

Cullen Scholarship: The harbour porpoise, *Phocoena*, in Dublin Bay: Assessing habitat use and the effect of anthropogenic activity using visual and acoustic methods (PhD Award)

Background

Dublin Bay is an important maritime area, both in terms of anthropogenic activity and the marine species that inhabit it. It hosts Ireland's busiest port, is a popular area for marine recreational activities and has a number of EU Designated habitats through Special Protection Areas (SPAs) and Special Areas of Conservation (SACs). One of these areas of conservation is the Rockabill to Dalkey SAC, which is designated for harbour porpoise, *Phocoena*, as high densities of this species occur in these waters. All large vessel traffic into and out of the Port passes through this SAC which also overlaps with the designated spoil grounds used for local dredging activities including Dublin Port dredging projects.

Vessel traffic is acknowledged as one of the main impacts on cetaceans worldwide due to noise pollution and ship strike (Avila *et al.*, 2018). Dublin Port has an average of 0.6 vessels arriving and leaving the port per hour and 0.64 million tonnes of goods being transported through it per day (Harrington & Smith, 2013). Redevelopments for Dublin Port are currently underway under the Alexandra Basin Redevelopment (ABR) Project to expand the ports capacity so that the increased demands for shipping and transport can be met. Additionally, further developments of the port are in planning (MP2), which will involve extensive marine activities until 2040. All these development plans involve extensive dredging operations within the bay and will result in increased vessel traffic here going forward (DPC, 2011). Recreational boating from Howth, Dublin and Dun Laoghaire also frequently use Dublin Bay including fishing vessels, yachts and RIBS.

Dredging activity has increased significantly since the ABR project that plans to dredge and dispose of 1 million m³ of fine silt and sand during capital dredging and 425,000m³ between 2024 and 2031 as part of MP2. This dredged material is disposed of at the spoil grounds off Burford Bank within the Rockabill to Dalkey Island SAC. Additionally, ongoing maintenance dredging of Dublin Port and dredging campaigns at Howth Harbour and Dún Laoghaire require disposal at the spoil ground at Burford Bank.

Although studies on the impact of dredging on cetaceans are limited (Bryant *et al.*, 1984; Richardson *et al.*, 1990; Diederichs *et al.*, 2010; Pirota *et al.*, 2013; Marley *et al.*, 2017), previous research in Dublin Bay indicates that dumping activity is significantly increasing harbour porpoise acoustic activity (Russell *et al.*, 2018).

The harbour porpoise population in this area is exposed to many anthropogenic activities. It is important to investigate the potential effects of these activities and their cumulative impact, particularly before vessel traffic increases as is predicted, given the important role this species has in the ecosystem and their protected status under the EU Habitats Directive.

Proposal

We propose a structured four-year PhD project on a full-time basis to assess harbour porpoise habitat use and response to anthropogenic activity in Dublin Bay using visual and acoustic data.

The project will aim to:

- Evaluate cetacean presence, historically and up to the present and review the potential impacts of anthropogenic activities in the bay.
- Investigate harbour porpoise habitat use and response to dredging and vessel activity.
- Evaluate the soundscape of the bay.

It is proposed that the above aims will be achieved under four key tasks:

A review of cetaceans in Dublin Bay and their threats

The first aim will be met by a comprehensive review of everything that is known about cetaceans in the bay, both past and present, using a combination of historical records, results from previous surveys (e.g. NPWS projects and Great Dublin Drainage (GDD) project and IWDG sighting records).

All potential threats and impacts on cetaceans in the bay will be identified by giving a detailed overview of anthropogenic activity in the area and reviewing how this activity may threaten cetaceans. This will encompass reviewing vessel-based activities on the water, industrial activities in the area, historical and current waste outlets into the bay, fishing activity in the bay and surrounding area and records of pollutant levels in the bay.

The harbour porpoise in Dublin Bay: Visual data

Here, the second aim of investigating harbour porpoise habitat use and response to dredging and vessel activity will be met through modelling data from multiple sources. This will include previously collected data by the NPWS surveys, the GDD project, data from MMO (Marine Mammal Observer) dredging effort watches and data that will be collected throughout the duration of this proposed project obtained through land-based watches.

The harbour porpoise in Dublin Bay: Acoustic data

An acoustic data collection approach, using an acoustic array made of C-PODs, JASCO AMARs and SoundTraps, will be used here to determine habitat use and response to anthropogenic activity. There are pros and cons to both visual and acoustic methods, and it has been established that these two methods work best when they are used hand in hand to maximise cetacean detection. The use of simultaneously collected acoustic and visual data will also give the opportunity to test the detection range of SAM and PAM devices through comparison of theodolite tracking data and acoustic detection from these devices.

The soundscape of Dublin Bay: ambient and anthropogenic trends

This will be achieved by collecting year-round acoustic data and modelling abiotic, biotic and anthropogenic acoustic trends in time, specifically focusing on ambient noise and how it changes across days, weeks, seasons and a range of environmental conditions. An extension of the current array using SoundTraps is proposed.

Outcome

The proposed research has the potential to have a significant impact on multiple scales, from the study site area to an international level. Within Dublin Bay, the improved understanding of harbour porpoise habitat-use and response to human activities in the bay can directly inform future management decision in the area, to mitigate against impacts of activities here. Dublin Bay was included in the UNESCO Biosphere designation in 2015 which now extends to over 300km² reflecting its significant environmental, economic, cultural and tourism importance.

On a national level, this work would advance our understanding of Ireland's most abundant and widespread cetacean species and how vessel traffic and dredging work may affect harbour porpoises in an internationally important habitat for the species, the Rockabill to Dalkey Island SAC.

Internationally, this research has the potential to build on our global understanding of harbour porpoise habitat use and response to vessel activity, improve understanding of the impact of dredging- an area in which there are very limited studies despite the large extent globally of the dredging industry. Dredging is a huge marine activity within Europe with an estimated turnover for dredging operations of around €1 billion during 2018 (International Association of Dredging Companies, pers. comm.)

There is a growing appreciation that the environmental impacts must be identified and mitigated within the concept of sustainability as an approach to informing social, environmental, and economic development. Notably, this research will address the impacts of dredging from a novel angle, as it is believed that no studies elsewhere have investigated the effects of the dumping activity which is associated with most dredging operations.

Up to four publications are expected as a direct outcome of the project.

Links to MI Strategy

This research will meet the objectives set in the Marine Institute's Strategic Plan in three ways:

1. It will inform and enrich the advice given to DTTAS relating to environmental impacts linked to port development – SFA1.
2. It will advance an area of research that is of critical importance for the sustainable development of Ireland's Blue Economy, meeting objectives set in the R&I Strategy – SFA3
3. It will de-risk investment in port development projects by informing environmental impact studies and improving planning applications – SFA4.

Specific Requirements

The scholar should have a primary degree in Marine Science/Zoology or related field. As the project will involve a significant amount of fieldwork in Dublin Bay/Dublin Port, the scholar can be based at the MI Dublin Office as required.

Financial Details

Scholarships will be up to €25,000 per annum (maximum funding of €100,000 over four years). This amount comprises a maintenance award of €16,000 (Irish Research Council rate) to the student as well as payment of fees to the host higher education institution (HEI). The maximum fees payable to the HEI will be €6,000 per annum. The scholarship award also includes a budget of up to €3,000 per annum for eligible research costs (travel & subsistence, publication costs, consumables and other costs e.g. laptop) for the sole use of the student, and are payable on a reimbursement basis direct to the host institution where the postgraduate student (scholar) is registered. There are no overheads payable on the scholarship. Publication costs are intended to cover publications on which the scholar is listed as first author and are published under Open Access.

Marine Institute Co-Supervisor(s)

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