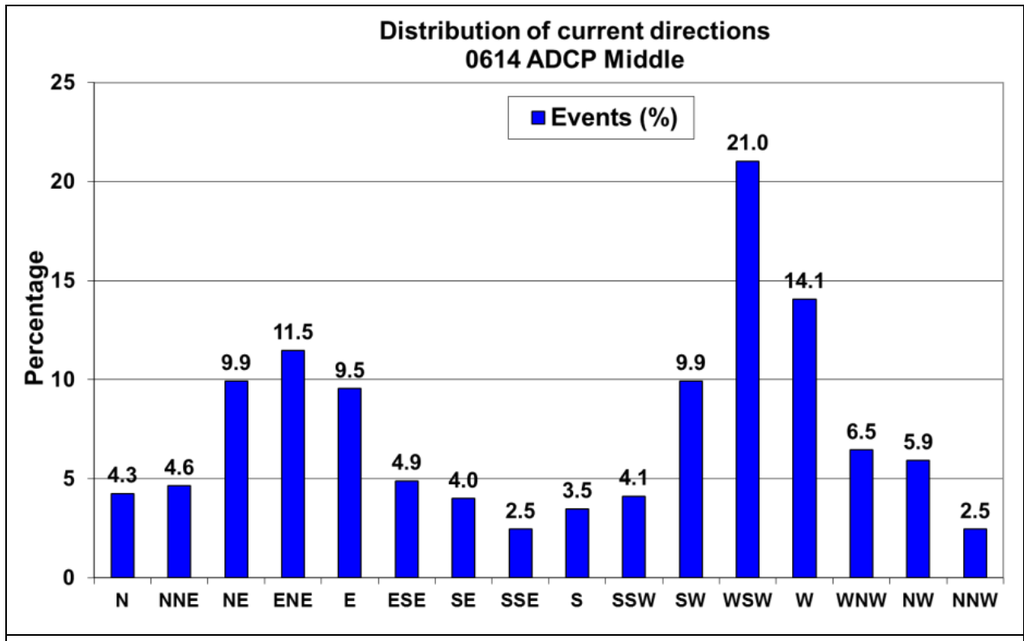
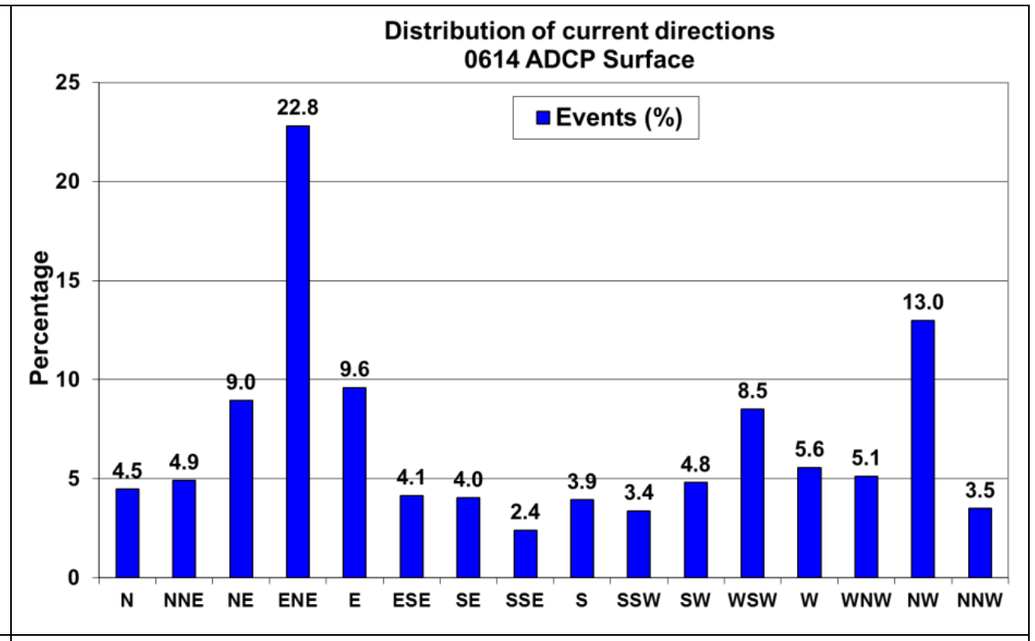
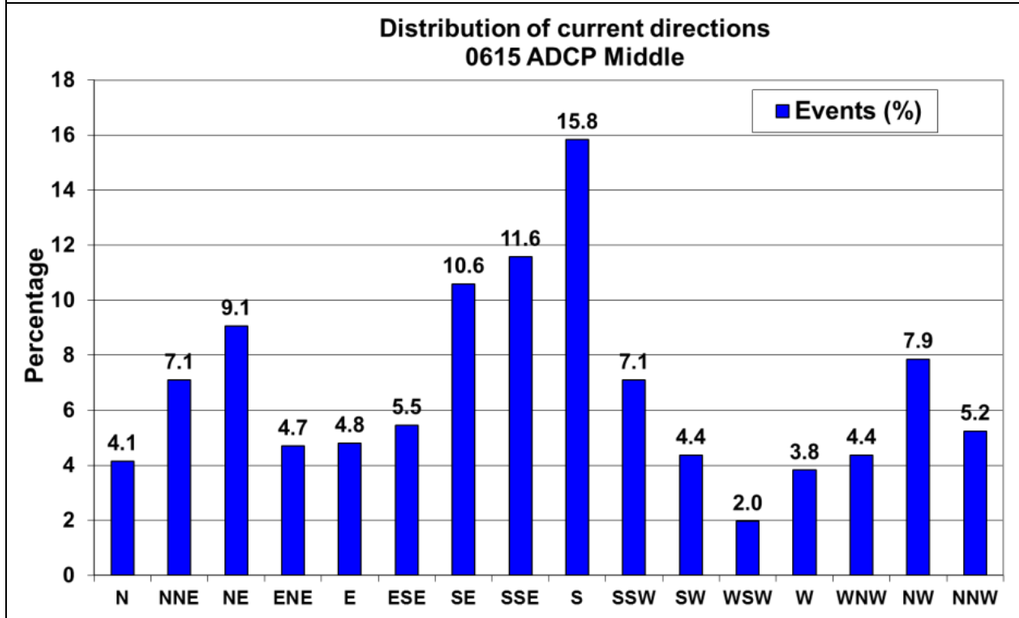




**Figure B5.** Current Rose of Middle (ADCP 0614, 4.309m & 0615, 6.709m from Bottom) and Surface (ADCP 0614, 7.509m & 0615, 11.509m from Bottom) ADCP XNorth bin layers from the October/November 2017 deployment. Each graph represents the main current direction and velocity frequency's ranging between 0 <= cs <= 1.0 meters per second (m/s).



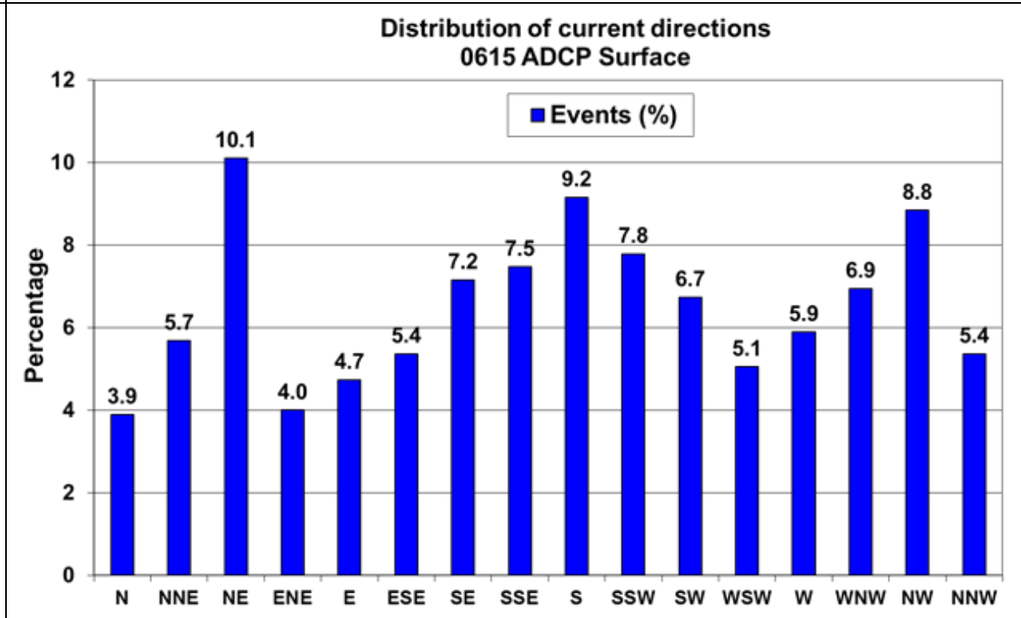
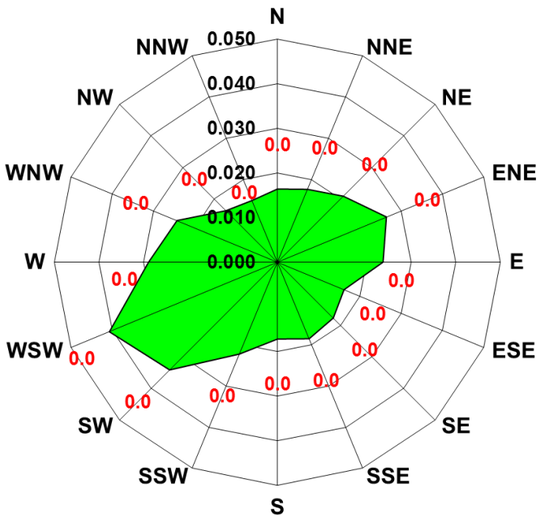
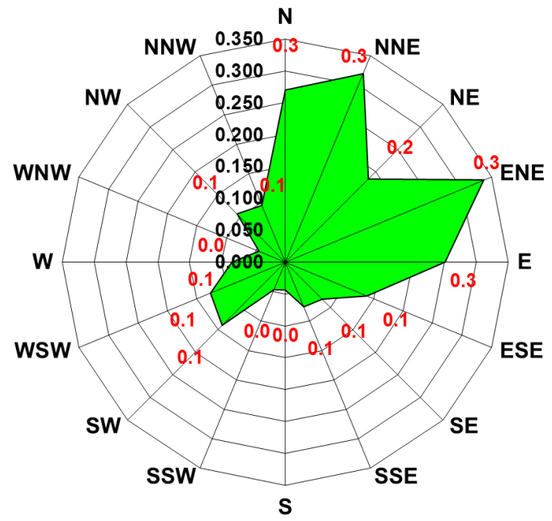
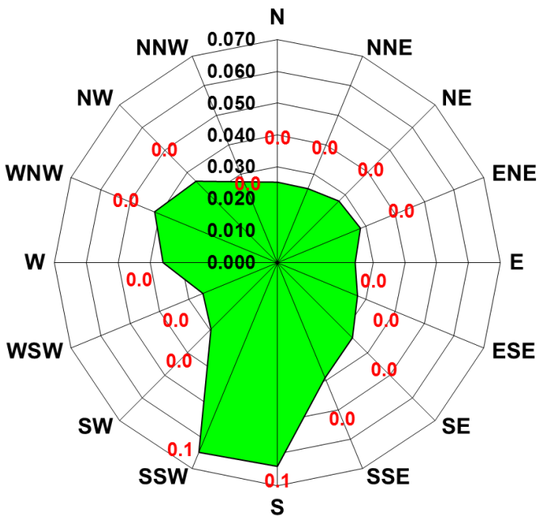




**Figure B6.** Distribution of Current Direction from Middle and Surface of ADCP 0614 and 0615.Current Rose of Middle (ADCP 0614, 4.309m & 0615, 6.709m from Bottom) and Surface (ADCP 0614, 7.509m & 0615, 11.509m from Bottom) from the October/November 2017 deployment.



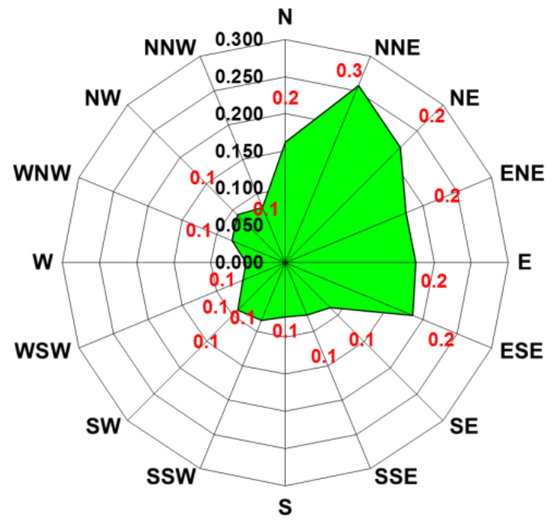
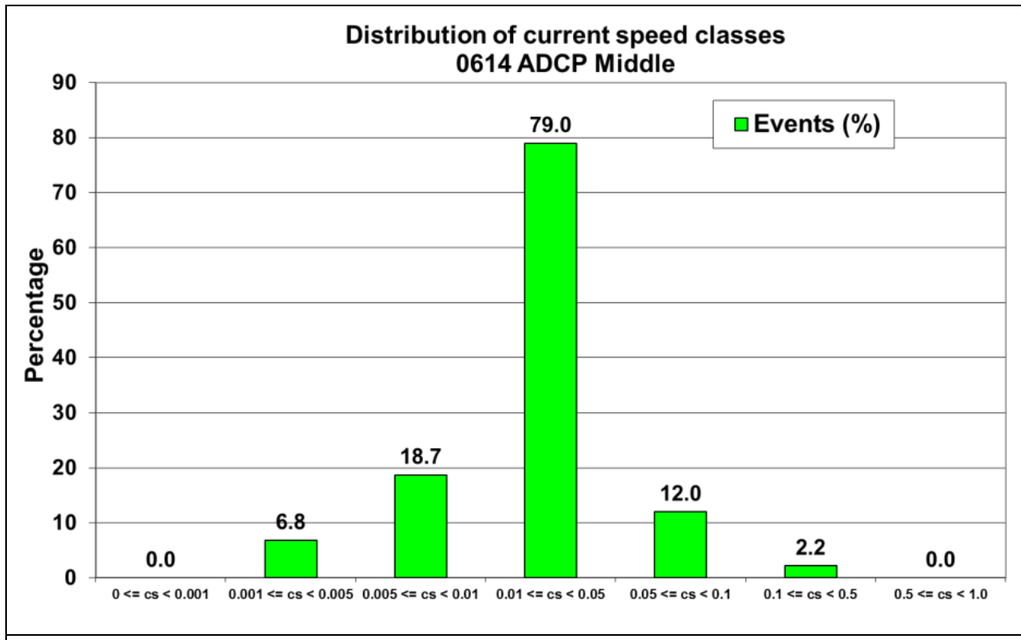
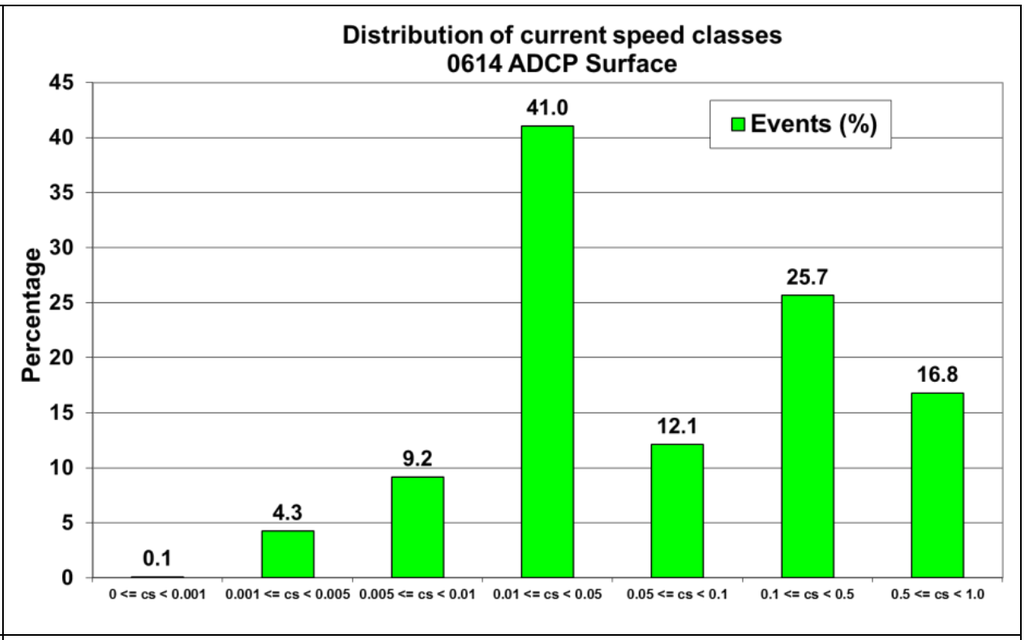
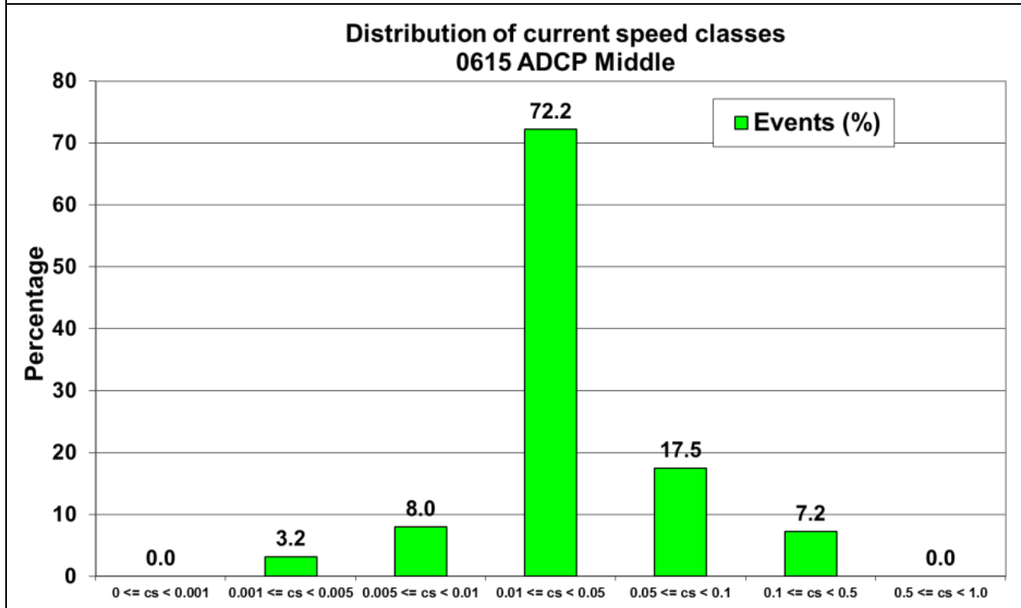




**Figure B7.** Average Current Speed for Middle and Surface from ADCP 0614 and 0615. Current Rose of Middle (ADCP 0614, 4.309m & 0615, 6.709m from Bottom) and Surface (ADCP 0614, 7.509m & 0615, 11.509m from Bottom) from the October/November 2017 deployment.



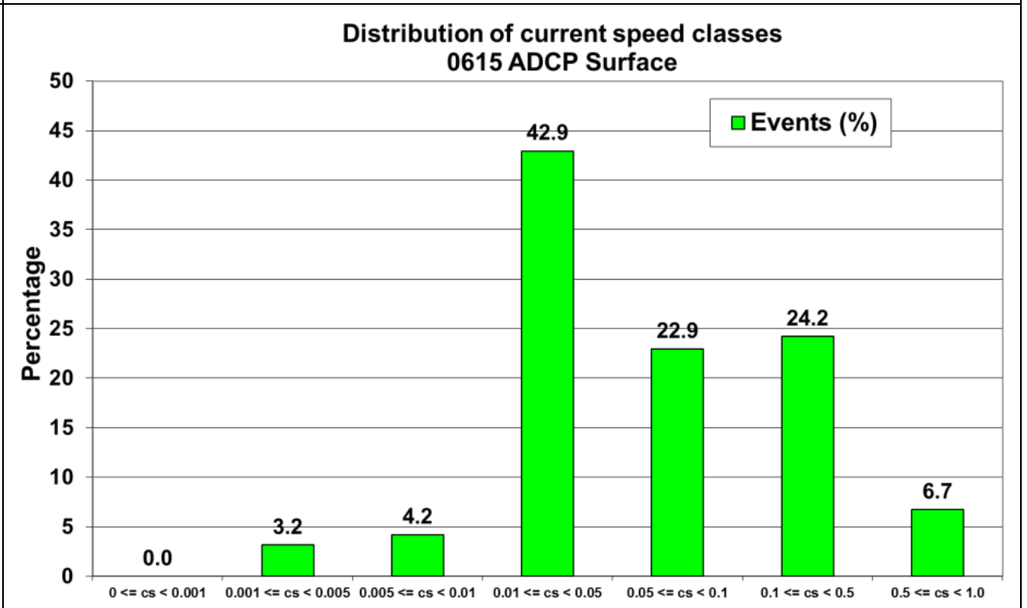




**Figure B8.** Distribution of current Speed Classes for Middle and Surface from ADCP 0614 and 0615. Current Rose of Middle (ADCP 0614, 4.309m & 0615, 6.709m from Bottom) and Surface (ADCP 0614, 7.509m & 0615, 11.509m from Bottom) from the October/November 2017 deployment.

# Kilmakilloge Harbour Study

# 2017


**Report By:**

**Dr. Gary R. McCoy & Dr. Terence O'Carroll**

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## 1. Introduction

At the request of the Aquaculture and Foreshore Management Division (AFMD) of the Department of Agriculture Food and the Marine (DAFM), and as set out in FoodWise 2025, BIM was asked to provide science based advice with regard to the shellfish carrying capacity of bays to facilitate licensing decisions.

Kilmakilloge Harbour was identified by AFMD as a priority area for a study to be undertaken. Currently nine rope mussel farmers actively farm 11 sites. These farmers are waiting on renewal of existing licences as well as decisions on a number of new applications for sites currently under review. BIM has carried out various activities and surveys over the last 14 months to try and address the key issues in respect of progressing sustainable shellfish aquaculture in the Harbour. It is hoped that the recommendations in this report will help the rope mussel industry and DAFM complete the process of licensing in the Harbour.

In order to complete this report, two stock and biomass surveys were undertaken along with mussel growth monitoring. Current meters were deployed at five locations to determine the flow of water in the Harbour and between the farm sites. Temperature and salinity loggers were also deployed and various readings in respect of phytoplankton abundance and depletion were taken. A new bathymetry map of the area has been provided in conjunction with the Marine Institute by GSI and the positional survey of the longline locations was updated.

There are a number of key issues which the current farmers and DAFM would like addressed and answered:

*Key issues effecting Kilmakilloge Harbour:*

- The Special Unified Marking Scheme (SUMS) for navigation and marking of the sites needs to be updated.
- Navigational channels and clear access to safe anchorages must be maintained.
- The negative visual impact caused by inconsistent floatation type and colour on longlines need to be addressed.

- The issue of farmers operating outside of their licensed area/licence conditions needs to be addressed.
- Some farmers feel the Harbour has reached its economic carrying capacity for shellfish production and do not want further licences issued.
- Concerns that the licensing of additional activity will lead to a fall-off in growth rates with a consequent economic implication.
- Determining if the carrying capacity has been reached within the existing site layout.

**Description of the area**

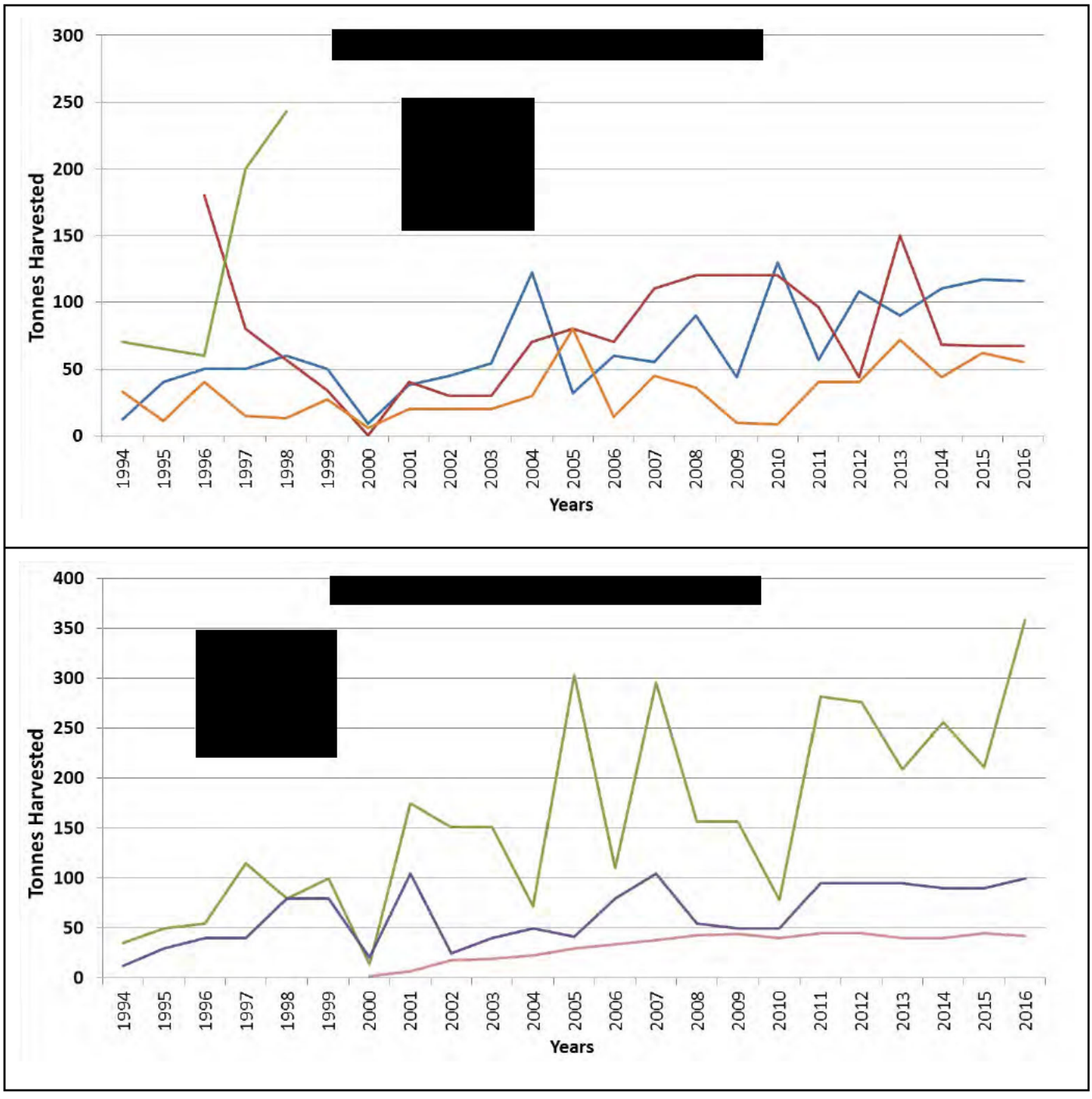
Kilmakilloge Harbour is an inlet situated on the south side of Kenmare River estuary about half way down the Beara Peninsula on the Southwest Coast of Ireland. Kenmare town is 17.7 km to its East and Ardgroom Harbour is 2.4 km to its West. It can provide anchorage and good shelter but requires good navigational awareness to avoid rocky shallows and aquaculture sites which contain mussel longlines and salmon farm structures. The maximum depth at the Harbour mouth is around 25 m; however, the main harbour area is very shallow with many of the aquaculture site occupying water depths of 10 m or less. During recent surveys undertaken in 2017, the highest temperature recorded in the Harbour occurred in June with temperatures ranging from 17 and 22 °C at a depth of 6 m and 1 m, respectively. The coldest water temperatures were recorded in March which ranged from 10 and 7 °C at a depth of 6 m and 1 m, respectively.

The main rivers, Glantrasna and Drunminboy, feed into the East of the Harbour with several other streams also contributing to fresh water input. However this has minimal effect on the current flow which is generally weak and is heavily influenced by the tidal cycle.

Note: As defined in Section 19A (4) of the Fisheries (Amendment) Act 1997, licenced sites referred to in this report are the current licence applications being considered for renewal in Kilmakilloge Harbour.

## 2. Historical Information

Over a period of 22 years local shellfish farmers have been supplying annual tonnage data to BIM. This annual tonnage of mussels is predominantly sold to France and other European countries as fresh product. During the Kilmakilloge Harbour survey, each farmer was asked to review previous year's harvested tonnages in order to provide up-to-date annual tonnage data and reflect a more accurate picture of the Harbours production.



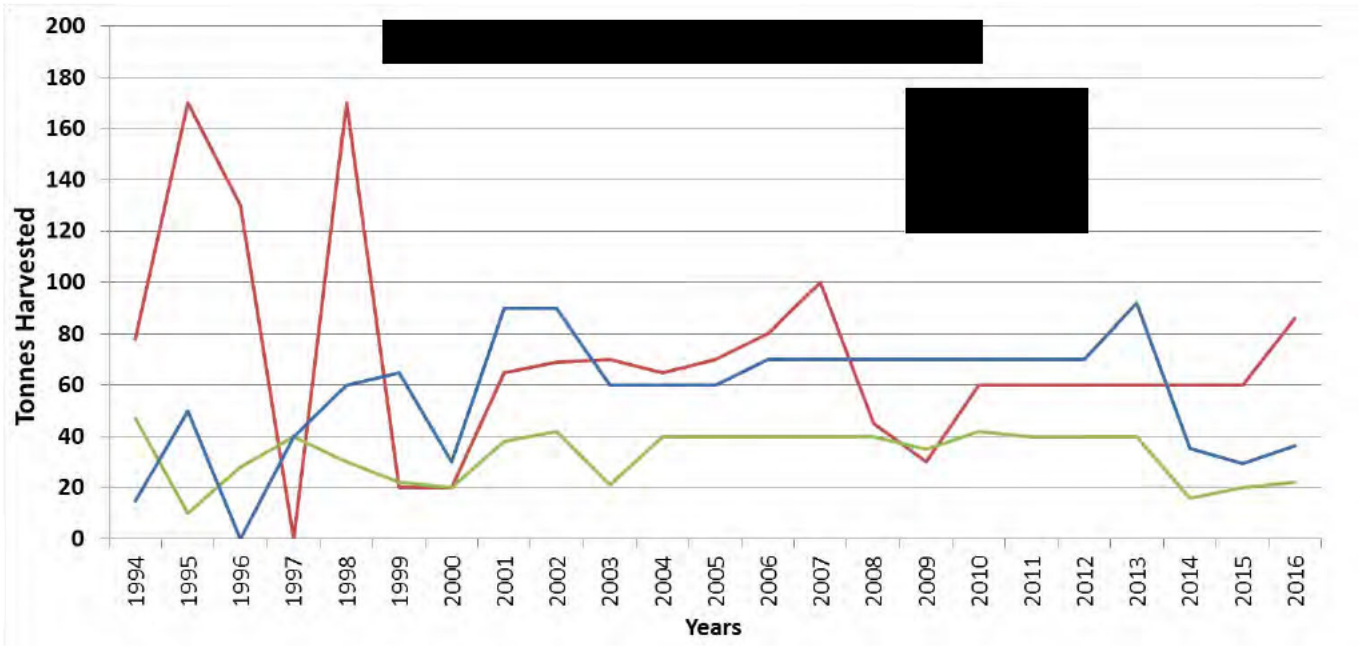



**Figure 1.** Annual harvested mussel tonnages (fresh and processed) over a 22 year period. Mussel farmers are grouped [redacted] depending on the general site locations in Kilmakilloge Harbour.

**Historical Trends**

Rope mussel farming started in Kilmakilloge Harbour back in 1979 and has been growing steadily since. However, from 1992 onwards the farmers began to notice problems with mussel seed collection and lower growth rates in many parts of the Harbour.

Naturally certain areas within a Harbour will produce superior mussel yields within a shorter time period, due to food availability, water flow quality and proximity to other active mussel longline sites. The introduction of extra mussel longlines or the increased number of droppers between barrels onto a particular site does not necessarily increase the mussel yield in that site, but may have an opposite effect. This can also have downstream consequences, which can particularly impact on neighbouring sites. From the annual tonnage information from 1994 to 1998 on the [redacted], mussel production of [redacted] exponentially increased which significantly impacted the production and seed collection of neighbouring farms, particularly [redacted] annual tonnage (Figure 1).

A more recent example of this occurring again is the introduction of extra longlines onto site [redacted] which has increased the annual mussel tonnage of this site over the last 5-6 years, but may be contributing to the decreased annual mussel

tonnage harvested on site [redacted] (Figure 4 & 5). However, site [redacted] crop/seed longlines [redacted], respectively, which could be aggravating the lower harvested mussel yield over recent years. Although the historic annual harvested mussel tonnages can highlight certain issues, it is not telling the whole story and a combination of other factors can also be impacting.

Other trends can be seen throughout the 22 year data set, particularly the dramatic fall in harvested mussels in the year 2000 among all farmers (Figures 1 & 2). This coincided with extensive periods of harmful algal blooms which resulted in prolonged closures as the toxin levels in the shellfish flesh were above the regulatory limit for harvesting.

Over a two decade period the annual reported harvested tonnage has averaged around 600 T, with the last 6 - 7 years yielding relatively consistent higher yields of approximately 700 to 880 T (Figure 2). Some inconsistencies may be due to farmers holding back stock to sell at a later date because of poor market prices, harmful algal bloom events, lower mussel spat settlement in a particular year, all of which have knock on affect on the annual mussel tonnages reported.

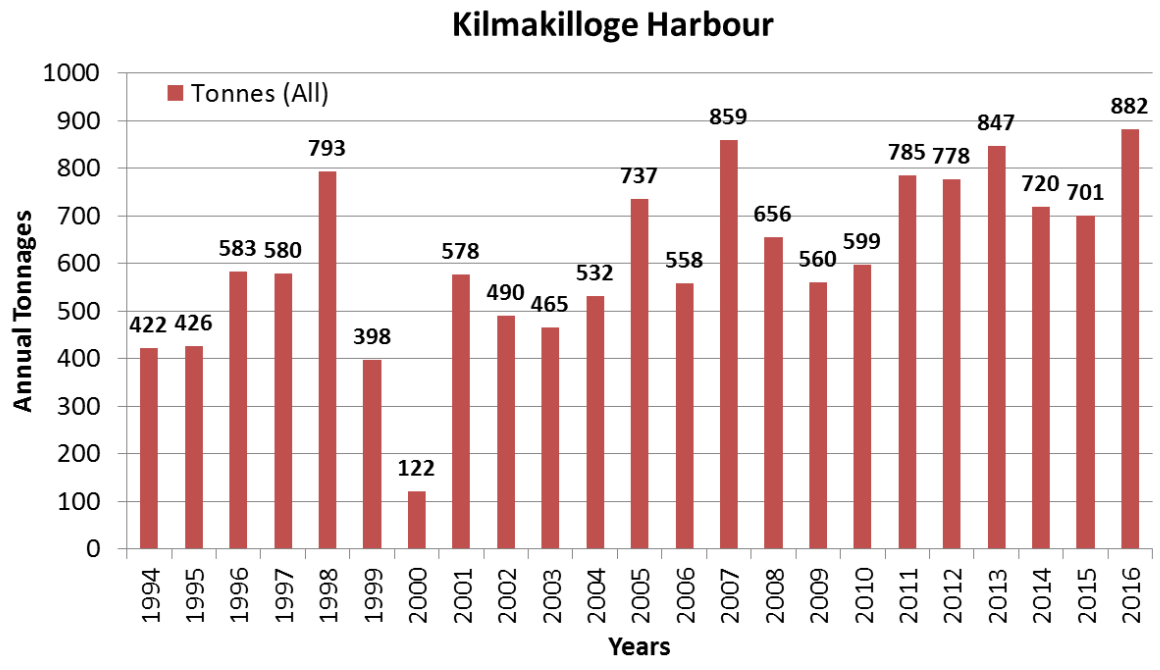



**Figure 2**. Total reported annual mussel tonnages harvested (fresh and processors) in Kilmakilloge Harbour over a 22 year period.

**Current Status**

Prior to 1996 there was 58 hectares of mussel longline sites licensed in Kilmakilloge Harbour (Figure 3) and this increased to 61 hectares in 1999 (see Appendix A, Table A1). There are currently 37 hectares of active mussel longline sites waiting on renewal and 32 hectares of new applications (many of these sites were previously licensed) waiting decision. Of these, 24 hectares have been applied for by from Kush Seafarms Ltd. (Figure 4; Appendix A, Tables A2, A3 & A4).

When the original applications for the mussel farms were made in the 1990's there was no easily available accurate method of locating sites on the water apart from DECCA, the use of radar and line of site. There were also problems transferring projections from Admiralty Charts onto the Ordinance Survey Ireland (OSI) maps. In addition, to make the positioning easier on drafting the maps, a North South one hectare grid system was used on the OSI maps. Hence, the regularised shape of the applications in Figure 3 (and the overlapping projection of sites onto land). At the time farmers only considered the surface structures and did not make provision for the positioning of anchors etc. within the licensed site as is now required. These issues have contributed to some of the current problems in the Harbour.

Generally mussel seed in Killmakilloge Harbour is obtained from putting out collection ropes onto which naturally occurring mussel larvae will settle. The main practice is to leave these seed collectors out, without stripping and repacking, until marketable size, usually 45 to 60 mm. However, there are some operators which incorporate thinning, stripping and repacking of mussel lines (as is the common practice in most of the other bays in the South West). [redacted] operates three sites in Kilmakilloge Harbour; [redacted] in the West and site [redacted] on the East side of the Harbour. [redacted]

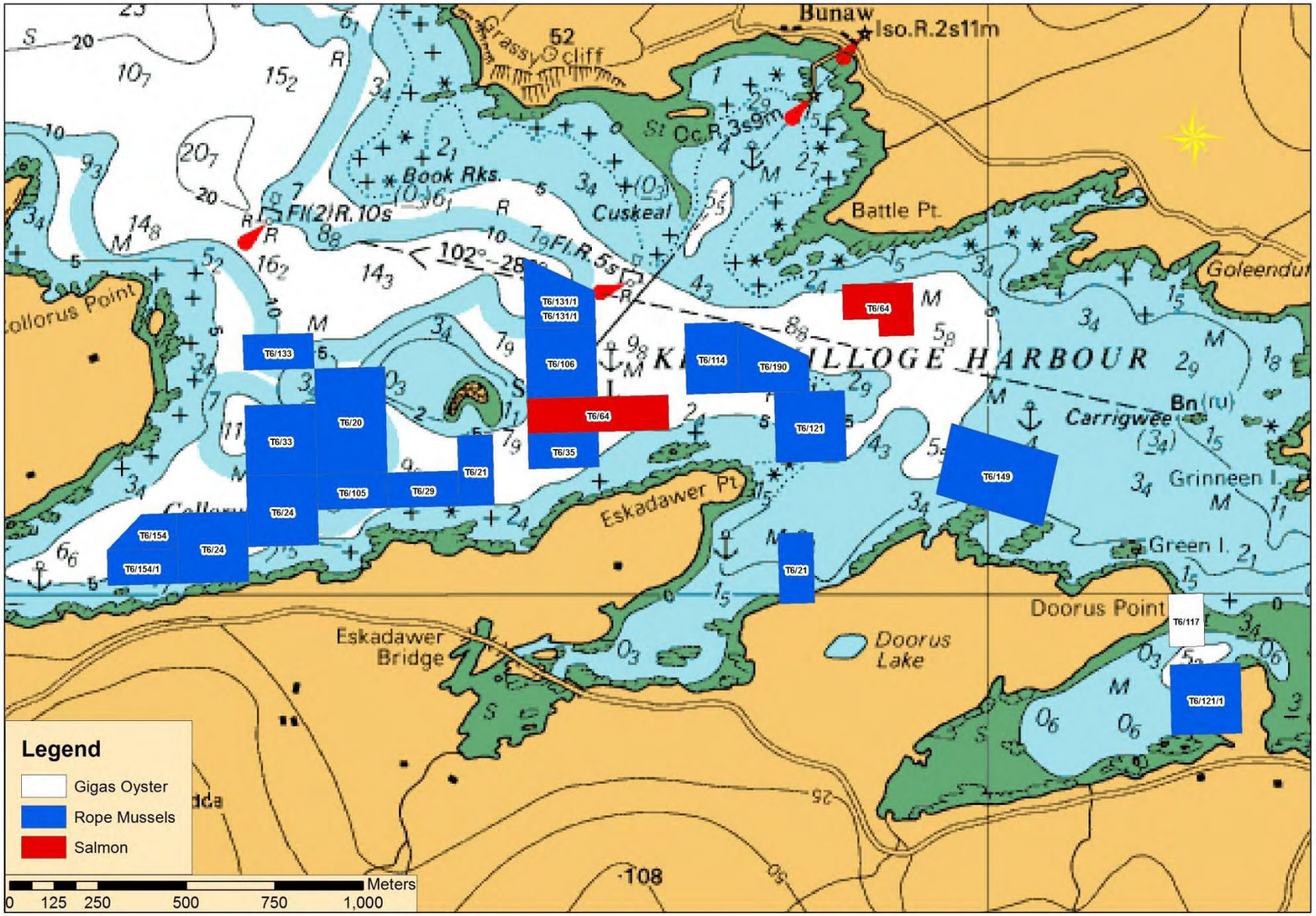



**Figure 3.** Licensed rope mussel, oyster and salmon farm sites during the period up to and including the year 1999 in Kilmakilloge Harbour.

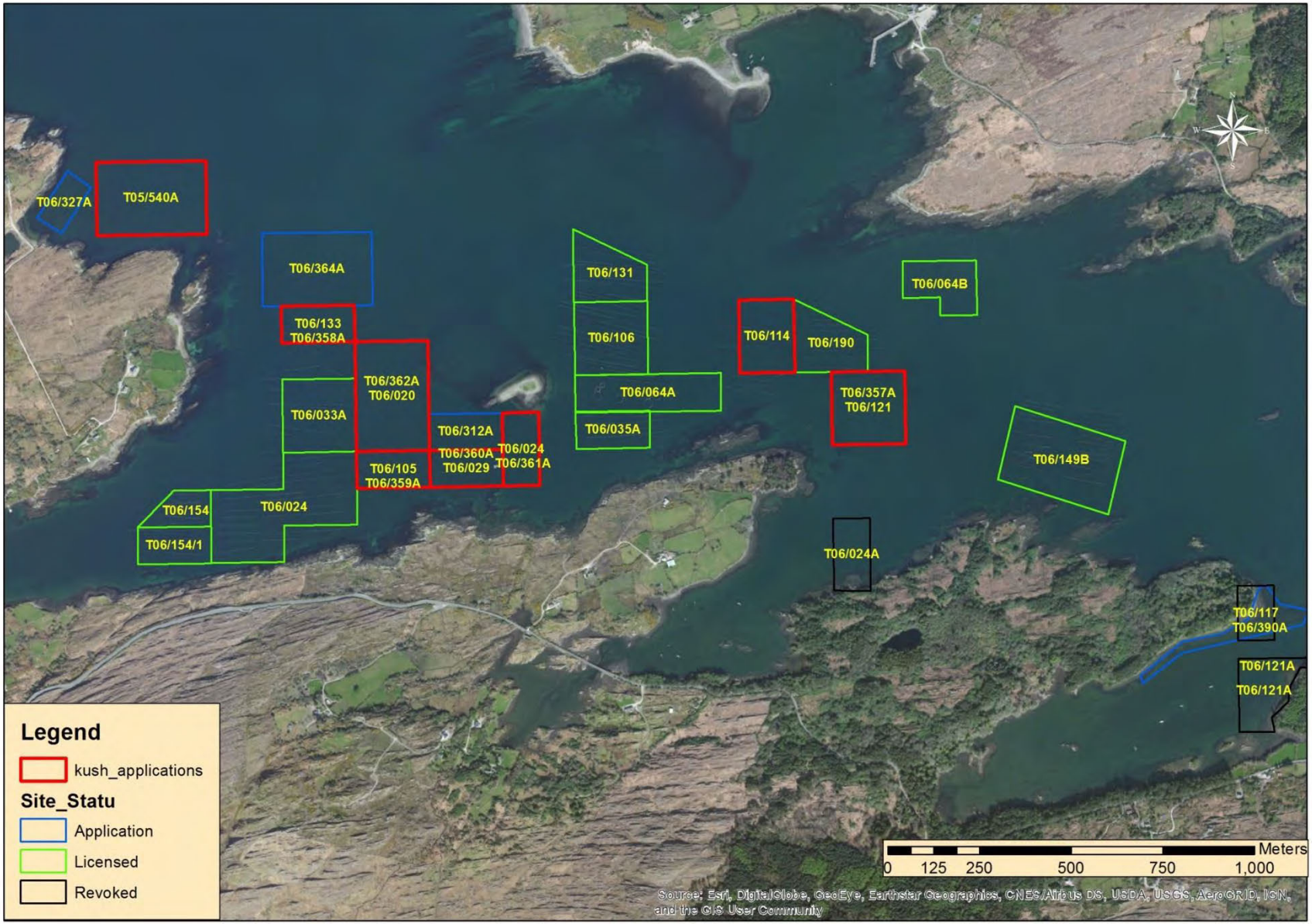



**Figure 4.** Kilmakilloge Harbour with licensed rope mussel sites waiting on renewal marked in green, application sites marked in blue and red (Kush Seafarms Ltd). Note T06/064A & 064B are Salmon farm sites, T06/327A & T06/390A are scallop and oyster farm applications, respectively.

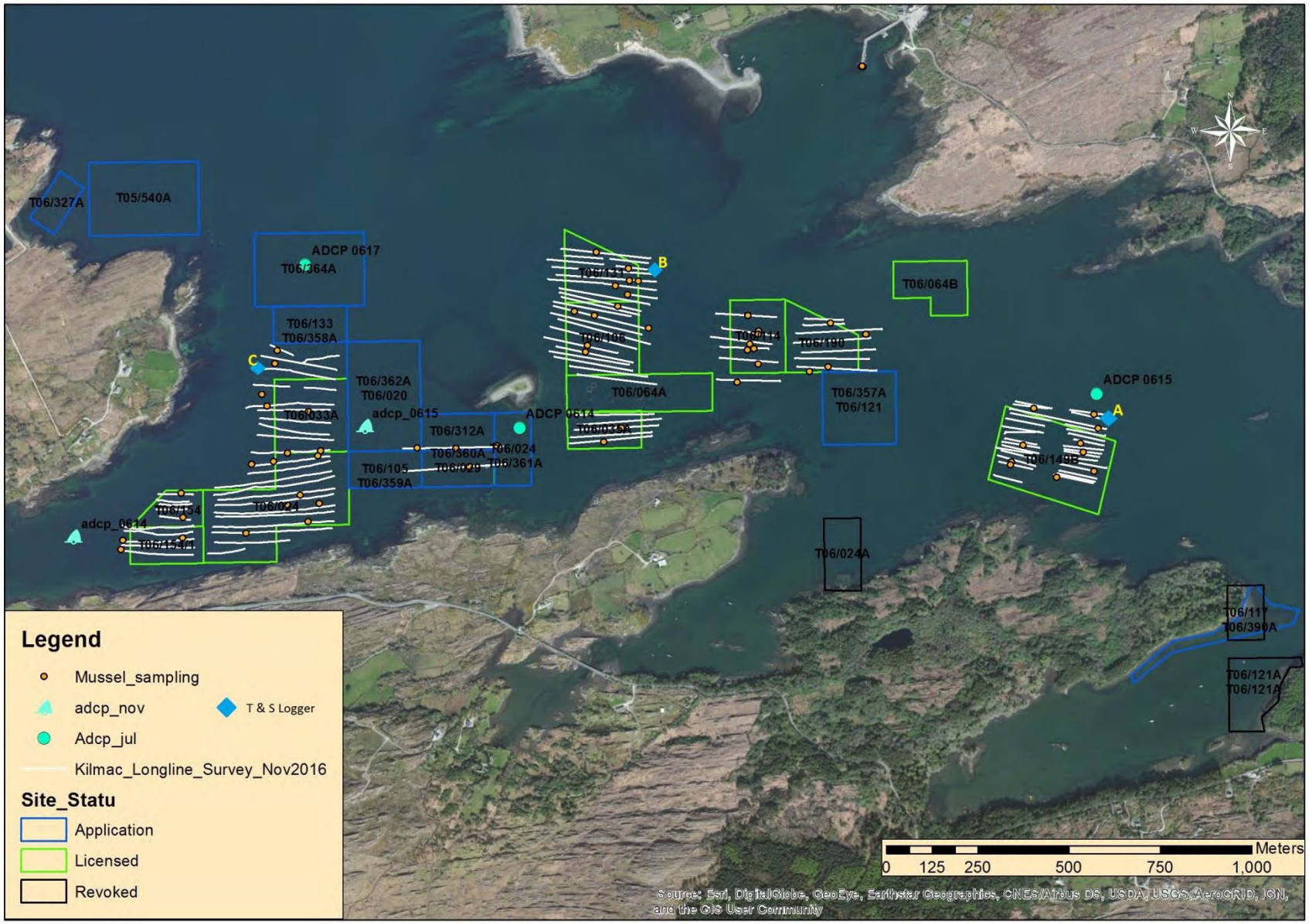



**Figure 5**. Kilmakilloge Harbour: actively farmed rope mussel sites with longlines marked in white. Orange points represent mussel sampling points from biomass survey carried out in November 2016.

## 3. Longline Survey November 2016

There are currently 9 active farmers in Kilmakilloge Harbour with a total of 11 actively farmed sites. Out of the 11 actively farmed sites, one is being operated under new application status (T06/312A), while the remaining 10 are waiting on renewal of their licences (Table 1).

The first biomass survey was carried out between 22nd and 24th November 2016. Each surface longline (all double headrope systems) length and location in the harbour was recorded using the Trimble GPS tracker (Figure 5 & see Appendix A, Figure A1). These longline locations were overlaid onto the rope mussel farmers licensed area. [redacted] (Table 1 and Appendix A, Figure A1). [redacted] Table 1 shows the total licensed hectares (under application for renewal or operating under Section 19(A)) assigned to each farmer compared to the number of hectares (covered by surface structures) in [redacted] Most farmers are farming similar hectares to their licensed hectares, and would require small modifications to [redacted] Figure 5 & Appendix A, Figure A1). It has been noted that slight modification to the location of the licensed area, may resolve some of these issues, whilst keeping the same hectares as per previous licence conditions. [redacted] and [redacted] are [redacted] (Table 1). There is also a problem in which two longlines North and South from site T06/106 are encroaching into [redacted] Figure 5 & Appendix A, Figure A1). [redacted]

The length of longlines in Kilmakilloge Harbour varies and a continuous longline in the Harbour would be typically over 200 m long. However, for the purpose of this reports analysis the length of one longline is represented as 110 m long. The total number of longlines for each mussel farm site is recorded in Table 2 along with the number of longlines per licensed hectare (Table 2). The number of longlines per licensed hectare is highly irregular between sites and can range between 3 and 7 longlines per hectare (Table 2). The

number of floats found on each site was also noted during the November 2016 survey with the average number of floats ranging between 23 and 31 per 110 m longline (Table 2). Flotation types in the Harbour are not uniform and there is a wide mixture being used, such as Gem plastics, Blue/Green second hand barrels from food sector, JFC and Rom across the majority of farmed sites (Appendix A, Table A7).

The number of droppers (the growing rope the mussels grow on which hangs below the surface) per licensed hectare compared to farmed hectares is presented in Table 3. Representing the number of droppers per farmed hectares gives a better overall indication of which farms have the highest and lowest density of droppers. [redacted] (Table 3). [redacted]

In the UISCE report on Killary Harbour the number of droppers per hectare was also discussed. At that time the Killary CLAMS group recommended the max number of 8 m droppers to be capped at 800 per Hectare. [redacted] when considering the actual farmed hectares (Table 3). However, the Killary UISCE report cannot be directly compared to Kilmakilloge Harbour, but may serve as a reference point to work from (Nunes *et al*. 2011, UISCE Summary Report 2010).

Kilmakilloge Harbour has an overall surface area of 550 hectares, of which 37 hectares is currently licensed for rope mussel cultivation but roughly 49 hectares is currently farmed in the Harbour. This is equivalent to the total area of the harbour being 10.2 times the farmed area.

Limiting the flotation on the licences to 18,000 litres per hectare was also recommended in Killary Harbour. If Kilmakilloge was to adopt this theoretical limitation the total flotation each farm would need to remove is highlighted in Table A6 in Appendix A.

**Table 1.** Kilmakilloge active farmers list with corresponding licence reference, licence area (ha), actively farmed surface area (ha) and percentage of longlines outside and inside licensed areas.

| **Operator / Producer** | **Carl Daly** | **Finbarr Daly** | **Kush Seafarms** | **Kush Seafarms** | **Kieran Lyons** | **Patrick Cronin** | **Shamrock Shellfish** | **Shamrock Shellfish** | **Kush Seafarms** | **Declan Sullivan** | **Ross Shellfish Ltd** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Licensee /Applicant** | **Carl Daly** | **Finbarr Daly** | **Paul Kelly** | **Paul Kelly** | **Kieran Lyons** | **Patrick Cronin** | **Sean McCarthy** | **Sean McCarthy** | **John Harrington** | **Declan Sullivan** | **Raymond Ross** |
| **Licence Ref.** | **T06/033A** | **T06/024** | **T06/154** | **T06/154/1** | **T06/312 Application** | **T06/131** | **T06/035A** | **T06/106** | **T06/114** | **T06/190** | **T06/149B** |
| **Licence area (ha)** | 4.00 | 8.00 | 1.50 | 2.00 | 2.00 | 3.00 | 2.00 | 4.00 | 3.00 | 3.00 | 6.50 |
| **Farmed surface area (ha)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| **Longlines outside licensed area (%)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| **Longlines in licensed area (%)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Table 2.** Kilmakilloge active farmer list with corresponding; licence reference; number of longlines surveyed during November 2016; number of floats; number of equivalent 110 m longlines; average number of floats per 110 m; number of longlines per licensed Hectare and number of longlines per farmed surface Hectare.

| Licensee | Carl Daly | Finbarr Daly | Paul Kelly | Paul Kelly | Kieran Lyons | Patrick Cronin | Sean McCarthy | Sean McCarthy | John Harrington | Declan Sullivan | Raymond Ross |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Licence Ref. | T06/033 A | T06/024 | T06/154 | T06/154/1 | T06/312 Application | T06/131 | T06/035A | T06/106 | T06/114 | T06/190 | T06/149B |
| No. Longline Survey Nov 2016 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| No. floats | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| No. of equivalent 110 m longlines | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Av. No. of floats per 110 m longline | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| No. of longlines per licensed Ha | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| No. of longlines per farmed surface Ha | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Table 3.** Kilmakilloge active farmer list with corresponding licence reference and estimated number of droppers per licensed hectare; number of droppers per farmed Ha and total dropper length on each farm (m).

| **Licensee** | **Carl Daly** | **Finbarr Daly** | **Paul Kelly** | **Paul Kelly** | **Kieran Lyons** | **Patrick Cronin** | **Sean McCarthy** | **Sean McCarthy** | **John Harrington** | **Declan Sullivan** | **Raymond Ross** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Licence Ref.** | **T06/033A** | **T06/024** | **T06/154** | **T06/154/1** | **T06/312 Application** | **T06/131** | **T06/035A** | **T06/106** | **T06/114** | **T06/190** | **T06/149B** |
| **No. of droppers per licensed Ha** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| **No. of droppers per farmed Ha** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| **Total dropper length on farm (m)** | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

# 4. Biomass Results

## 4.1 *Total tonnage and mussel measurements*

Total mussel biomass surveys were undertaken in November 2016 and August 2017 over a two/three day period, respectively. It must be noted that harvesting of mussels can be continuous especially between August and February. The calculated biomass of mussels at the time of each survey is given in Tables 4 & 5 which includes an estimate of harvested stock from the empty lines present at the time of the surveys to show the potential biomass if all the lines were full at that particular point in time.

Kilmakilloge is in a state of balance of around 18 month's growth cycle, which is discussed in more detail in Section 5.

The total annual harvested tonnage of 882 T reported in 2016 for Kilmakilloge Harbour was the highest it has been over the last 22 years. Because of the continuous nature of the harvesting and growth of the mussels a standing biomass of between 750 to 1,000 T is sufficient to produce an annual harvest crop of around the same level as long as the growth period remains at less than two years.

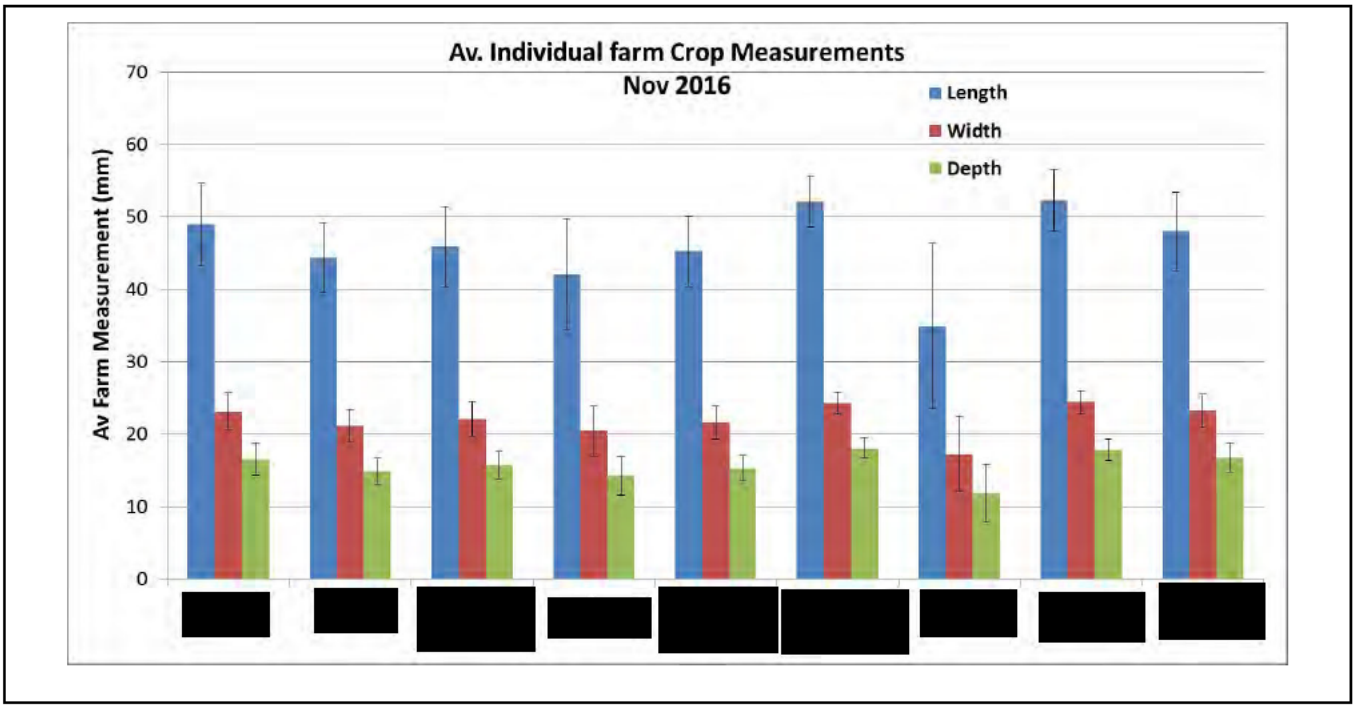
In general when looking at individual sites there is a [redacted] (see Appendix A, Figure A2 to A4). However, when comparing all the sites, both in November 2016 and August 2017 surveys, the difference between sites is small and is more apparent in half grown and seed growth stages (Figure 6 & 7). [redacted] This is discussed further under mussel growth rates in Section 5 below.

**Table 4.** The average total weight and standard deviation in tonnes (T) for the November 2016 mussel survey.

| | Survey Tonnage | Assumed Tonnage of Empty lines | Total Tonnage | Total Crop | Total Half grown | Total Seed |
|---|---|---|---|---|---|---|
| **Av. Total Weight (T)** | 978 | 59 | 1037 | 500 | 192 | 286 |
| **ST. Total Weight (T)** | 195 | 8 | 203 | 85 | 19 | 91 |

**Table 5.** The average total weight and standard deviation in tonnes (T) for the August 2017 mussel survey.

| | Survey Tonnage | Assumed Tonnage of Empty lines | Total Tonnage | Total Crop | Total Half grown | Total Seed |
|---|---|---|---|---|---|---|
| **Av. Total Weight (T)** | 756 | 13 | 769 | 197 | 509 | 50 |
| **ST. Total weight (T)** | 152 | 2 | 154 | 37 | 101 | 13 |



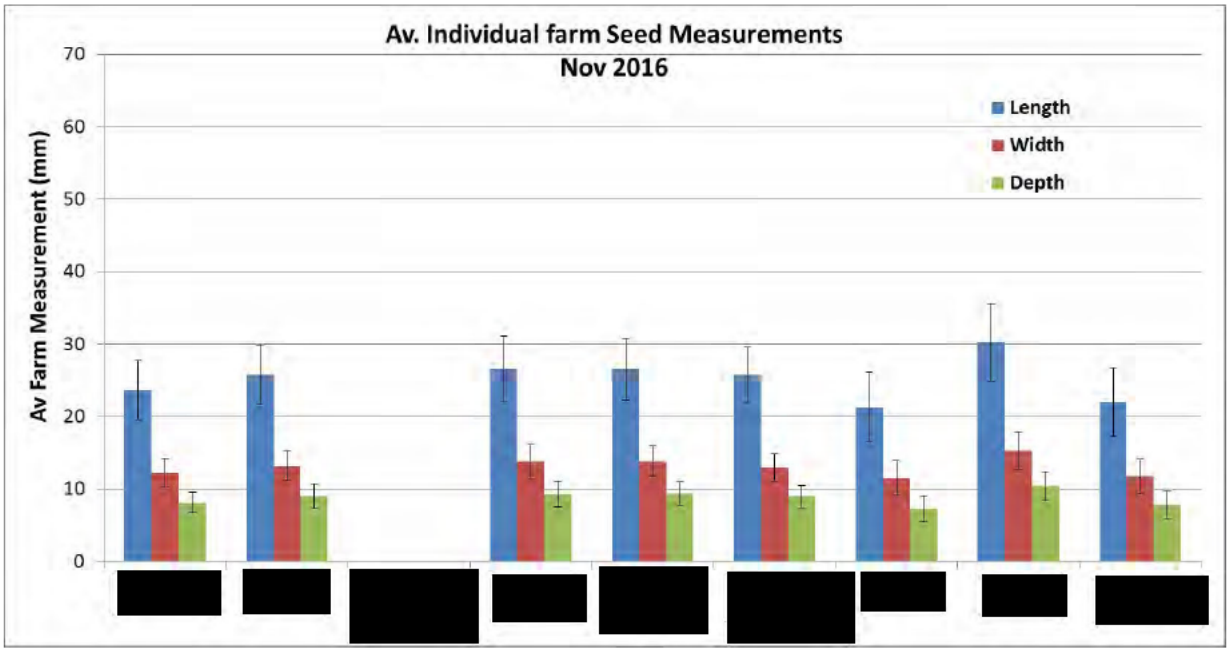
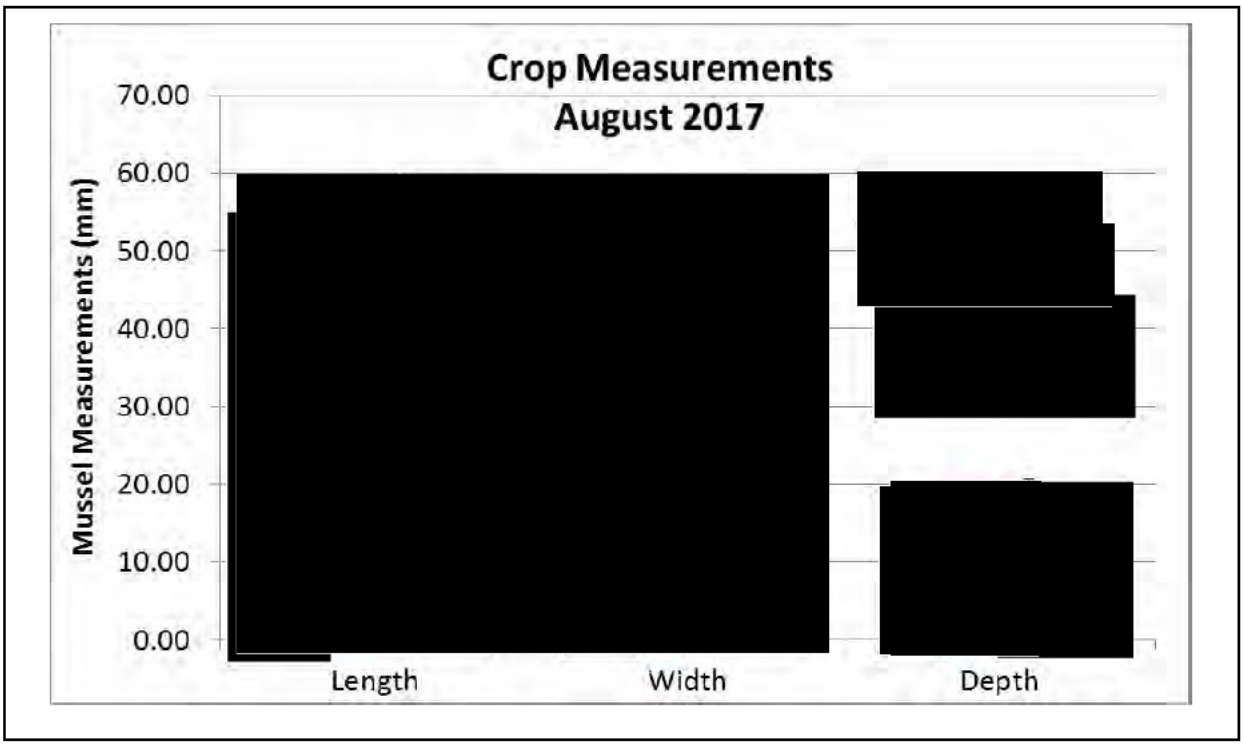
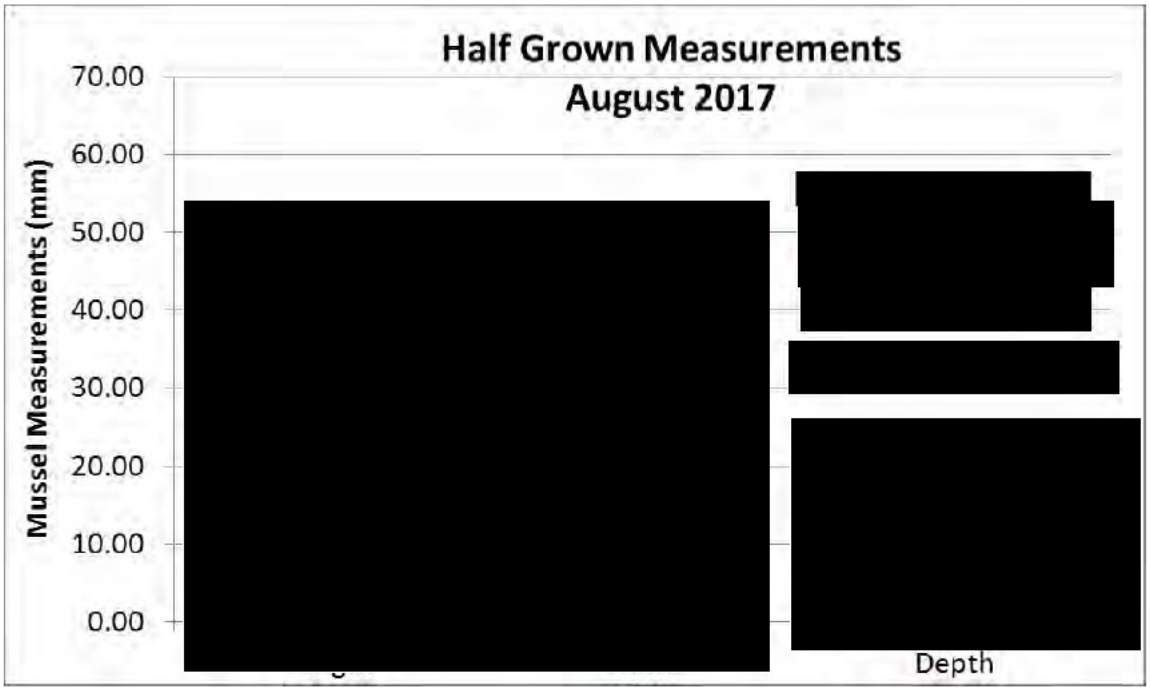



**Figure 6**. Average Individual farm crop (above) and seed (below) measurements from the November 2016 Survey.





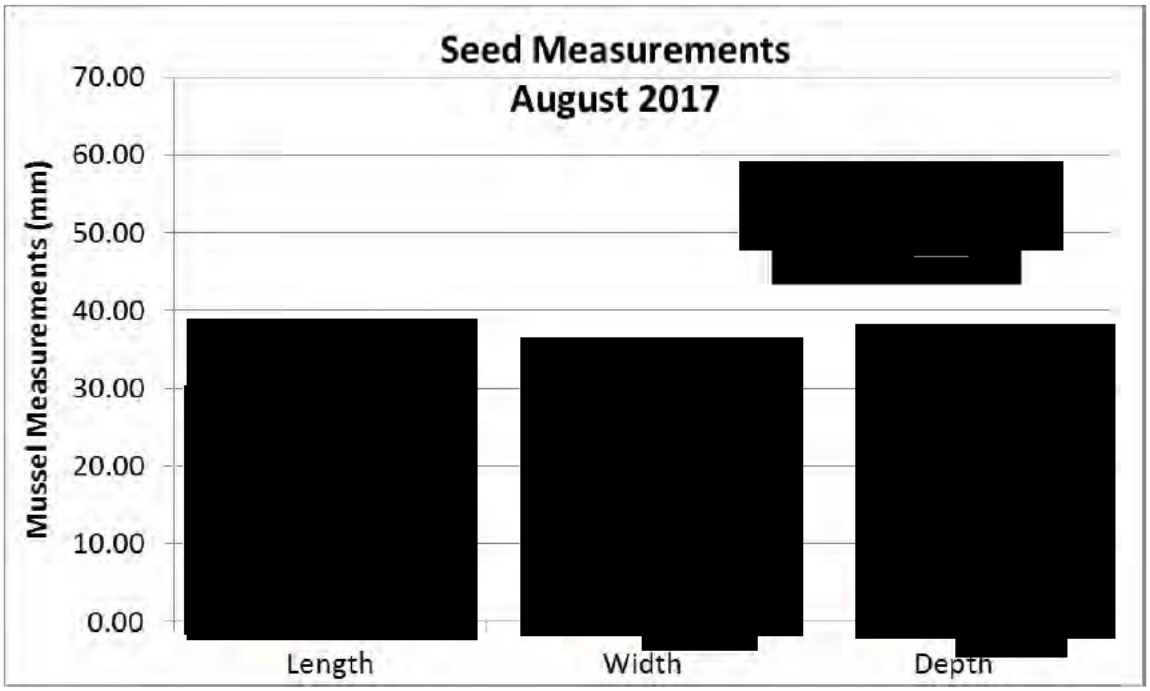




**Figure 7.** Average mussel measurements of Crop (top), Half Grown (middle) and Seed (bottom) from [redacted] sampled during August 2017 survey.

## 4.2 *Meat Yields from Biomass Surveys*

During the November 2016 and August 2017 biomass surveys, mussel samples were taken from strategic/representative points within each actively growing site in Kilmakilloge Harbour (Figure 5). Mature crop samples were taken from the outer, middle and inside longlines with some samples also taken from the West/East of each individual farm to give a broad range of mussel quality in the entire site. This meant that three to five mature crop samples were taken from each site. Half grown and seed samples if available were also taken from each farm depending on the growth cycle during that period. Sub-samples (30 or 50 cm) of mussels were stripped from droppers at 2 m depth at each location. On site the dropper lengths were noted, type of rope used, number of droppers between floats, distance between each float, number and type of float on each longline and length/position of each longline. This was done for the whole of Kilmakilloge Harbour.

Mussel samples from each site were weighed, sub-samples from these were weighed, counted and measured (minimum of 100 mussels). Thirty mussels were randomly selected and individually weighed and the length, width and depth were measured. The mussels were placed in a saucepan with a tight fitted lid and a cup of water. Meat yield was calculated using the following protocol below.

**Meat yield protocol**

Randomly select 30 mussels. Dry their shell and weigh them (sample weight).

Place mussels in saucepan with tight fitted lid and one cup of water.

Steam cook the mussels for 2 mins or until shells open.

Remove the meats from shells pat dry with kitchen/paper towel and weigh the meats.

$$\text{\% Meat yield} = \frac{\text{Weight of mussel meats} \times 100}{\text{Sample weight}}$$

Meat yields were averaged from the three to five mature samples taken from each farmer's site. Each individual farm's meat yield for November 2016 and from four selected sites in August 2017 were averaged and compared. These results give a good indication on the quality of mussel on each farm, which also gives an indication on the overall food availability throughout the year. This can also tell us to a certain extent which farms are impacting on

others and which areas are more favourable for growth. It should be noted however, farming practises can also impact on individual farmer's meat yields and must also be considered when comparing average meat yields from each farmer's sites.

During the November 2016 survey the highest meat yields were observed at sites [redacted] and [redacted] sites (Figure 8). [redacted] and [redacted] these three sites are located in the [redacted] Kilmakilloge Harbour, respectively (Figure 5 & 8). [redacted], along with other factors, to this [redacted] Also, noted previously due to thinning and repacking with the relocation of half-grown lines means that this [redacted] compared to longline sites which rely on natural seed collection. The [redacted] in Kilmakilloge Harbour is site [redacted] and the f[redacted] Figure 5 & 8). However, farming practices could also be a contributing factor.

During the August 2017 biomass survey from the four sites chosen (Figure 9), [redacted] November 2016 survey (Figure 9). [redacted] and [redacted] showed consistently higher meat yields (Figure 9).

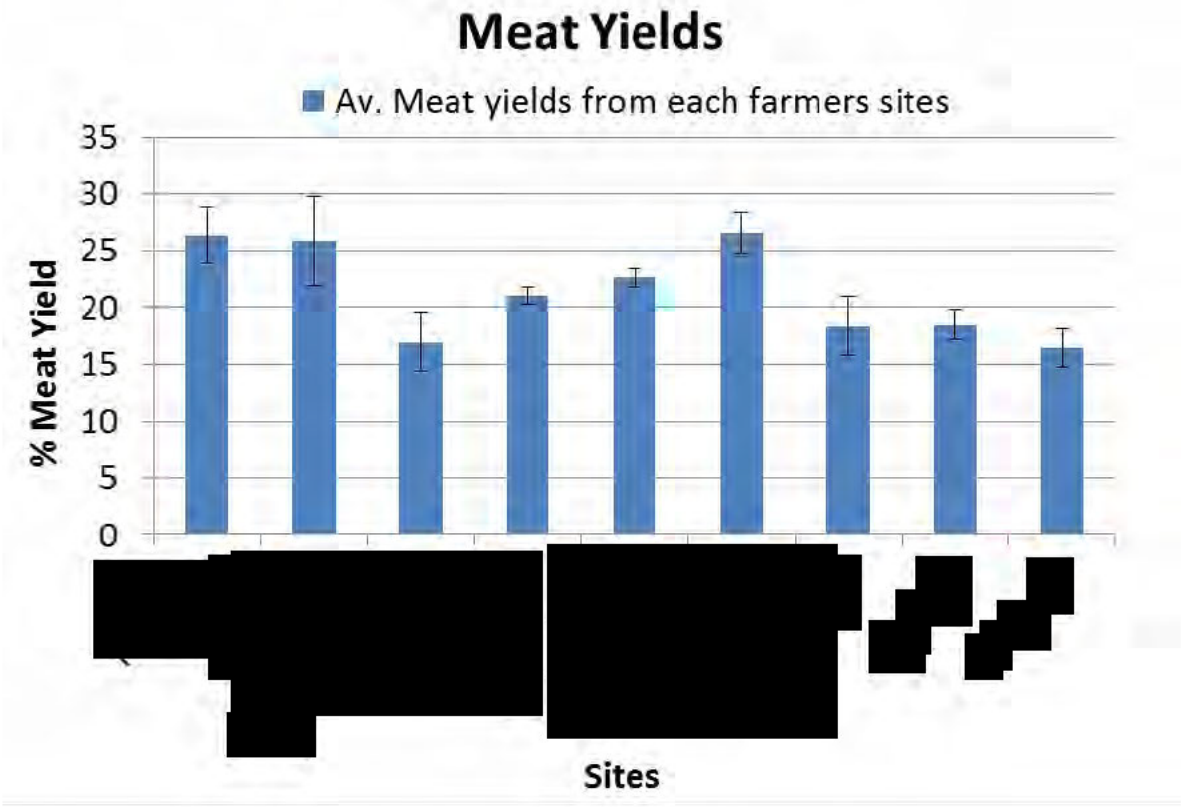



**Figure 8.** Average meat yields from each actively growing mussel farm site in Kilmakilloge Harbour during November 2016 survey.

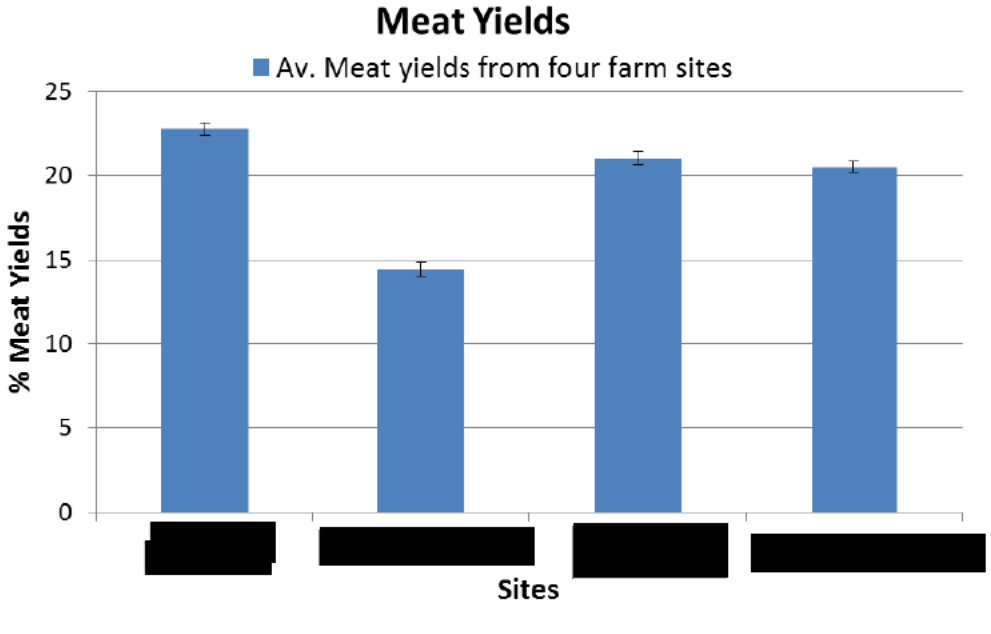



**Figure 9.** Averaged meat yields from four selected mussel farm sites licenced to [redacted] and [redacted] in Kilmakilloge Harbour during August 2017 survey.

## 5. Mussel Growth Rate

[redacted] were chosen to monitor the mussel growth rate within Kilmakilloge harbour. These sites were the same locations as the A[redacted] stations marked in Figure 5. Every two to three months, mussel sub-samples were removed from the droppers containing the temperature and salinity loggers. This coincided with checking and downloading logger data which occurred on four occasions from 02.02.17 to 18.10.17.

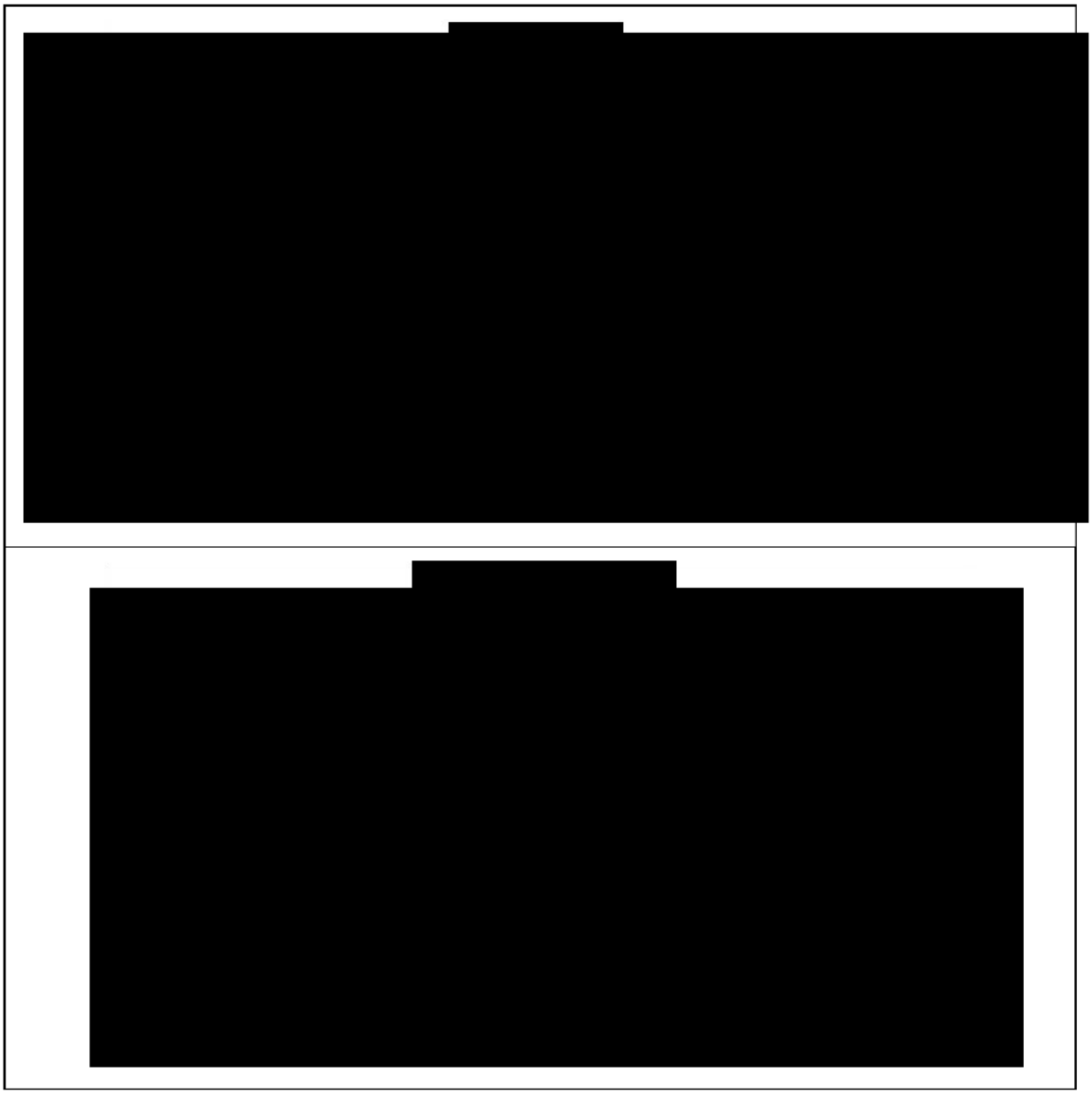
The results show the steady growth of mussels over a 9 month period with the frequency of size ranges moving to a more favourable harvestable mussel size range of 50 - 55 mm in October 2017 (Figure 10 & 11). The spat settlement of this group of mussels would have begun in May/June 2016, giving a 16/17 month growth cycle up to October 2016. However, farmers will be harvesting a number of tonnes every few weeks from this date, with the main bulk more likely harvesting between November and February when market prices for mussels are at their highest.

Although there has been a steady increase in mussel size, there has been over 80 % decrease in the average pieces/meter from seed to mature crop across the natural collection sites which where thinning and repacking practices are not implemented (Figure 12). Therefore, the density and mortality are significant big factors affecting growth rates and meat yields in Kilmakilloge Harbour. Also, there are indications that [redacted] being [redacted] (where larger mussels on the outside of the droppers fall off) during winter conditions. In particular the size range frequencies in [redacted] site in February and April stay similar, which would indicate little growth and therefore mussel drop off occurring during these months (Figure 10).

The average pieces/meter of crop on the [redacted], [redacted] of the Harbour generally increases when moving from [redacted] the November 2016 biomass survey (Appendix A, Figure A5).This is also the case with seed in the [redacted] and [redacted] and [redacted] during this period (Appendix A, Figure A5).

There was little difference in Crop pieces/meter between the [redacted]) during the August 2017 survey (Appendix A, Figure A6). However there was generally higher pieces/meter in sites [redacted]

The findings indicate that in the [redacted] This is generally consistent with the mussel length, width and depth measurements observed across the Harbour as discussed in Section 4.



[redacted]

**Figure 10.** Mussel size range frequencies from [redacted] Kilmakilloge Harbour over four sampling periods.

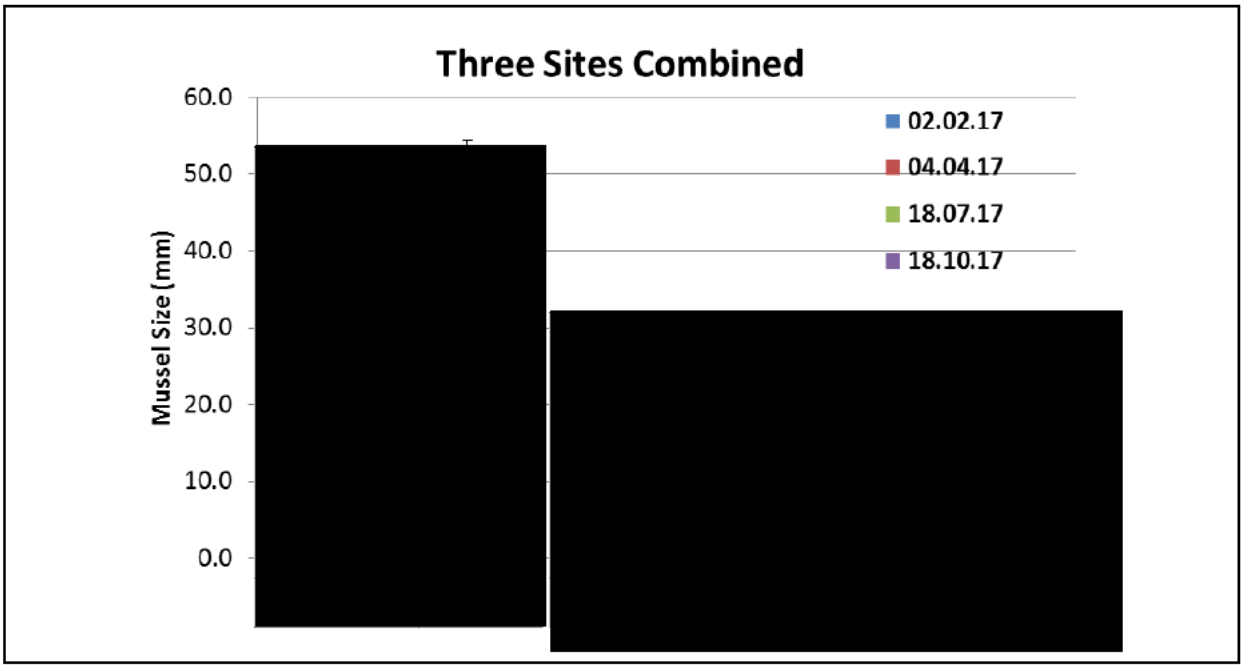



**Figure 11**. (Above) Combined average length, width and depth of mussels from three combined sentinel site locations over four sampling time periods. (Below) Average pieces/kg of three combined sentinel site locations over four sampling time periods.

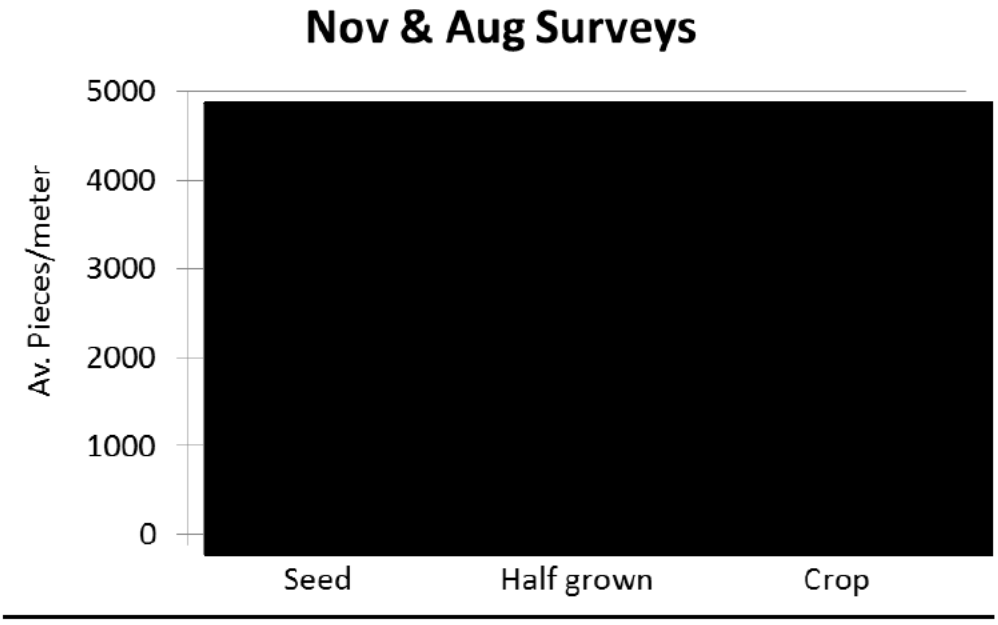


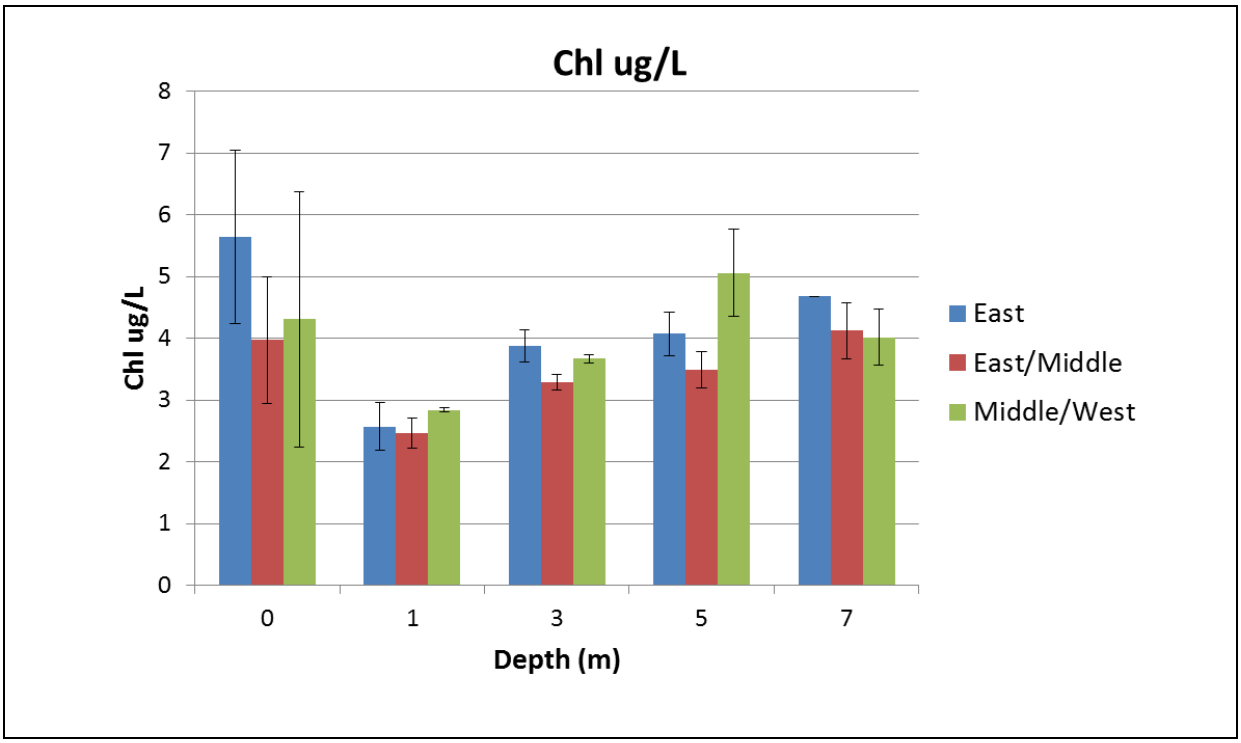

**Figure 12.** Average pieces/meter of seed, half grown and crop from sites [redacted] Combined results from the November 2016 and August 2017 sampling surveys.

## 6. Phytoplankton Depletion Study

### 6.1 *5th & 6th April 2016 survey*

The main objective was to determine the extent of phytoplankton depletion through the mussel longlines in Kilmakilloge Harbour from East to West on the outgoing tide and West to East on the incoming tide. On the 5th April 2017 the survey followed an East to West direction following the outgoing tide. On the 6th April 2017 the survey followed a West to East direction following the incoming tide.

The monitoring equipment, the EXO2 Sonde, used in this survey can detect a number of environmental parameters such as temperature, salinity, turbidity, dissolved oxygen and total algae. Results from the EXO total algae PE sensor, which is a digital smart sensor for chlorophyll and phycoerythrin, are presented from fixed depths ranging from surface (0), 1, 3, 5 and 7 meters depending on the station depth profiles (Figure 13 & 14). The EXO2 Sonde was deployed at sampling points at various positions around the mussel longline farms covering the inner, middle and outer parts of Kilmakilloge Harbour.



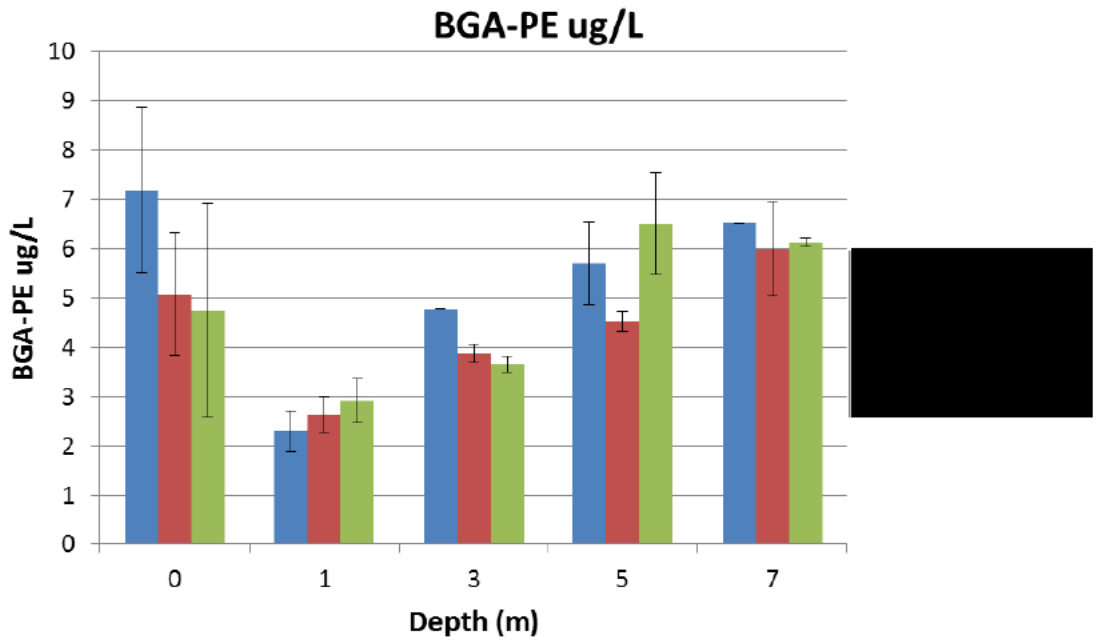



**Figure 13.** Average chlorophyll (Chl ug/L) and phycoerythrin (BGA-PE ug/L) EXO2 sonde results from the sampling points of [redacted] (05.04.17) at the most Eastern half of the Harbour during high tide and sampling points were taken over a 3 hour 30 mins time period following the outgoing tide toward the [redacted] of the Harbour.

During the 5th April 2017 survey there appeared to be a lower proportion of phytoplankton located around 1 to 3 m depth throughout the Harbour. This depth is a particularly active mussel feeding depth as it is the middle area of the droppers suspended on the mussel longlines. Dropper length runs from the surface to a depth of around 5 to 7m throughout the Harbour. The highest concentration of mussels are located between 1 and 4 m on the droppers, with the first meter being subjected to surface water chop and last one/two metres of droppers falling foul of competing species for space or hitting the sea floor at low tides, which results in fewer mussels at these depths (survey observations, results not shown). Therefore depths of around 3 m are good areas of the water column to show phytoplankton depletion trends throughout the study area of Kilmakilloge Harbour during incoming and outgoing tides. However, it should be noted that there will not necessarily always be less phytoplankton at these depths.

Blooms of algae can develop in such high numbers and at varying depths in the water column, that filter feeding mussels may have very little impact on their depletion or increasing numbers when conditions are favourable for growth. These results only give an indication of what may be happening on one particular day in an entire year.

On the 5th April 2017 the survey started at the [redacted] of the harbour during high tide and sampling points were taken in between mussel longlines over a 3 hour 30 mins time period following on from farm to farm on the outgoing tide toward the [redacted] of the harbour. The average phycoerythrin levels observed from three sections of the bay at a depth of 3 m decreased from East to West (Figure 13).

This can also be observed during the 6th April 2017 survey with average chlorophyll and phycoerythrin levels also decreasing from [redacted] at a depth of 0 to 3 m (Figure 14). This survey started at the most [redacted] the harbour during low tide and sampling points were taken in between mussel longlines over a 3 hour 30 mins time period following the incoming tide toward the [redacted] the Harbour. It was also noted that a higher proportion of the phytoplankton had accumulated at a depth of 5 m with chlorophyll and phycoerythrin levels ranging from 2.7 to 5.61 Chl µg/L and 3.05 to 6.68 BGP-PE µg/L, respectively. This could have been why the depleting phytoplankton trend from [redacted] was not observed at this depth due to oversaturation. The individual farm sites of [redacted]

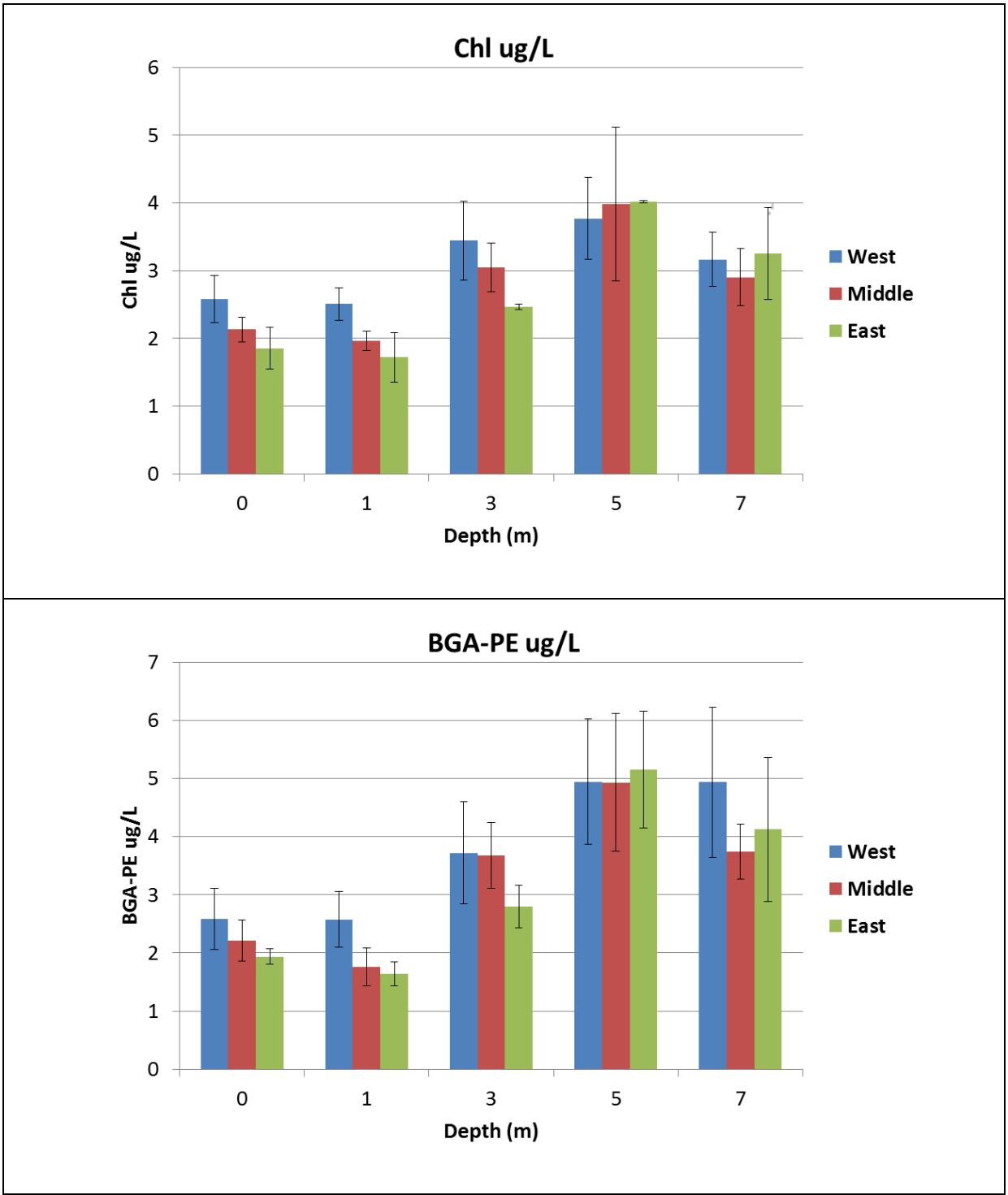
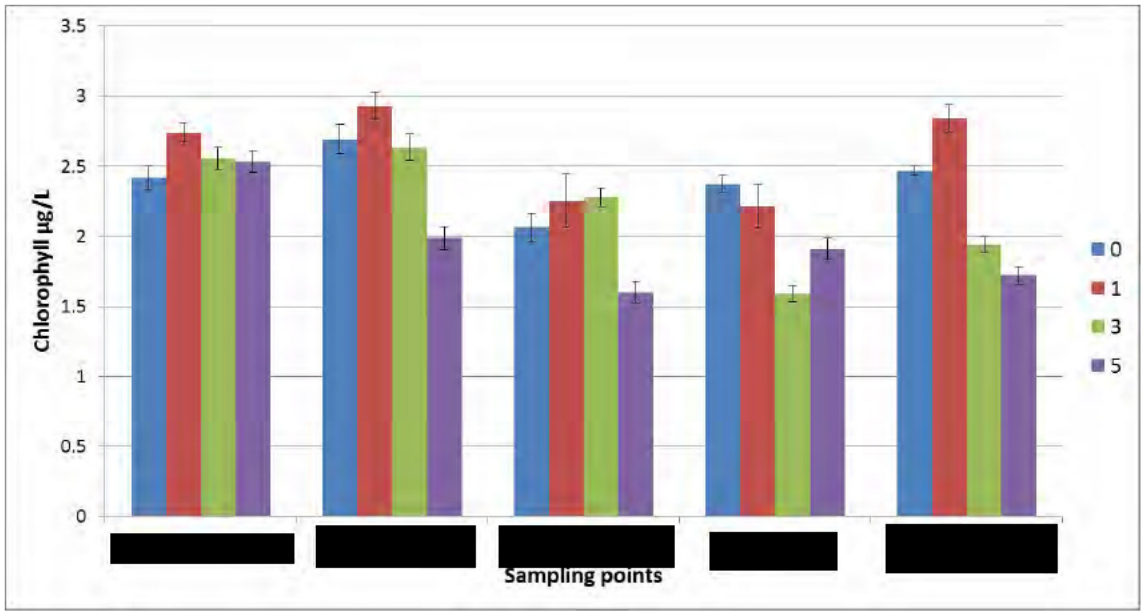



**Figure 14.** Averaged chlorophyll (Chl ug/L) & phycoerythrin (BGA-PE ug/L) EXO2 sonde results from the sampling points of [redacted] and [redacted] at profile depths of 0, 1, 3, 5 and 7 metres. The survey started (06.04.17) at the most [redacted] of the Harbour during low tide and sampling points were taken over a 3 hour 30 mins time period following the incoming tide toward the [redacted] of the Harbour.

## 6.2 *1st November 2017 survey*

A study was undertaken to assess the flow of current leading into site [redacted] to see if there was phytoplankton depletion from [redacted] across the farms during the incoming tide. This was to determine if this sheltered site was being impacted by the neighbouring farms (Figure 16). Two current meters (Acoustic Doppler Current Profiler (ADCP) units) were deployed on the [redacted] on the 18th October 2017 to cover a tidal cycle and retrieved two weeks later on the 1st November 2017. The ADCP locations chosen were [redacted] These ADCP units were deployed outside the mussel longline structures to prevent interference and potential backscatter (see Section 7 for further details). On 1st November 2017 the day of the retrieval, prior to lifting the two ADCP units, a number of EXO2 Sonde profiles were recorded at 0, 1, 3 and 5 m depths (Figure 16). One hour prior to high tide several station amongst the mussel longline structures were sampled between the [redacted] farm towards [redacted] (Figure 5).

The results show a general decrease of average chlorophyll and phycoerythrin levels from East to West during the incoming tide (Figure 15). This trend is more clearly observed at a depth of 3 m, from the three sampling point in-between the two ADCP sites which is consistent with observations performed in April 2017 as mention above.



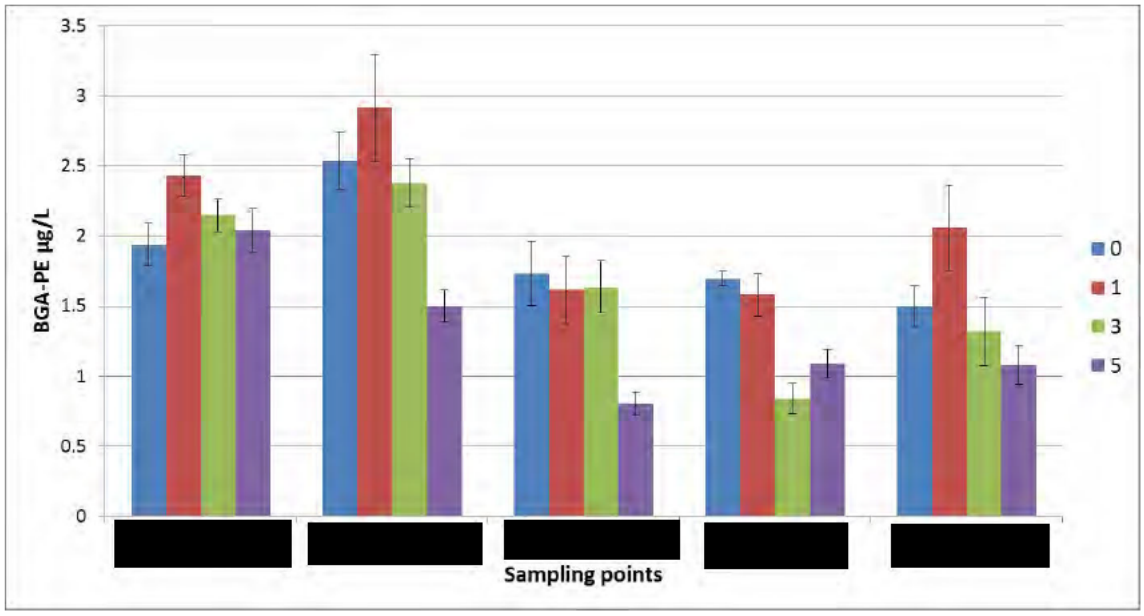




**Figure 15.** Average chlorophyll (Chl ug/L) & phycoerythrin (BGA-PE ug/L) EXO2 sonde results from the several sampling points starting at [redacted] and finishing at the [redacted] at profile depths of 0, 1, 3 and 5 metres. The survey started an hour prior to high tide on the 01.11.17.

## 7. Kilmakilloge current profile

Over a period of 21 days from 28th June to 18th July 2017, two ADCP 1200 KHz (0614 & 0615) and one ADCP 600 KHz (0617) unit (Rowes technology) were successfully deployed and retrieved in Kilmakilloge Harbour (Figure 16). These three ADCP units were deployed (28.06.17) at the following locations: mouth of the Harbour (ADCP 0617; 51°46' 27.16917"N; 9°49' 45.35347"W); behind Spannish Island (ADCP 0614; 51°46' 13.20687"N; 9°49' 14.78757"W); and in the inner Harbour area (ADCP 0615; 51°46' 16.57102"N; 9°47' 51.87912"W; Figure 16).

A second deployment of two ADCP 1200 KHz (0614 & 0615) was carried out from 18th October to 1st November 2017 as mentioned above in Section 6.2. Current profile data was successfully downloaded from each unit.

On the incoming tide the main current flow enters Kilmakilloge Harbour from a NW/NNW direction and exits on the outgoing tide from a SSE/SE direction in the middle and upper half of the water column (see Appendix B: Figure B1 and B2). Once the incoming tide enters the Harbour the water flow immediately hits a shallow shelf attached to the Western side of Spannish Island. This forces the main flow of water into two channels, one which travels directly East to the inner half of the Harbour past sites [redacted] whilst the other half of the flow is forced directly South through two shallow water channels west of the island passing sites [redacted]

During the outgoing tide, the flow of water passes by sites [redacted] from an E/ESE direction. The flow then meets the obstacle of Spannish Island again and splits into two channels. One channel stays on an ESE direction passing North of the island while the second flow of water moves quickly South of the island from an East direction through application sites [redacted]. Due to the mussel longline structures located on [redacted], the flow swings up from the South through the channels on the West of the island and finally leaving the Harbour from a SSE/SE direction.

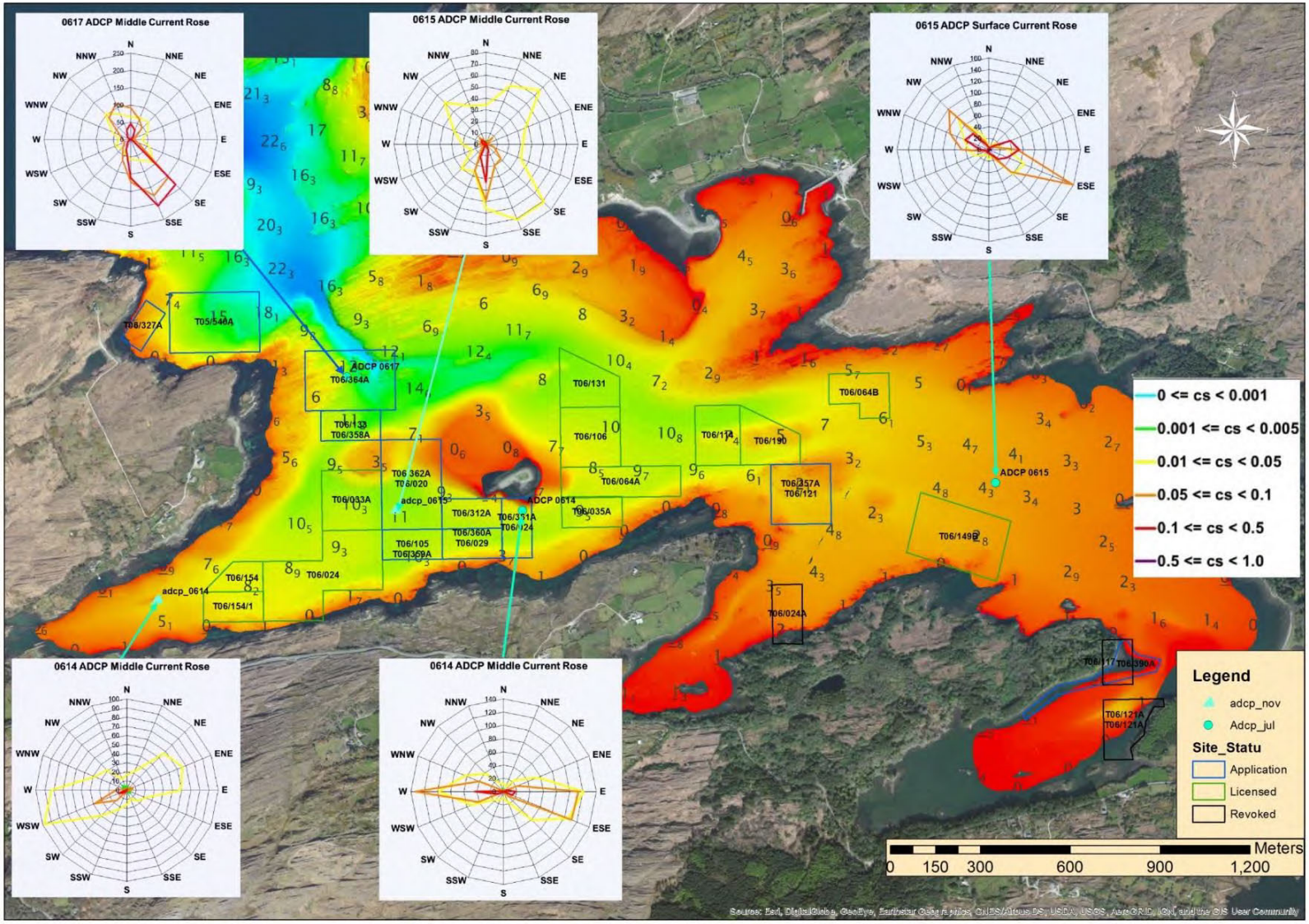



**Figure 16.** Current roses, directions of ADCP's 0617, 0615 and 0614 in Kilmakilloge Harbour during the 21 day deployment between 28.06.17 to 18.07.17 and additional deployment of ADCP's 0615 and 0614 for 14 days between 18.10.17 to 01.11.17. Each individual ADCP image represents the main current direction and velocity frequency ranges in the middle of the water column (except ADCP 0615 deployed in July which show surface readings) between 0 <= cs <= 1.0 meters per second (m/s). Bathymetry provided by Geological Survey Ireland www.gsi.ie in association with the Marine Institute.

Comparisons between all five locations indicated that over the 21 day deployment in June/July and 14 day deployment in Oct/Nov 2017, that the highest average current speeds at the bottom and middle of the water column were relatively consistent between all 5 deployment sites ranging from 0.041 to 0.064 m/s except for ADCP 0617 site which recorded higher velocities of 0.111 and 0.099 m/s at the bottom and middle, respectively. This most likely is due to the complicated bathymetry at the mouth of the Harbour (Figure 16). The highest average surface current speeds ranged between 0.223 and 0.351 m/s, except for ADCP 0617 site which recorded very low velocity of 0.082 m/s in comparison to the other sites. The location of the highest average surface speeds was recorded from ADCP 0614 behind Spannish Island (0.351 m /s) across all 5 deployment sites during the June/July deployments (Figure 16). For more detailed analysis and description of current flow data, please refer to the text in Appendix A Section 5 and for the Figures in Appendix B displayed on A3 size format (Appendix B, Figures B1 to B8).

The main finding from both survey periods is that there is a general consistency with predictable current flow directions and velocities, but that some complicated bathymetry features (narrow deeper channels) at the seabed, channels West of Spannish island and mussel longline structures at the surface can cause some unpredictable current flow directions and velocity speeds which would not have been observed without the aid of ADCP and bathymetry data (bathymetry was provide by Geological Survey Ireland, www.gsi.ie). This indicates the extended longline structures [redacted] and [redacted] are significantly reducing the water flow and therefore food availability from the [redacted] Figure 5 and 16).

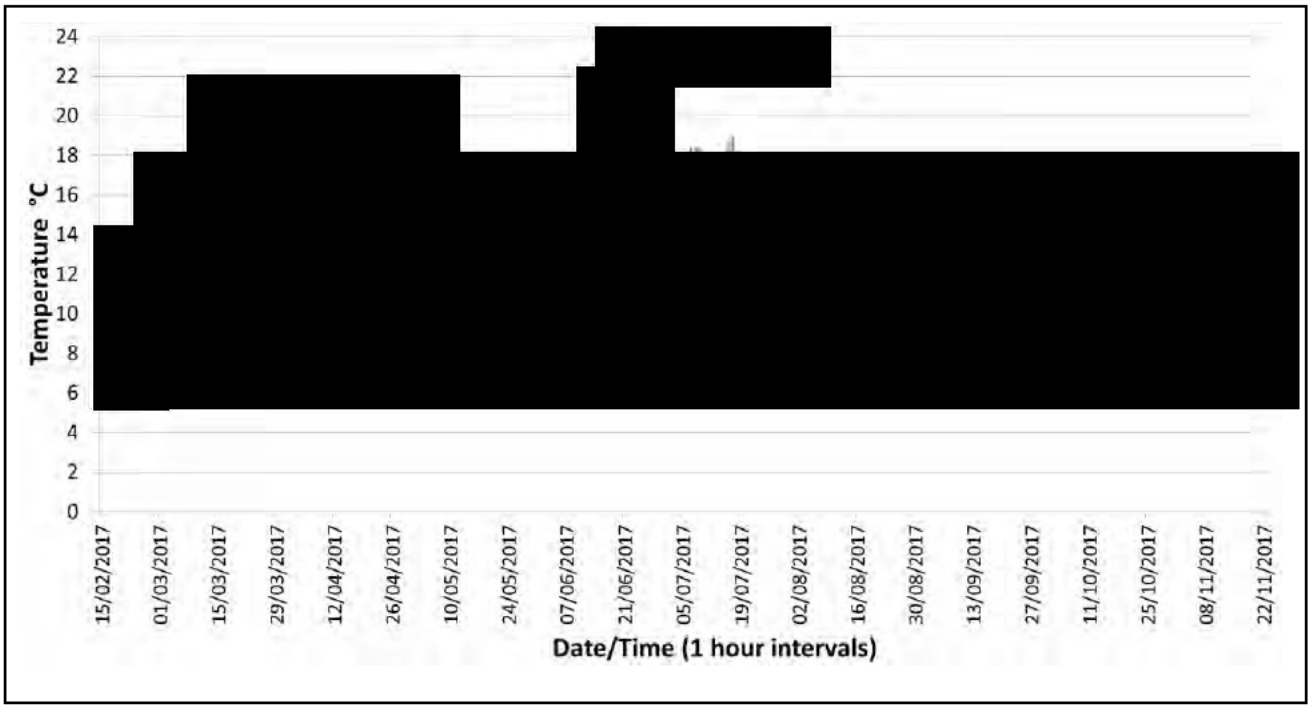
The current flow data has been sent to the Marine institute to help validate their high resolution model for Kilmakilloge Harbour.

## 8. Temperature Data

Temperature data from Kilmakilloge Harbour was recorded from six Star Oddi loggers deployed at three sites at a depth of 1 m (A, B and C), 4m (A) and 6.5 m (B and C), respectively (Figure 5).

The temperature profiles of the three sites monitored were quite similar (Figure 17). The highest surface temperatures were between 19.55 and 21.94 °C recorded on the 19/06/17 and the highest bottom temperatures were recorded between 17.02 and 17.51 °C, over three different dates (Figure 17). The lowest surface temperatures were recorded at the beginning of March which was between 6.78 and 7.58 °C, bottom temperature at 6.5 m during this period ranged between 7.77 to 10.07 °C (Figure 17).

At present the Marine Institute (MI) are developing three high resolution local scale models for the west coast of Ireland as part of the Tools for Assessment and Planning of Aquaculture Sustainability (TAPAS) project. Kilmakilloge Harbour within Kenmare Bay is one of these models. Temperature data recorded in the Harbour has been made available to the MI to further validate and help setup the hydrodynamic component of their coupled physical – biogeochemical – shellfish simulation models (Dabrowski *et al.* 2016, Fennel *et al.* 2006, Mamoutos *et al.* 2017).



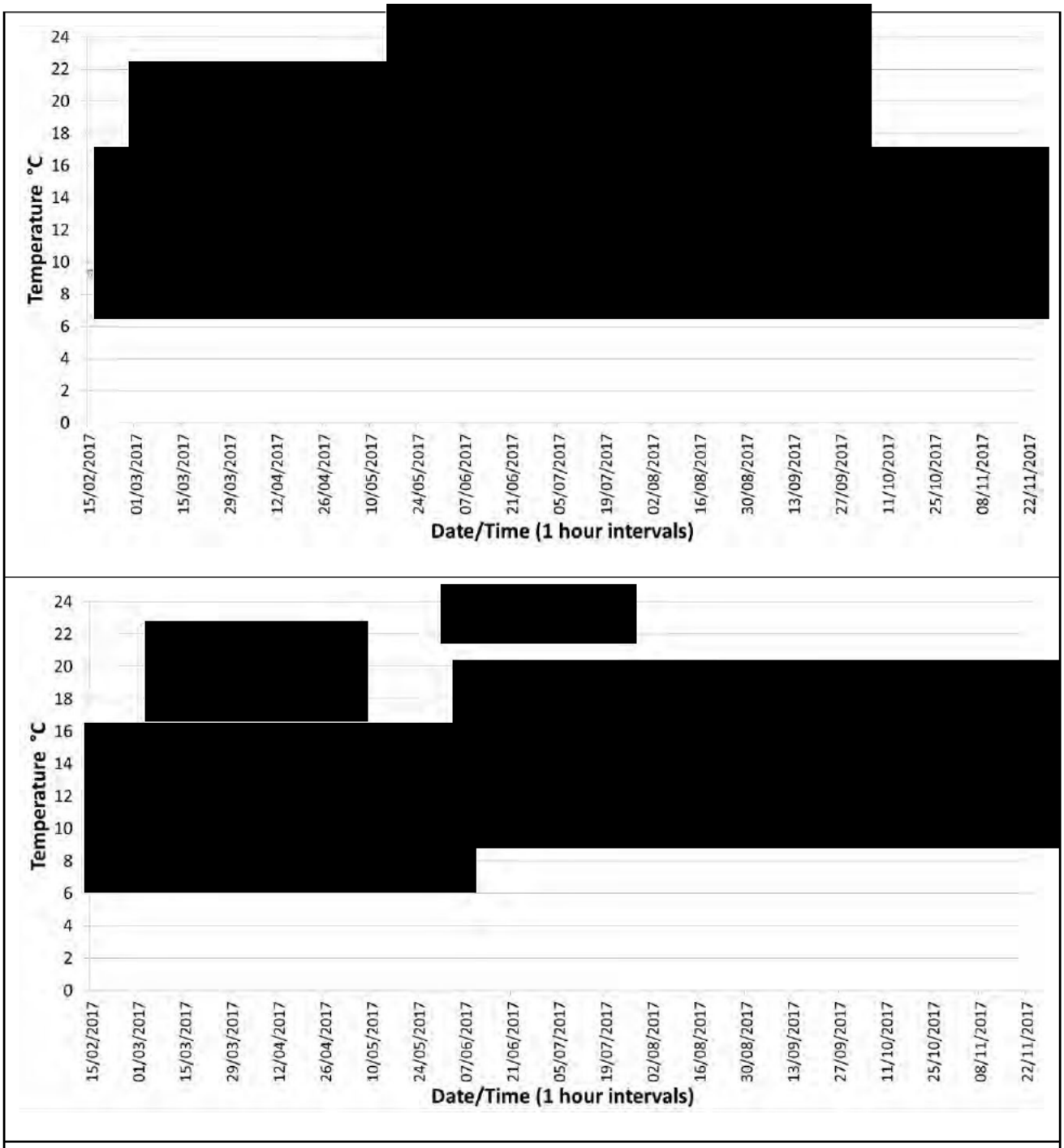



**Figure 17.** Temperature recorded every hour from 15.02.17 to 23.11.17 in three separate dropper locations in Kilmakilloge Harbour. Top refers to 1 m depth and bottom refers to 4 m [redacted] depth, respectivily on dropper.

## 9. Discussion

Over a 22 year period, annual harvested tonnage in Kilmakilloge Harbour has been reported, with the last 7 years yielding around 700 to 880 tonne per annum. Biomass results averaged a total of 1,037 tonne during the November 2016 survey and 769 tonne during the August survey which includes the assumed tonnage from empty longlines at the time of the survey. There was little difference in average mussel crop measurements between sites; however [redacted]. [redacted] Naturally, certain locations produce better meat yields than others, mostly outer seaward farms produce better yields than inner enclosed more sheltered farms surrounded by neighbouring longline sites. This is also seen in the higher meat yields at [redacted] and [redacted] sites compared to [redacted] and [redacted]

From the bathymetry and the current flow data it is clear that certain channels are important in permitting good flow of algae and nutrients around the Harbour. Historically when site [redacted] was occupied from 1996 to 1998 the production of the inner sites [redacted] was severely impacted for growth and seed settlement. This site [redacted] is located at the mouth of the channel leading into the western side of the bay and any future development of this site will impact on the inner sites. The same applies to application [redacted] which is at the [redacted]. As such, any development of this site would impact on all the sites in the Harbour. There are currently longlines in the [redacted] that are not in any licensed area these impede the flow of water, nutrients and algae to the inner sites as well as creating a hazard to navigation for access to the anchorage marked on the charts in this part of the Harbour.

Similarly development of the northern portion of application [redacted] will impede the flow in the channel to the [redacted]. The [redacted] is too shallow at either side of the channel (East to West) to allow the deployment of longlines in any case.

At present Kilmakilloge is somewhat in a state of balance with 18 months growth cycles from seed to mature crop ready for market. There is potentially more than 80% mortality from spat to crop on naturally collecting farms that do not thin seed. From a productivity and biomass

perspective this is highly inefficient, as any mussel that has died was feeding and removing phytoplankton that other mussels could have utilised, so as such this is wasted productivity. Thinning seed and repacking reduces this mortality significantly by over 60% (from previous studies comparing various bays and growing methods). If all the farmers adopted the practice of thinning and repacking then the overall productivity of the harvested crop could be increased by up to 15 to 30%. The down side of this however is that it is more labour intensive and increases the cost of production slightly.

An individual's farmer's husbandry practises can affect his own farm productivity and growth rates as much as the proximity and practices of other farms around his site. If the density of droppers per meter of head rope is twice the average then the biomass is initially doubled on the longline. This may be fine when seed is small but as it grows it is competing with its neighbour on the dropper or the adjacent dropper for food which will slow down growth and reduce meat yield.

Phytoplankton depletion surveys through the mussel longlines showed a general decrease of average phycoerythrin and chlorophyll levels when following the tidal flow, particularly at a 3 m depth which is the most active mussel feeding zone for droppers which average around 5 to 7 m in length throughout Kilmakilloge Habour.

Previous scientific studies carried out in Kilmakilloge Harbour indicate that the flushing rates for the Harbour vary from three to four and half days depending on spring or neap tides. This has an influence on the amount of plankton available for filter feeding mussels and due to the enclosed nature of the Harbour and low water exchange at the bottom to middle of the water column means available food is over grazed, reducing growth rate and potentially damaging the environment overall. However, the surface velocities is increased by a factor of 4 to 8 when compared to the bottom and middle of the water column with some of the highest current flows recorded around Spannish Island. This good surface flow around this area could also provide good distribution of plankton feed.

Historically the sites located around Spannish Island have been known to be good areas to produce mature mussels within a shorter growout time to market. However, placing more longline structures in these areas could have an even bigger negative impact, reducing current flow and potentially collapsing an already fragile system which is evident from the meat yields observed at [redacted]

During the longline survey in November 2016, none of the farmers had 100 percent of their longlines in their licensed areas. As mentioned, in the early days available technology use to position longlines was not very accurate, though now it is no longer a problem. Consideration should be given to whether lines or boundaries should be adjusted on a case by case basis. Each farmer varied on the number of longlines/portion outside their areas and the number of longlines per hectare was also highly variable ranging from 3 to almost 7 longlines (110 m length equivalents) per hectare. Some of the licences did not specify the numbers of longlines that could be deployed or the colour of the barrels/floats. Number of droppers per farmed hectare is a more accurate measure of overcrowding, and some seed lines contained up to 48 droppers between floats rather than the 14 that is more normal.

A wide range of flotation types are used in the Harbour and range in colour from blue, green, grey and black. This increases the visual impact along with the longlines in the Harbour. The positioning of longlines and how they are marked also leads to problems in respect of navigation which will need to be addressed by a new Single Unified Marking Scheme (SUMS) for the Harbour.

The information supplied in this report has helped BIM to provide recommendations to optimise the productivity of mussel longline production in Kilmakilloge Harbour, whilst trying to safeguard its sustainability and the lively hoods of all who benefit economically and socially from the Harbour.

## 10. Recommendations

The purpose of this study was to optimise the productivity of the Harbour. When assessing new applications the existing farmers in the Harbour should be prioritised. In determining the feasibility of any new application, its potential impact on the growth and productivity of the existing active sites should be considered. From all the available data presented above, Kilmakilloge Harbour is in a state of balance. The current growth cycle is at the recommended 18 months cycle. Many of the farmers are exceeding the recommended three longlines per hectare (see Appendix A, Table A5 for additional information). This is not a violation of their licence requirements as it is not stipulated in their licences, except for three licences [redacted] However, almost all farmers have extended longlines which take up more area than their licence hectares.

- To control stocking density within the Harbour flotation should be used as opposed to number of longlines per hectare. As in other bays a maximum of 18,000 litres of flotation per hectare should be used (see Appendix A, Table A6 for additional information).

The realignment and positioning of longlines will improve the visual impact of the Harbour. In order to address the colours of the floats at least three years would be required to replace the blue and green barrels with either grey or black floats (see Appendix A; Table A7). An incentivised barrel replacement/recycling scheme will be required.

- An incentivised float replacement/recycling scheme should be put in place for a specified period of time.

Existing mussel production areas in the Harbour need to be agreed to ensure the maximum allowable seed collector lines and the minimum distance between droppers. This should be discussed among farmers and relevant bodies, with a view to maximise growth rates of mussels and encouraging water flow and food availability between longlines and neighbouring sites.

- Seed collection droppers should be no closer than 25 cm apart, while for half grown and mature crop this should be 50 cm.

Where the repositioning of site boundaries to accommodate existing longlines is not possible the longlines or the portion of them outside the boundaries should be removed. As most anchors ropes are deployed at a 3:1 length to depth ratio and as most sites are less than 10 metres deep then the boundary to enclose the mooring systems should extend approximately 25 m further than the surface component of the longline. Realistically, getting each farmer to reduce their existing longlines observed at the surface to within their licensed boundaries would be significant progress and BIM believes all farmers would agree to this stipulation and would understand the benefits to the overall production in the Harbour. However, making sure all anchors at either end of each longline are completely within licence hectares would be very challenging and a realistic additional distance boundary of 25 meters either side of each licensed sites to cover anchor locations should be considered (Figure 18). Farmers would be more willing and cooperative in complying with the above changes if BIM and DAFM were able to provide assistance to carry out the physical relocation of longlines using chartered vessels.

- Boundaries of sites should be adjusted where possible to incorporate existing longline structures. Where this is not possible longlines should be moved into licensed areas.
- Mooring systems should be incorporated into the footprint of the licence area.
- The longlines to the [redacted] should be removed along with portions of the longlines in [redacted] which are outside licenced boundaries and are encroaching on the [redacted]
- There are several other longlines in the Harbour that encroach on navigation channels, and should be moved.

In respect of safe navigation in the Harbour, once the application and renewal boundaries are finalised a new SUMS should be undertaken with additional lights and navigation buoys installed. An initial drawing of how application and renewal boundaries and navigational aids could potentially be arranged is highlighted in Figure 18.

- A new SUMS should be undertaken with additional lights and navigation buoys installed in agreement with the local industry, DAFM, Commissioner of Irish Lights and the Marine Survey Office.

Three licence applications, if granted, will impact seriously on productivity, growth rates and meat yields in the [redacted].

- Licence applications [redacted] and the northern portion of [redacted] should not be granted.
- From the current studies BIM does not believe that licence application [redacted] will have any significant impact on the productivity in Kilmakilloge Harbour and therefore could be licensed, though there are small concerns that some of this site may be used periodically in a scallop fishery.
- Although [redacted] have been applied for onsite [redacted] due to the shallow nature of the [redacted] of this site only two hectares would be suitable for longline culture (Figure 18). As this is an inner site it is not expected that this site would have high productivity though it may be useful as a seed collection site.

Following discussions with the applicants, the licence applications [redacted] (as per Figure 18) to [redacted] (approx. 4 Ha) [redacted] that leaves at least a 100 m channel between it and the licences in the [redacted] of the Harbour. In conjunction with this, application [redacted] maintain the same overall area but be amended to run parallel and become longer and narrower (Figure 18). Additionally, BIM believe that application sites [redacted] will not dramatically impact on the productivity of mussel sites in Kilmakilloge Harbour based solely on the current flow data and their site locations (Figure 16 & 18).

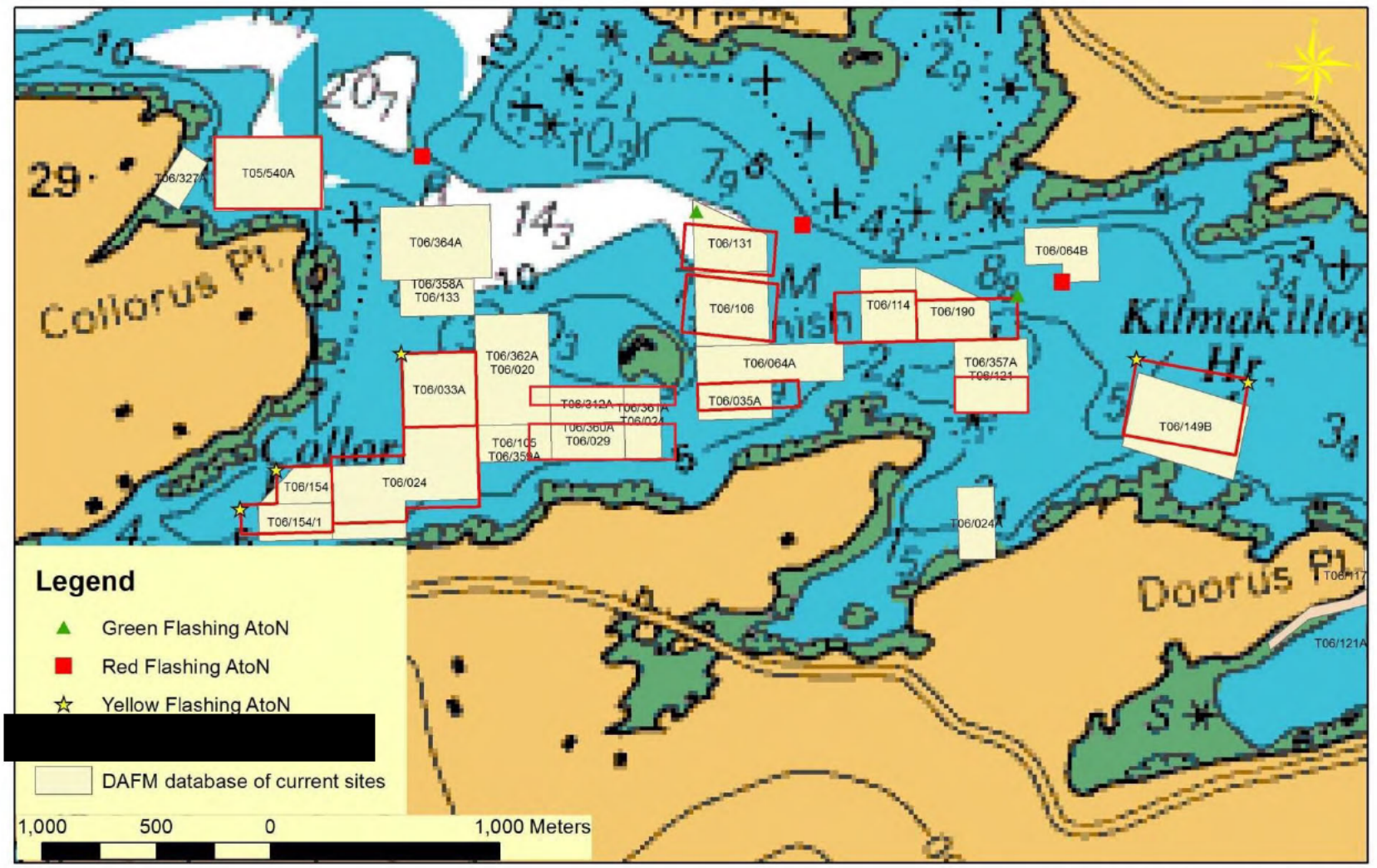



**Figure 18.** SUMS map: Rough proposal of revised mussel longline licensed sites locations waiting on renewal and potential new re-organised applications in Kilmakilloge Harbour. New proposed licensed sites [redacted] drawn to try and incorporate existing longline and mooring locations while keeping with the same licensed hectares. (**Note:** New proposed site locations, navigational markers in red and green are include to aid navigational routes are rough drawings and are not to the correct scale or position, this will require further geographical precision by DAFM engineers).

## 11. Acknowledgments

A lot of the work carried out in Kilmakilloge Harbour would not been achieved without the help and support of the mussel farmers operating in the area. BIM would like to acknowledge their assistance, advice and patience during the study period, particularly those who provided vessels to aid survey work. We would also like to thank the BIM staff who participated in surveys carried out in the Harbour, provided technical support, recommendations and proofing of the working draft report.

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Production Data Killmackillogue 2010-2020

| Year | T06/190 | T06/114 | T6/106, 35 | T6/131 | T6/154, 154/1 | T6/24 | T6/312 | T6/33 | T6/149 | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 548 |
| 2019 | [redacted] | [redacted] | [redacted] | | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 415 |
| 2018 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 834 |
| 2017 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 623 |
| 2016 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 933 |
| 2015 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 780.8 |
| 2014 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 712 |
| 2013 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 816.6 |
| 2012 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 752 |
| 2011 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 753 |
| 2010 | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | 720.5 |
| Grand Total | 343 | 490 | 2309 | 945 | 682.9 | 976 | 467 | 1003 | 672 | 7887.9 |