

Assessment of Risk to Marine Mammals from Proposed Maintenance Plough Dredging at Auginish Jetty, Co. Limerick

Client: Malachy Walsh and Partners

Ecological Consultants: IWDG Ltd.

Author: Dr. Joanne O'Brien

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**Irish Whale and Dolphin Group,
Merchants Quay, Kilrush, Co. Clare, Ireland
consulting.iwdg.ie**

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1. Introduction

The Irish Whale and Dolphin Group (IWDG) were contracted by Malachy Walsh and Partners to carry out a review of marine mammal activity in the vicinity of Aughinish Jetty, Co. Limerick, within the Lower River Shannon Special Area of Conservation (SAC, site code 002165). Proposed maintenance plough dredging operations are required at the site, and hence the IWDG were requested to prepare a Marine Mammal Risk Assessment.

The proposed works involve maintenance plough dredging at the sites highlighted below (Figure 1), including the inner and outer berths of the jetty which are approximately 900m offshore and accessed by a causeway road. A third site, dredge area C, is located close to the mainland, to the right of where the causeway begins. In addition dredging may take place in the area granted in the original foreshore licence/lease as accumulations can occur and will need to be dealt with to maintain navigation depths. It is envisaged that plough dredging will be required at the site a number of times throughout the year. The number of time per year and the periods involved will vary based on the level of accumulation or mounding of material on the sea bed. Typically a bed leveller/plough dredger is used to level local bed anomalies as required during the year. When the bed leveller/plough is deployed to level the sea bed and move material the duration can vary from a day to a number of days , but typically it can take 3 or four days depending on the volumes. The Dumping at Sea Permit application is seeking an annual max dredge volume of 16,000tonnes or 8,000m³ of material and a permit for an 8 year period. While the annual max amount is being sought typically bed levelling events could be of the order of 800m³ to 6000m³ in a worst case event. Typically the plough/bed leveller could be on site for a period of 1 to 4 days at any one event.

The plough dredging will be focused on areas where localised mounds of sediment/mud are collected on the seabed around the jetty due to action of propellers and bow thrusters from ships servicing the facility and in combination with the natural accumulation of material from deposition in the estuary. The proposed maintenance work will therefore be aimed to level or contour the seabed, by moving/pulling the sediment/mud build up to a lower level or area of depression. The location of Aughinish Jetty and the proposed works are within the Lower River Shannon SAC, with species of interest including otter (*Lutra lutra*) and bottlenose dolphins (*Tursiops truncatus*). The Shannon Estuary is home to Ireland's only resident group of bottlenose dolphin and is only one of two designated areas for the species in Ireland. Although both seal species that occur in Irish waters

are not listed as species of interest for the estuary, but they are known to occur up river as far as Limerick docks.

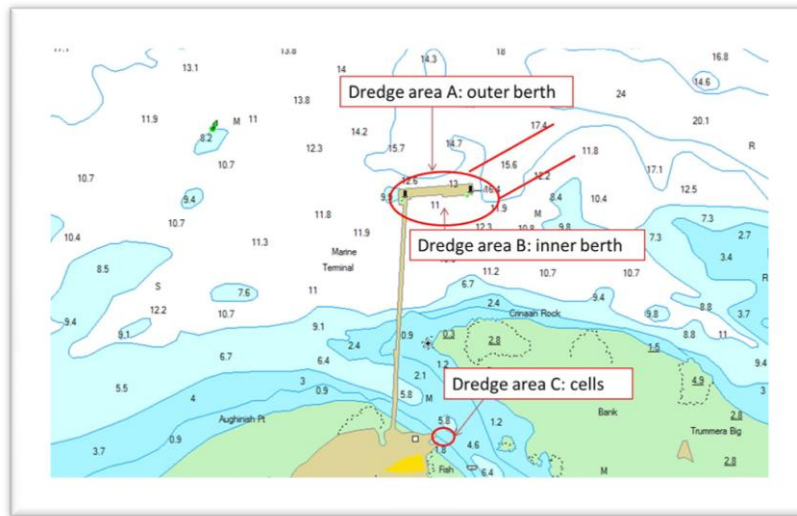


Figure 1. Location of the dredge site at Aughinish Jetty and surrounding areas, Co. Limerick.

A marine mammal risk assessment is a requirement for the applications for a dumping at sea permit and foreshore licence within this SAC. This marine mammal risk assessment will consider the following based on the NPWS guidance document (NPWS, 2014); 1) Source, 2) Species and 3) Environment.

1. Source; where the source of anthropogenic noise will come from the dredger itself at the jetty whilst carrying out the works. Noise will also result from the excavation activities.
2. Species; based on assessment from various data sources on the species of marine mammals occurring within the proposed dredging area.
3. Environment; where dredging activities will take place, marine mammal occurrence within these areas will be assessed.

2. Legal Status of Marine Mammals in Ireland

In Ireland, cetaceans (whale, dolphins and porpoises), pinnipeds and the Eurasian otter (*Lutra lutra*) are protected under a suite of national and international legislation. All cetaceans, as well as grey (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*) and our only species of otter are protected under the Wildlife Act (1976) and amendments (2000, 2005, 2010 and 2012). Under the act and its amendments, it is an offence to hunt, injure or wilfully interfere with, disturb or destroy the resting

or breeding place of a protected species (except under license or permit from the Department). The act applies out to the 12 nm limit of Irish territorial waters. Additionally, all cetaceans, pinnipeds and otter are protected under the EU Habitats Directive, where all cetaceans are included in Annex IV of the Directive as species ‘in need of strict protection’. Under this Directive, the harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), grey seal, harbour seal and Eurasian Otter are listed under Annex II, which identifies these species of community interest and whose conservation requires the designation of Special Areas of Conservation (SACs).

In 2007, the National Parks and Wildlife Service (NPWS) of the Department of Arts, Heritage and the Gaeltacht produced a ‘*Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters*’ (NPWS, 2007). These were subsequently reviewed and amended to produce ‘*Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters*’ (NPWS, 2014). This guidance document sets out the potential risks to marine mammals from man-made sounds. It states that “*An assessment of risk forms an important part of the decision-making framework for mitigating the effects of anthropogenic sound in the marine environment. It is recommended that ... [certain] coastal and marine activities undergo a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species, to inform the consenting process.*”

The NPWS draft guidance states:

“A risk assessment for each marine mammal species of relevance to the proposed works area needs to consider the nature of the sound source, its likely and/or potential effects on individuals and/or populations and on their likely habitat...

Where an assessment identifies the likelihood of a risk to protected marine mammal species, either by virtue of (a) the proposed operation or activity and/or (b) the sensitivity of a particular site in which the sound-producing operation or activity is proposed, it is recommended that appropriate risk management measures are pursued by the relevant Regulatory Authority.”

The guidance goes on to state:

“Following the initial identification and assessment of risk arising from an operation or activity ... a menu of management options is available to Regulatory Authorities in their decision making process and it includes:

A1. Consent without mitigation (e.g., where the risk of any adverse effects has been ruled out)

A2. No consent given for the activity

A3. Avoid critical habitats for marine mammals (e.g., designated sites or other locations identified as sensitive via the risk assessment process)

A4. Avoid operations during key periods of the species' life cycle (e.g., breeding/resting, migration)

A5. Avoid time periods when effective impact mitigation is not possible, and/or

A6. Risk minimisation measures, namely

A6.1. Minimise the duration over which the sound-producing activity is intended to take place;

A6.2. Minimise the individual and cumulative sound pressure and exposure levels delivered into the environment by the activity. If necessary the use of alternative, lower impact equipment and methods should be explored (e.g., vibratory hammer, gravity base piles).

A6.3. Incorporate the use of clear “ramp-up” or “soft-start” procedures, whereby sound energy input to the marine environment is gradually or incrementally increased from levels unlikely to cause significant behavioural impact on marine mammals to the full output necessary for completion of the activity.

A6.4. Incorporate the use of fully enclosing or confined bubble curtains, encircling absorptive barriers (e.g., isolation casings, cofferdams) or other demonstrably effective noise reduction methods at the immediate works site, in order to reduce underwater sound propagation from on-site operations. Studies have shown that such methods can provide a significant reduction in sound input to the wider aquatic environment in the order of 10-30 dB.

A6.5. The use of trained marine mammal observers (MMO's) provides effective means of detecting marine mammals in the vicinity of coastal and marine operations. Associated operational considerations should also be taken into account.”

The NPWS guidance document includes measures specific to dredging activities. The guidelines recommend that listed coastal and marine activities (including dredging) be subject to a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species

to address any area-specific sensitivities, both in timing and spatial extent, and to inform the consenting process. Once the listed activity has been subject to a risk assessment, the regulator may decide to refuse consent, to grant consent with no requirement for mitigation, or to grant consent subject to specified mitigation measures (Figure 2).

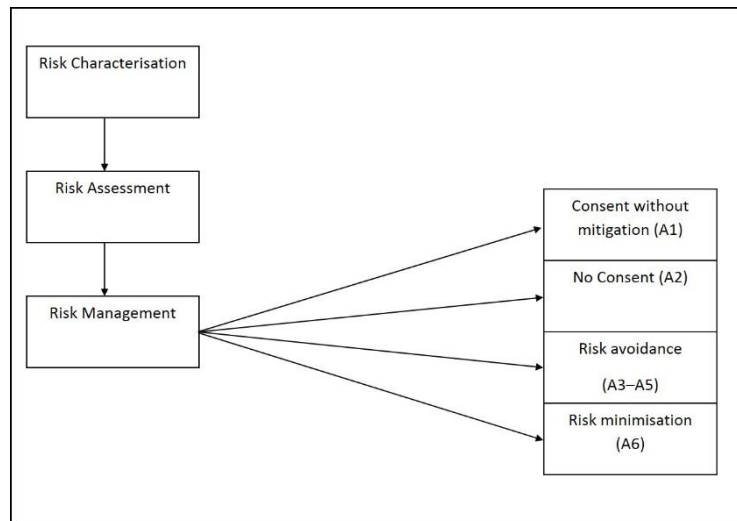


Figure 2. Flow diagram illustrating the staged process towards managing risk (NPWS, 2014).

3. *Information on the Proposed Activity*

Aughinish jetty is used for the import of bauxite and the export of alumina. In order to maintain the required depth at both its deep water berths, routine plough dredging is required, on a number of occasions throughout the year to reduce the accumulation of sediments at each of the shipping berths at the jetty. In addition there is a new bauxite unloader being fitted on the jetty structure. This new unloader will require the berthing of ships at different locations along the face of the jetty. As ships will be using a greater proportion of the jetty along its length there is also some accumulated material that will need to be removed to ensure adequate water depths over the entire jetty length. This work is expected to take place on a number of occasions during the year and each event could vary between one and four days subject to volume. The mounds of sediment will be flattened out, by pulling it down into depressions to maintain to ensure the berths and surrounding areas are in accordance with published depths. A plough dredger usually consists of a basic design, composed of a steel bar, which can be pulled over the sea bed. The frame of the bar is equipped with a blade to scrape and cut into the sediment layers, which build up in front of the plough and are pushed away from the dredge area.

During the plough dredging operations, there will be a localised increase in turbidity as there will be disturbance of silt/sand/mud on the bed as it is spread out or pulled to a lower lying area. This re-suspension of sediment is more localized during plough dredging, staying close to the sea bed. This is a temporary impact, and once each stage of dredging is completed, the material will re-settle sea bed and some will remain in suspension within the water column.

4. Marine Mammal Activity within the Area of Proposed Activity

To date 24 species of cetaceans have been recorded in Irish waters and two regularly occurring seal species, *the Grey Seal and Harbour/Common Seal*. Of the 24 cetacean species recorded in Irish waters, one species is known only from strandings (Gervais beaked whale (*Mesoplodon europaeus* (Gervais 1855)), two species are known only from sightings ((beluga *Delphinapterus leucas* (Pallas 1776)) and northern right whale), while 21 species have been recorded both stranded and sighted (Berrow 2001; O'Brien *et al.*, 2009a). This high number (around a quarter of the world's total number of species) reflects the diversity of habitats from the relatively shallow (<200m) continental shelf, to the deep water (>2000m) to the west (including the shelf edge). Seal species have been found to breed around all coastlines of Ireland and use the coastal and offshore waters in their daily lives for foraging, transit between terrestrial resting places (known as haul-out sites), and other behaviours linked to their annual life cycles (e.g., social behaviour, territoriality).

The following sources of records for marine mammals were accessed to assess their occurrence within and around the area of the proposed dredge operations at Aughinish jetty. These sources included;

1. The National Biodiversity Data Centre (NBDC) online database of species (accessed at www.biodiversityireland.ie on 14th January, 2016)
2. A review of published literature on the distribution and abundance of bottlenose dolphins in the Shannon Estuary SAC.
3. A review of Static Acoustic Monitoring (SAM) data from Foynes carried out under the PReCAST programme (O'Brien *et al.*, 2013)
4. The Shannon Dolphin and Wildlife Foundation (SDWF) an ancillary group of the IWDG who manage and maintain Static Acoustic Monitoring (SAM) data from all around the Shannon Estuary since 2004. The SDWF have an archived dataset of SAM from Aughinish between 2011 and 2014. (Accessed 10th January, 2016).

This risk assessment was based on a review of the available data and literature sources listed above. SAM provides a very robust method of monitoring as it can provide an insight in site usage 24 hours a day and during adverse weather conditions. SAM can allow for an effective estimate of possible impacts on dolphins from the proposed works data is available 24 hours a day. The data is collected through the use of C-PODs. Once deployed at sea, the C-POD operates in a passive mode and is constantly listening for tonal clicks within a frequency range of 20 to 160 kHz. When a tonal click is detected, the C-POD records the time of occurrence, centre frequency, intensity, duration, bandwidth and frequency of the click (Chelonia Ltd). Internally, the C-POD is equipped with a Secure Digital (SD) flash card, and all data are stored on this card. Dedicated software, CPOD.exe, provided by the manufacturer, is used to process the data from the SD card when connected to a PC via a card-reader. This allows for the extraction of data files under pre-determined parameters, as set by the user. Additionally, the C-POD also records temperature over its deployment duration. It must be noted that the C-POD does not record actual sound files, only information about the tonal clicks it detects. The C-POD detector is a sound pressure level detector with a threshold of 1Pa peak to peak at 130 kHz, with the frequency response shown below. A detection distance of 797.6m \pm 61m (75% of groups recorded <400m) for C-PODs and bottlenose dolphins was generated in the Shannon Estuary O'Brien *et al.* 2013).

4.1 The National Biodiversity Data Centre's online mapping system of species records

The National Biodiversity Data Centres' (NBDC) online database was accessed for grey and harbour seal records, as well as European otter records in the vicinity of the proposed works at Aughinish. The maintenance dredge operations at Aughinish will take place entirely within National Grid Square (NGS) R25X. This NGS as well as the surrounding NGSs were also checked for records of all three species (harbour seal, grey seal, and otter).

(i) Harbour seals

Some of the most important haul-out sites for harbour seals are along the west coast of Ireland, including; Bantry Bay, Kenmare River, Galway Bay, Sligo Bay and the Donegal Coast and Carlingford Lough (Lyons, 2004). Harbour seals are less widespread and abundant in Ireland than grey seals. Previous abundance estimates for harbour seals in the Republic of Ireland, include 2,905 from a 2003 survey (Cronin *et al.* 2004), but more recent estimates by Duck and Morris (2013) in 2011 and 2012, showed an increase of 18.1% increase from 2003, with a total of 3,489. Only two records of harbour seals exist for the Inner Shannon Estuary within the NBDC database, none of which occur within the area of the propose works, but across the estuary in the Fergus Estuary. The last seal

survey undertaken in the Shannon Estuary was in 2012, when a single harbour seal was sighted (Duck and Morris, 2013; Figure 3).

(ii) Grey seals

Grey seals are widespread and abundant in Ireland, with the greatest numbers found in the south-western, western and northern coasts, but smaller populations are also found on the east and south coasts. Previous work has shown the largest populations exist on the Blasket Islands, Inishkea Island group and the Saltees (Lyons, 2004). A minimum estimate of 5,343 grey seals was recorded among haul-out sites in the Republic of Ireland between 1-9 March, 2007, with over 45% of all grey seals recorded on two islands, Inishkea North, Co. Mayo and the Great Blasket Island, Co. Kerry (O’Cadhla *et al.* 2007). Grey seals are highly mobile and may remain at sea for extended periods, especially outside the breeding season, travelling distances of several hundred kilometres from breeding colonies (Cronin *et al.* 2013). During the 2012 aerial survey, no grey seals were recorded in the Shannon Estuary (Duck and Morris, 2013; Figure 4) and only a single record exists on the NBDC database for the species, all outside the area of the proposed works (Table 1).

Table 1. Records of Harbour and Grey seals within and surrounding NGS Q71.

Grid square	Species	Date	Location	Precision	Source
R25	Harbour seal	16/08/2003	Fergus Estuary	10km	NBDC/NPWS
R25	Harbour Seal	01/09/2012	Fergus Estuary	10km	Callan and Duck, 2013
R25	Harbour seal	16/08/2003	Fergus Estuary	10km	NBDC/NPWS
R25	Grey seal	16/08/2003	Fergus Estuary	10km	NBDC/NPWS

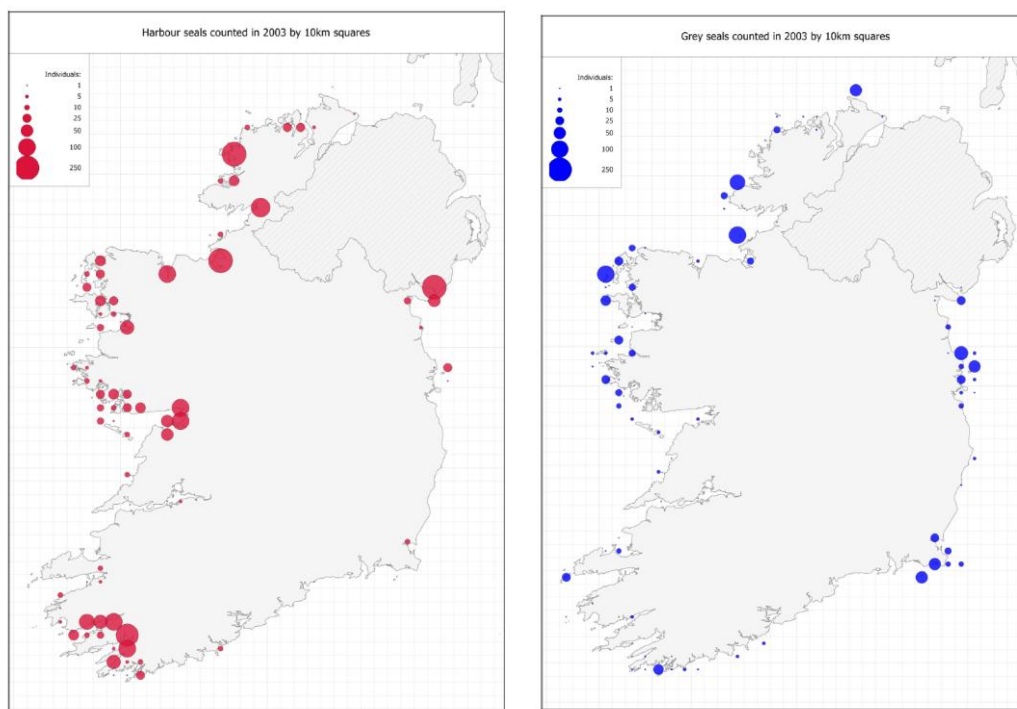


Figure 3 and 4. The number and distribution of harbour (orange) and grey seals (blue) counted in west, south-west, south and east Ireland from the 2003 Irish Seal Survey (From Duck and Morris, 2013).

(iii) Otter

Otters are found across a variety of aquatic habitats, including; rivers, lakes, estuaries, canals, marsh and along the coast. Coastal dwelling otters require access to fresh water to regularly rinse their fur to avoid problems with insulation. No records of otters were found to exist on the NBDC database in the vicinity of the proposed works, and only 2 records at adjacent areas, but all well outside the area of the proposed works (Table 2).

Table 2. Records of Otter within and surrounding NGS Q72

Grid square	Species	Date	Location	Precision	Source
R35	Otter	2004/2005	Ballysimon	100m	NBDC
R25	Otter	24/01/2005	Poulaweala Creek	100m	NBDC

4.2 A review of bottlenose dolphin sightings in the Shannon Estuary from published literature

Bottlenose dolphins are widespread and relatively abundant off the Irish coast with most sightings along the western seaboard (Berrow *et al.* 2010a). Recent genetic evidence (Mirimin *et al.* 2011) suggests the existence of three discrete populations of bottlenose dolphins in Ireland: the Shannon Estuary, a coastal inshore population and a putative offshore population. The “putative offshore population” that was suggested by Mirimin *et al.* (2011) has recently been confirmed by Louis *et al.* (2014) who showed offshore dolphins in Ireland are genetically discrete from the Inshore population and part of a large wide-ranging group that includes dolphins from the Bay of Biscay and the Azores. O’Brien *et al.* (2009b) showed that the “Inshore population” (referred to as the Connemara-Mayo population by Ingram *et al.* 2001 and Mirimin *et al.* 2011) which is regularly recorded off Connemara is highly mobile with re-sightings of individual bottlenose dolphins from around the entire Irish coast including records from waters within and adjacent to the proposed site. IJsseldijk *et al.* (2012) carried out a more recent analysis which included 50 individual dolphins photographed off Connemara and showed a very high overall re-sighting rate of c.28%. These results suggest that this highly mobile population is relatively small and exhibits high local site fidelity. Recently individuals from this “Inshore population” in Ireland have been matched to the northeast and west coast of Scotland (Robinson *et al.* 2012) and to southwest England (Ryan *et al.* 2010).

Resident Bottlenose dolphins of the Shannon Estuary

The Shannon Estuary is the most important habitat for bottlenose dolphins in Ireland, where research carried out since 1993 has shown that the dolphins occurring here are resident, i.e. they are present here throughout the year, and the estuary has been highlighted as a very important calving area (Berrow *et al.* 1996; Ingram 2000). Bottlenose dolphins are the only cetacean to be recorded within the estuary alive, upriver from Kilbaha, Co. Clare, with the highest concentrations found in the outer Estuary, off Kilcredaun Head and in the middle of the estuary off Moneypoint and Tarbert (Ingram and Rogan 2002). Berrow (2009), suggested that dolphins are found to frequently range upriver, during both summer and winter. The abundance of dolphins in the estuary is known from a number of estimates carried out to date, with estimates ranging from 140 ± 12 in 2006 to 107 ± 12 , CV = 0.12 in 2010 (Ingram 2000; Ingram and Rogan 2003; Englund *et al.* 2007; 2008; Berrow *et al.* 2013).

Noise levels from the Shannon Estuary have been previously described and an effect of vessel activity on bottlenose dolphin presence was assessed acoustically (O'Brien *et al.* 2015). Results showed a significant increase in the inter-click-interval (ICI) of dolphin echolocation clicks in the presence of vessels, but it was uncertain if this behavioral shift was a negative response, or a possible interim mechanism for managing an increase in ambient noise levels. A significant change in the acoustic repertoire is cause for concern and proves the need for assessments of potential sources of disturbance, especially given results on other species have proven foraging disruption caused by boat presence in killer whales and common dolphins (Williams *et al.* 2006; Stockin *et al.* 2008).

Information on bottlenose dolphin site usage at Aughinish cannot be established as very few sightings exist upriver. Dedicated research carried out within the middle of the estuary, from Tarbert out west to Ballybunion Bank. Berrow (2009) looked at the winter distribution of bottlenose dolphins and areas upriver previously not covered during dedicated surveys, but no sightings were recorded upriver of Foynes Island. Therefore based on current sightings data very little information could be concluded on the occurrence of dolphins at Aughinish.

4.3 A review of long-term Static Acoustic Monitoring (SAM) at Foynes from O'Brien *et al.* (2013)

A long-term SAM study was carried out as part of a larger national project at Foynes between February 2009 and October 2010 called PRECAST. This project was funded under the Sea Change Strategy with the support of the Marine Institute and the Marine Research Sub-Programme of the National Development Plan 2007–2013, and through funding from the Department of Arts, Heritage and the Gaeltacht. A total of 591 days were monitored at the site and likely trends influencing dolphin presence at the site was assessed (O'Brien *et al.*, 2013). Of the 591 days monitored, dolphins were present at the site on 41% of days.

The data were analysed by year (2009 and 2010), and under variables (season, diel, tidal cycle and tidal phase) and the influence of such trends on the presence statistically explored. Season was shown to significantly affect the presence of bottlenose dolphins ($\chi^2=183.3$, $p<0.0001$), with a peak in detections during spring and gradually decreasing throughout summer and autumn, with winter showing the lowest detections (Figure 5). Variation across diel cycle was found to be significant ($\chi^2=133.6$, $p<0.0001$; Figure 5), with a pattern of higher detections across night and morning, and lower detections during the day and evening. Significant variation across tidal phase ($\chi^2=194.9$, $p<0.0001$; Figure 5) showed a rise in detections during neap tide. Results show that tidal cycle had a significant

effect ($\chi^2=179.4$, $p<0.0001$; Figure 5), which was most likely due to a decrease in detections during slack high tide. Given the close proximity of the Foynes monitoring location to Aughinish jetty (4.2 km), it is likely that bottlenose dolphin trends at the two sites are very similar.

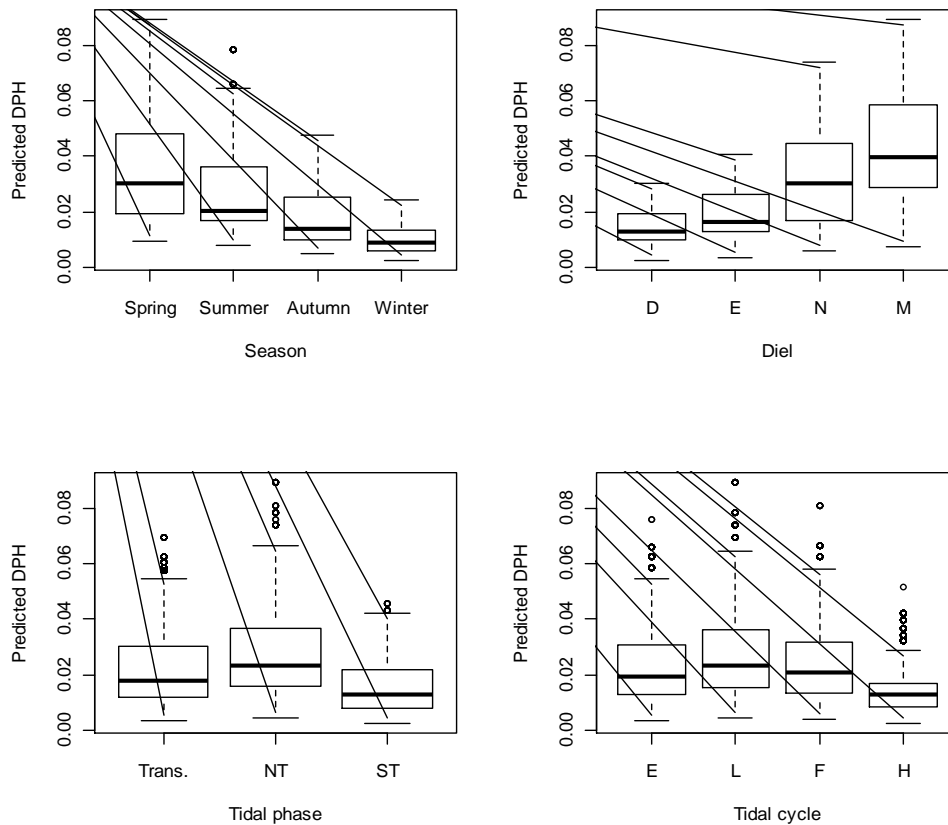


Figure 5: Predicted proportion of detection positive hours, for dolphins at Foynes across the four variables of season; diel, where D =day, E= evening, M= morning and N = night; tidal phase, where Trans.=transitional phase, NT= neap tide and ST=spring tide; and tidal cycle, where E =ebb, L = slack low, F= flood and H=slack high (© O'Brien *et al.* 2013).

4.4 Archived Static Acoustic Monitoring (SAM) data from Aughinish Jetty

SAM was carried out around the estuary as part of the Shannon Integrated Framework Plan (SIFP; <https://shannonestuariesifp.wordpress.com/>) for the Shannon Estuary, where a number of deep water ports were the focus of long-term monitoring. SAM was carried out from Aughinish from November 2011 to February 2014, with some gaps present in the dataset due to technical problems with the equipment. A total of 446 days were monitored over the 27 month period (Figure 6). Dolphin detections were logged at the site on 29% of days monitored, with ranges in detection positive minutes per day from 0 to 33, meaning dolphins were present at the site on some occasions for a total of 33 minutes in a day over a 24 hour period (Figure 6). A gap in the dataset was evident

for Autumn, but detections were more abundant during the winter months. From a quick overview of the SAM data from Aughinish using the cpod.exe software no clear diel trend was evident. These results are different to the long-term study at Foynes, but a generalisation of the Aughinish results should be treated with caution as gaps do exist and no statistical modelling was carried out to date.

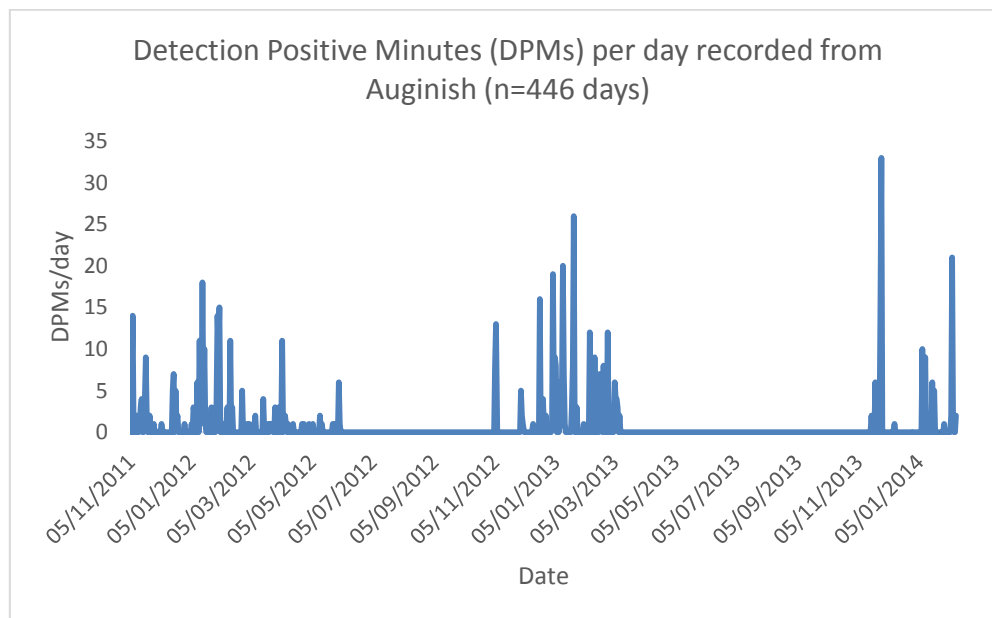


Figure 6: Detection Positive Minutes per day recorded at Aughinish (446 days monitored)

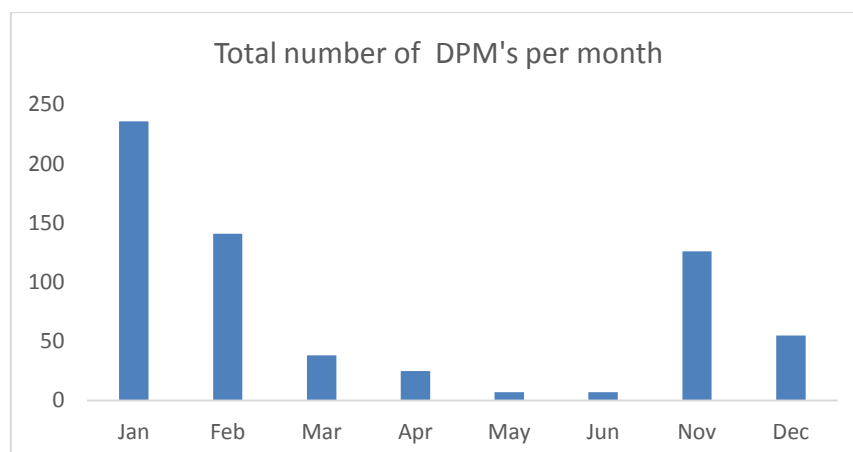


Figure 7: No of Detection Positive Minutes (DPM's) recorded per month across years (note gap in dataset for July, August, September, October).

4.5 Summary of Desktop Data Records of Marine Mammals

In summary, from the data sources accessed, grey and harbour seals and otter have not been recorded close to the proposed works. However, from the SAM data, a good picture of bottlenose

dolphin activity at the site was achieved. Bottlenose dolphins at Foynes were found to be present on 41% of days monitored, whilst only 29% of days monitored at Aughinish. The dataset from Foynes was more representative, with data recorded across all seasons, and therefore is a more complete dataset from which to draw conclusions. Based on these results, its likely to encounter dolphins at the site across all seasons, but the Foynes dataset shows significantly more detections occurs during the spring. Additionally, detections have been recorded across all tidal states but significantly more during a neap tide, but the most important result with regards to day and night-time activity (diel cycle) at the site showing significantly more detections recorded during night-time hours, which could explain the low number of visual records upriver.

5. Impact Assessment

5.3 Description of Dredging Activity and Impacts

For the majority of dredge operations worldwide, one of four kinds of dredgers are used. These include; cutter suction dredgers (CSD), trailing suction hopper dredgers (TSHD), grab dredgers (GD) and backhoe dredgers (BHD). Additionally, a plough or seabed leveller is used to flatten/level areas without lifting material from the seabed and dumping it elsewhere, including three main types of plough, i) agitators and ii) levellers and iii) material movers. The proposed maintenance dredging at Aughinish will be plough dredging utilising a leveller.

Plough dredging is routinely used in the Shannon Estuary as part of maintenance operations. Dredge operations emit continuous low frequency sound into the marine environment, and because of this sound signature, these type of works are generally considered of lesser concern for impacts on marine mammals. The M.V. Shannon 1 is the vessel frequently used for plough operations, and this technique of dredging gives rise to a lesser amount of re-suspension of sediment into the water column as the work is localised to the seabed. Sound production from this operation will be largely influenced by sediment properties, and based on how hard or consolidated these mounds are will determine how much force the dredger must apply to move the material (Robinson *et al.* 2011). These operations are most likely to occur within the frequency band 70-1000 Hz, peaking at 100-110 dB, with sounds inaudible at approximately 500 m from the source (Clarke, 2002). The dredger itself is a source of continuous noise during operations, reaching 100 to 115dB in the immediate vicinity of the dredger, but it is likely this noise diminishes to acceptable levels (50-70dB) a few hundred metres from the dredging site (Bray, 2008). These source levels (SL) at frequencies below 500 Hz are similar

with those expected from a cargo ship travelling at a speed of between 8 and 16 knots (Arveson and Vendittis, 2000).



Figure 8. Plough dredger used in the Shannon Estuary M.V. Shannon 1©Irish Waterway History

Sound exposure levels from these operations are thought to be well below thresholds expected to cause injury to a marine mammal. However, noise generated by dredging, from the physical presence of the dredger, and possibly from the increased water turbidity in the area of operations have the potential to cause low level disturbance such as masking or behavioural impacts such as displacement. The presence of an operational dredger at the site will lead to a small local increase in noise, but given the Shannon Estuary is Ireland's premier deep-water port, and caters for ships up to 200,000 deadweight tonnage, disturbance from these operations are likely to be minimal.

5.2 NPWS Assessment Criteria

1. Do individuals or populations of marine mammal species occur within the propose area?

- From the data sources accessed, the most likely species to be encountered at the site are bottlenose dolphins. However, based on SAM data, they do not occur at the site everyday but when they do, it can often be during night-time hours.

2. Is the plan or project likely to result in death, injury or disturbance of individuals?

- There is some potential for direct or indirect impact from the dredge operations on marine mammals in the area, mainly through increased noise, leading to masking or displacement.
- With regards to these potential impacts, the proposed works are expected to be intermittent and over short durations typically between 1 and 4 days, keeping potential disturbance to a minimum. Additionally, the Shannon Estuary is a busy shipping port so the presence an additional vessel for these short intermittent durations should not have a significant impact.
- The risk of injury or mortality of a marine mammal over the course of the works is considered extremely low as the sighting rates for the area are low. If marine mammals occur with the area, they are already exposed to large vessels on a daily basis and would be aware of their presence. The dredge vessel will be relatively slow moving and thus ensuring any animals in the area would have sufficient time to avoid any collisions and thus injury or mortality. Additionally, if operations are carried out during daylight hours, then this will reduce any potential impact of the dredge operations on bottlenose dolphins, as significantly more detections were recorded at Foynes during night-time hours.

3. Is it possible to estimate the number of individuals of each species that are likely to be affected?

- Based on abundance estimates for the Shannon Estuary carried out to date (2006 to 2010), it is likely the population of bottlenose dolphins lies between 140 ± 12 (2006) and 107 ± 12 (2010). A more recent abundance estimate was carried out in 2015 by the NPWS, but results from this study are not yet available. The number of dolphins likely to occur as far up river as Aughinish are low, given that all abundance estimates to date are based on survey coverage from Tarbert west towards Ballybunion Bank in the outer estuary.

4. Will individuals be disturbed at a sensitive location or sensitive time during their life cycle?

- Given that dolphins were only detected on 29% of days monitored out of a total of 446 days in comparison with Moneypoint, where they are detected on average 73% of days (O'Brien *et al.* 2013) suggests that this is not a core habitat for their daily habits and therefore not a sensitive habitat for their lifecycle.

5. Are the impacts likely to focus on a particular section of the species' population, e.g., adults vs. juveniles, males vs. females?

- It is impossible to assess this impact/risk as the data available does not permit. Sightings of dolphins upriver are sporadic and little photo-identification studies have been carried out in this section to provide a robust assessment.

6. Will the plan or project cause displacement from key functional areas, e.g., for breeding, foraging, resting or migration?

- Based on the datasets available, it is extremely unlikely that the proposed works will cause displacement from key functional areas.

7. How quickly is the affected population likely to recover once the plan or project has ceased?

- It is expected that animals displaced from the vicinity of the dredging site would return after the works have stopped. Displacement if evident should be short lived based on the duration of the proposed works, and given this area of the estuary is susceptible to regular daily shipping activity.

5.2 Mitigation

To minimise the risk of permanent or temporary injury and disturbance to marine mammals, especially bottlenose dolphins in the vicinity of dredging operations, the NPWS 'Guidance to manage the risk to marine mammals from man-made sound sources in Irish waters – January 2014' (NPWS, 2014) recommended that stated mitigation procedures for dredging are followed and monitored by a suitable qualified Marine Mammal Observer (MMO).

1. A qualified and experienced marine mammal observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms (as presented in Appendix 7; NPWS, 2014).

2. A dedicated Marine Mammal Observer will conduct a 30 minute watch for marine mammals (specifically bottlenose dolphins at this site) within 500m of the *dredging* vessel prior to start up. If a seal, otter or bottlenose dolphin is sighted within 500m of the vessel, start-up must be delayed until the animals are observed to move outside the mitigation zone or the 30 minutes has passed without the animal being sighted within the mitigation zone.

Pre-start monitoring

3. Dredging activities shall only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring, as determined by the MMO, is not possible the sound-producing activities shall be postponed until effective visual monitoring is possible.
4. An agreed and clear on-site communication signal must be used between the MMO and the Works Superintendent as to whether the relevant activity may or may not proceed, or resume following a break (see below). It shall only proceed on positive confirmation with the MMO.

Dredging operations

7. Once normal dredging operations commence, there is no requirement to halt or discontinue the activity at night-time, nor if weather or visibility conditions deteriorate nor if marine mammals occur within a 500m radial distance of the sound source, i.e., within the Monitored Zone.

Breaks in sound output

8. If there is a break in dredging sound output for a period greater than 30 minutes (e.g., due to equipment failure, shut-down or location change) then all Pre-Start Monitoring must be undertaken in accordance with the above conditions prior to the recommencement of dredging activity.

Reporting

9. Full reporting on MMO operations and mitigation undertaken must be provided to the Regulatory Authority as outlined in Appendix 7 (NPWS, 2014).

5.3 Summary

Based on the location of Aughinish Jetty within the Lower River Shannon SAC, and given that there is evidence for the year round detection of dolphins at the site, it is recommended that the NPWS guidelines are adopted and followed for the duration of all works. Observations should be carried out from land, or from the dredge vessel, and the relevant mitigation outlined above implemented. All observations and a detailed report of mitigation should be used to inform future works. The proposed works with the mitigation outlined above are considered unlikely to present a risk to bottlenose dolphins or other marine mammals that could be encountered at the site.

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