

The history of the European native oyster *Ostrea edulis* in Northern Irish waters and the four phases of resource exploitation

Jade Kirkpatrick^{1,*} , Rachel Millar² and David Smyth²

¹ Queen's University Belfast, School of Biological Sciences, 19 Chlorine Gardens, Belfast, BT9 5DL, UK

² Ulster Wildlife, McClelland House, 10 Heron Road, Belfast, BT3 9LE, UK

Received 14 September 2023 / Accepted 4 September 2024

Handling Editor: Tom C. Cameron

Abstract – An in-depth history of the European native oyster in Northern Irish waters has been absent from international and regional peer-reviewed publications. The knowledge of historical losses and a need to recover ecosystems for habitat and biodiversity purposes are primary drivers in an urgency to restore *Ostrea edulis*. However, a comprehensive record of *O. edulis* in Northern Ireland is required to assist with this work. The authors compiled a list of relevant references from grey material, rare historical archives, library collections, government reports and peer-reviewed publications. Archival reviews have been tabulated into a timeline, which documents site location, exploitation, sites of significant interest and socio-economic histories of the coastal communities who relied on the oyster. The reference material identified four distinctive phases of exploitation whereby harvesting transits from personal use to commercialization, collapse and then restoration. The study revealed that *O. edulis* harvests in the early 1800s in Northern Ireland were predominantly destined for export to supply collapsing stocks throughout Britain. Fishing was intense with the fishery closed by 1903. However, the species has proved to be extremely resilient with small artisanal fisheries still in existence today. This research will offer habitat managers guidance in relation to site selection and anthropogenic pressures when restoring the European flat oyster to the iconic historical beds of the Northern Irish Sea loughs.

Keywords: Historical ecology / site-selection / exploitation / management

1 Introduction

Native oysters worldwide have been recognized for the number of beneficial ecosystem services that they provide within the marine environment (Coen et al., 2007; Zu Ermgassen et al., 2013; Thomas et al., 2022). Globally native oysters have been in decline since the 1700s with an estimated 85% loss in reefs and beds (Beck et al., 2011). As a result, there has been a pro-active drive to restore compromised or missing oyster populations for their ecological benefits rather than their commodity value throughout the world's coastal waters and oceans (Smith et al., 2023).

Historical evidence has provided valuable guidance for countries such as Germany, Netherlands, and Belgium when initiating restoration trials and further challenging large scale programs in the North Sea (De Mesel et al., 2018; Kamermans et al., 2018; Pogoda, 2019). Similarly, a project to restore a billion *Crassostrea virginica* to New York's commercial

harbor in the USA (Kim et al., 2017), was inspired by the ecological and socio-economic history of the oyster in the waterways of New York (Franz, 1982).

When attempting to restore a lost priority habitat such as that created by native oysters, historical records highlighting the associated socio-economic benefits and ecosystem services, can act as a persuasive mechanism to convince policy makers that action is required. Peer-reviewed, regional and global historical accounts of *O. edulis* (Hayden-Hughes et al., 2023) have provided beneficial templates for potential restoration practitioners to follow when constructing their own provincial historical timeline. Hayden-Hughes (2023) produced an in-depth account of population demise in Wales, which has proved to be an influential publication in the construction of a restoration action plan for the species by Natural Resources Wales (M. Hayden-Hughes, personal communication, 2023).

In Northern Ireland, environmentally focused native oyster restoration first began in 2022 when Ulster Wildlife embarked on small-scale marina-based cage restoration projects (Ulster Wildlife, 2022). Interest has grown rapidly within Northern Ireland's local government bodies and environmental

*Corresponding author: jkirkpatrick07@qub.ac.uk

non-governmental organization's (eNGO) to build on the success of this project. However, permissions for up-scaled seabed deployments have proved difficult to obtain as Northern Irish legislators are reluctant to grant permission unless the proposed site has a historical provenance (Agri-Food and Biosciences Institute, personal communication, 2023).

Historical site-specific records relating directly to native oysters in Northern Ireland are sparse within scientific literature and this has hindered ambitious restoration plans. Practitioners of pro-active established projects have shown that providing historical evidence to legislators in relation to site suitability has been extremely useful when attempting to gain permissions to up-scale restoration (M. Hayden-Hughes, personal communication, 2023).

Ulster Wildlife an eNGO in Northern Ireland have decided to up-scale their present restoration project by undertaking direct seabed deployments. Therefore, it is an optimum time to document the past and present history of *O. edulis* in Northern Ireland. As such, a historical timeline that includes locations, phases of exploitation and sites of interest along with socio-economic histories of coastal communities, will prove invaluable for future restoration and habitat management in Northern Ireland.

2 Methodology

The authors investigated a comprehensive collection of reference sources to create a timeline which documented the history of the native oyster in Northern Ireland from the Mesolithic to present day. This included information from; university archives, library collections, government reports, peer-reviewed publications, historical societies, newspapers, railway transport manifests, marine taxonomic lists, and zoo archeological excavation reports. Digital libraries and photographic collections were also examined for additional records and location specifics (Fig. 1). The documentation of the history resulted in the citation of 66 references. These references revealed distinct phased exploitation of *O. edulis* populations throughout the country.

Key words and terms used in archival searches included 'oyster' 'Ostrea edulis' 'oyster beds' 'oyster lays' 'oyster ground' 'oyster reef' 'oyster bank' 'oyster perches' 'oyster fisheries' and 'oyster plantations'. The broad range of different terminologies is due to cultural and historical differences throughout the regions of Ireland. Other searches included less specific terminology such as 'fisheries' 'dredging' and 'seabed lease'. It was anticipated that these themed searches would provide a wider context to the state of commercial fishing and aquaculture throughout the timeline. Specific information searched for within the archives included: numbers and tonnage of oysters landed; annual landings; price of oysters; numbers of individuals involved in the fishery; railway transport records; government fisheries management policies; songs and poems relating to oysters and site and place names associated with oysters.

3 Results

Northern Ireland became a country in 1921, when Ireland was partitioned by the Government of Ireland Act 1920, therefore reference to generalized Irish beds before this date can include both northern and southern loughs, with Carlingford and Foyle loughs being termed as border loughs.



Fig. 1. Oyster vendor selling from Carlingford Lough (Curtin, 1900).

The coastline of Northern Ireland spans an approximate 650 km with a tidal range varying between 2 to 4 m with a mean of 3.1 m (Carter and Newbould, 1984). Seawater temperatures range between 7°C and 15.4°C. Salinity can vary between 18 PSU in estuarine regions up to 34 PSU in the low-flush marine catchments (Evans et al., 2003). Northern Ireland has five sea loughs which have historically provided substrate suitable for oyster larvae settlement and the stable environmental conditions conducive to self-sustaining populations of *O. edulis* (Fig. 2).

During archaeological digs at coastal sites in Northern Ireland, *O. edulis* shells were unearthed in excavations from a layer dated to the Mesolithic period (10,000 to 5,000 BC) (Day & McWilliams, 1837). Another significant epoch relating to native oysters in Northern Ireland was recorded by Norman scholars of the 1100s based at Carrickfergus Castle, County Antrim (Waterman, 1952).

An abbreviated synopsis of significant historical references where *O. edulis* has been recorded by historians of the time is presented in Table 1, three locations of significance were revealed: Strangford Lough, Carlingford Lough, and Lough Foyle (Tab. 1). Within these three sea loughs the prolific harvest of oysters and their subsequent demise can be linked to targeted sites. For example, in Strangford Lough many of the heavily harvested historical sites were located on the eastern shore, several of these still have remnants of the *O. edulis* populations present today.

During the peak of oyster fishing in Northern Irish waters in the mid-1800s, many landings were exported to augment depleted beds in other parts of the UK with only a fraction of landings going to the local market (Went, 1963). The outcome for *O. edulis* stocks was the same as the rest of Europe with the inevitable collapse of the fishery in 1903 (Went, 1963). The research revealed four recognized phases of exploitation for a natural resource as identified by Mac Con Iomaire, (2004) and the authors have used this to divide the timeline results into "Personal use", "Commercialization", "Collapse" and "Recovery".

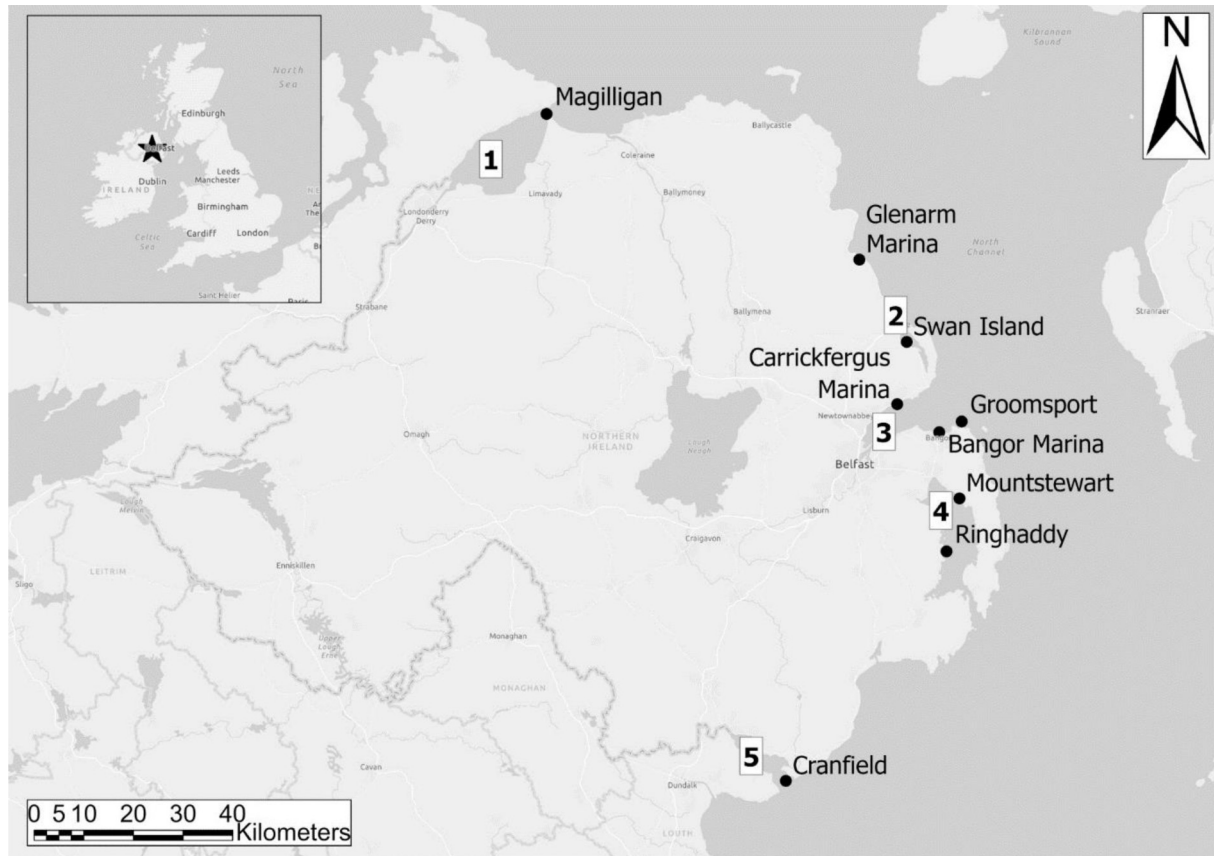


Fig. 2. Northern Ireland's sea lagoons and historically significant native oyster sites past and present. 1. Lough Foyle, 2. Larne Lough, 3. Belfast Lough, 4. Strangford Lough, 5. Carlingford Lough. Magilligan a historically high density oyster site, Glenarm Marina, second cage system 2023, Swan Island a culture site created by translocation in the 1800s, Carrickfergus a prolific oyster fishing port of the 1800s, Bangor Marina home to the first native oyster cage system in 2022, Groomsport a historical public fishery of the 1800s, Mountstewart oysters farmed in the 1100s, Ringhaddy a historically prolific site from the 1600s to the 1900s and Cranfield a renowned high density oyster site during the 17–1800s. ArcGIS Pro (Version 2.9.3).

4 Discussion

4.1 Phase one of exploitation, personal use of *O. edulis*

The historical timeline of the European native oyster *Ostrea edulis* in Northern Ireland aligns with other documented regions within its natural range (Thurstan et al., 2013; Hayden-Hughes et al., 2023). Archaeological digs have revealed middens containing native oyster shell, throughout Ireland, highlighting the prominence of oysters as a reliable and accessible food source for coastal dwellers (MacLean, 1993). Epipaleolithic sites dated between 20,000 and 10,000 BP unearthed at Glenarm on the northeast coast of Northern Ireland (Fig. 2), recorded oyster shells in high abundance. Indeed, this was common at sites along many of the northeastern coastal locations (Movius Jr et al., 1937). The aforementioned utilization of these widely available shellfish suggests that gathering was at a low intensity as oyster shell was continually present throughout the epochs of the Mesolithic and Neolithic. Harvesting during this period was undoubtedly for personal use within family groups or to feed small local populations and can therefore be termed as phase

one exploitation (Mac Con Iomaire, 2004). This level of exploitation continued to be practiced in Northern Ireland until the late 1600s with reference to the high abundance of *O. edulis* on the low intertidal (Montgomery, 1683) and the importance the oyster played as a staple food within coastal communities (Tab. 1). The Montgomery Papers state that in 1683 “oysters were being dredged in deep water as well as gathered along the foreshore of the Lough and that they were good to eat both summer and winter”. Oysters were without doubt plentiful and were the food of the common people. The communities that participated in this harvesting during the late 1600s were extremely isolated with no organized road networks or structured transport present, limiting the harvest to community self-sufficiency (Day & McWilliams, 1991).

4.2 Phase two of exploitation, *O. edulis* becomes a commodity

As the industrial revolution gained momentum throughout Northern Ireland populations grew. Inhabitants of Belfast rose, from 37,277 in 1821 to 150,000 in 1861 (McComb, 1861). The need for large quantities of affordable and easily accessible

Table 1. Historical timeline detailing the events that lead to the exploitation and depletion of the native oyster categorized in phases of “Personal use”, “Commercialization”, “Collapse” and “Recovery”.

Phase 1	“Personal use”
Mesolithic	Excavations at shell middens in Strangford Lough, Larne Lough, Belfast Lough, and the Northeast Coast revealed large quantities of <i>Ostrea edulis</i> shell (Movius Jr, 1954; Murray, 2007; Warren, 2015).
Neolithic	<i>Ostrea edulis</i> shell present and common in excavations of midden pits throughout Ireland, notably Glenarm (Richards & Schulting, 2006; Movius Jr et al., 1937).
400–1100	<i>Ostrea edulis</i> shells present at ringforts, caves, and middens in Co. Antrim, Co. Down and Co. Londonderry (Murray, 2007).
1100–1300	Excavations of kitchen midden at Norman Castle Carrickfergus, unearthed large quantities of <i>Ostrea edulis</i> shells (Waterman, 1952).
1300–1600	To ensure that all fishermen earned a liveable wage, prices were fixed in 1461. All men were allowed to fish for oysters within the catchment but were not allowed to sell oysters cheaper than the fishery working the area to control the market (Went, 1963).
1600–1620	In Counties Donegal and Londonderry oysters were fished in a controlled manner whereby only enough were harvested to feed the family (Jefferies, 1997; Allen, 2010).
1620–1700	Oysters were being dredged as well as hand harvested (Montgomery, 1683; Harris, 1744).
Phase 2	“Commercialization”
1700–1740	Evidence of oysters being commercially exploited throughout Co. Down in local farmers markets (Harris, 1744; Seward, 1795; Royle, 1994; Smyth, 2007).
1740–1770	Becoming a sellable commodity due to better boats with more dredge capacity resulting in increased landings (Royle, 1994).
1770–1780	The first report of a recognized commercial oyster fishery in Belfast Lough was in 1780 when it was stated that “the oysters are dredged from September to May by 27 boats and 123 fishermen” (McSkimin, 1839).
1780–1800	Oysters were transported from Carlingford Lough to Dublin for immediate consumption as they were in high demand (Mac Con Iomaire, 2004). Irish oysters were supply points for the English and Scottish commercial markets (Hayden-Hughes et al., 2023). Notably, by 1832 most of the oysters along Lough Foyle were sent straight to Liverpool rather than local market and this was followed by Irish oysters being used to restock foreign beds (Went, 1963).
1800–1840	Typical daily cartload of oysters from Lough Foyle was 30,000 and of this quantity, approximately 400 to 500 of the larger oysters were taken and sold to carriers at a rate of 3 pounds per cartload (Day & McWilliam, 1835). In Belfast Lough, 800–1200 oysters per boat were dredged in the early 1800s, landings declined to 300 oysters per boat in the 1830s. As they were being depleted the price rose from 4–7 shillings per hundred to 8–18 shillings (McSkimin, 1839).
Phase 3	“Collapse”
1840–1860	Even during the no take months from May to August, oysters were still being sold fresh in Donaghadee, Belfast and Newry markets (Day & McWilliams, 1837). Oyster beds diminished so significantly that an enquiry was conducted by the Inspector of Irish Fisheries, to see how the decline could be halted (Smyth, 2007).
1860–1900	Oyster fisheries were collapsing throughout Ireland with specific mention to Carlingford Lough, Ballynahinch, Belfast Lough and Lough Foyle, but it was perceived that if regulations were enforced the populations could recover (Blake et al., 1870).
1900–1920	All fisheries in Ireland no longer economically viable. Belfast fishery was considered closed in 1903. Artisanal fisheries still in operation in parts of Ireland (Browne, 1904; Smyth et al., 2021).
1920–1970	It was specifically noted that in Lough Foyle, beds that were formally worked, now rarely had oysters present (MacDonald et al., 1952).
Phase 4	“Recovery”
1990–2000	In the 1990s, an EU funded project deployed 75 tonnes of cultch topped with 3,000 mature <i>O. edulis</i> on historic beds in Strangford Lough. No observed population growth or recruitment was recorded from this effort (Smyth, 2007). A grower in 1998, laid 125,000 oysters on the low western shore of Strangford Lough. This inadvertent restoration boosted population numbers significantly (>1.5 million by 2006) (Kennedy & Roberts, 1999; Smyth et al., 2009).
2020–Present	Current <i>O. edulis</i> restoration project in place by Ulster Wildlife in both Bangor (Belfast Lough) and Glenarm (North Channel Strait) with plans to expand (Ulster Wildlife, 2022).

food increased with oysters meeting these requirements. This marked a drastic change in the resource niche of the oyster with a transition from a locally consumed self-sustaining food to that of a tradeable market commodity. Demand for oysters resulted in an inevitable change in harvesting intensity. *O. edulis* was now a target species for fishermen making it susceptible to over-exploitation, a situation identifiable as phase two of exploitation (Mac Con Iomaire, 2004). This shift from local harvest to a fishery under pressure was evident within Ireland's native oyster population from the 1700–1800s (Thom, 1864). During this period, native oysters were viewed as the food of the common person or working class, with a belief by the populous that the Irish oyster beds were inexhaustible, akin to the view in other parts of Europe (Gibson, 1969; Murphy, 2018).

There were numerous references to an active and significant commercial *O. edulis* fishery in Strangford Lough in the mid-18th century. Harris (1744), in his review entitled *The Ancient and Present State of County Down*, wrote “On the west of Strangford Lough is Ringhaddy a place to be noted for its bounty of oysters and those who gather them”. The abundance of native oysters at Ringhaddy must have been well known, because Seward (1795) and Hansbrow (1835) both confirm the observations of organized commercial fishing.

Exploitation intensified in the mid-1800s with advancements in fishing techniques, specialized dredges (Fig. 3), and boats, which allowed fishermen increased access to once inaccessible stocks. Fishery intensity now moved beyond the shallow waters which had been previously restricted oyster harvesting to hand gathering or shallow dredge work (Brabazon, 1848). This had the effect of flooding the market with large quantities of oysters from deeper water. Which led to underpricing and an increase in fishing intensity as fishermen tried to maximize market returns from the Northern Irish sea loughs. Oysters became one of the first “fast foods” by the time of the industrial revolution with the ever-growing market demand facilitated by industry advancements with the development of steam driven oyster dredgers and increased tow capacity (Holt et al., 1901).

Examples of the huge appetite for oysters within Ireland during the 1800s are revealed in the following chronicled examples: Mrs. Upton, a woman of the bedchamber to Queen Charlotte in the late 1700s returned home to County Antrim in Northern Ireland with her pay and receipts showing purchases of one hundred oysters for one pence (which would approximately be £20–£30 today taking into consideration long term inflation trends) (Stevenson, 1920). Irish native oysters had become so beloved that during the Napoleonic Wars, in a small town in France, men from Dublin could be identified by their impulse to join in the known call of the Carlingford oysters (Thom, 1864). By the early to mid-1800s oysters had become particularly fashionable with city dwellers in Northern Ireland, with oysters from specific regions gaining considerable reputations, “Magnificent Carrickfergus oysters six to a plate as no stomach could contain more, formed a feast for the giants” (Marshall, 1906). Belfast's oldest public house, ‘White's Tavern and Oyster Rooms’ situated off High Street was adjacent to bridges that crossed the River Farset and busy quayside. The tavern became a renowned location for high-quality native oysters (Fig. 4) (Whites, 1868).



Fig. 3. Oyster dredge and net from Carlingford Lough (Murphy, 1958).

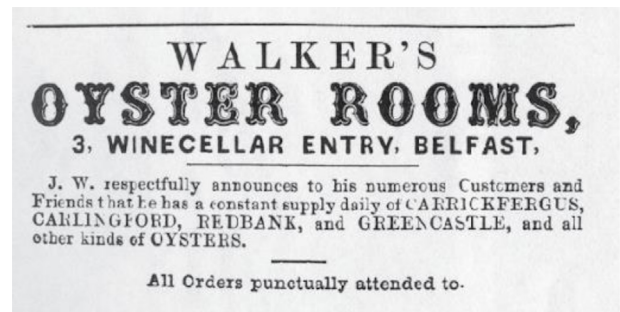


Fig. 4. Advertisement of the oyster rooms in White's tavern in 1872 (Baker, 2011), advertising the continued popularity of the native oyster into the “Collapse” phase of the timeline.

4.3 Phase three of exploitation, the collapse of the oyster fishery

The late 1700s marked the entry of professional fishermen's cooperatives to the *O. edulis* fishery in Ireland with control of the oyster stocks now influenced by market values. As a result, the fishery was put under significant pressure due to the supervision and coordination of the cooperatives. Fishermen could harvest beds in a more competent manner with boats working in unison to maximize dredging output and thereby depleting standing stocks at a more rapid rate than previously. As a result, the market value increased as evermore pressure was put on the oyster beds. Oysters had shifted from a food for all to an exclusive delicacy for the few. This was demonstrated by the fact that a hundred Northern Irish oysters could be purchased for one pence in the late 1700s (Stevenson, 1920) but by 1815 prices had reached approximately 18 pence for a hundred (Smyth, 2007). In 1844, Mr. Barry an inspecting commissioner of fisheries in Ireland stated in his report that when the Lough Foyle fishery was decreasing materially there was a five-fold increase in price, from 6 pence per one hundred oysters to 3 shillings (Thom, 1864). As commercial demand for oysters grew to new heights in the early 1800s charitable businessmen offered loans to allow the working class the

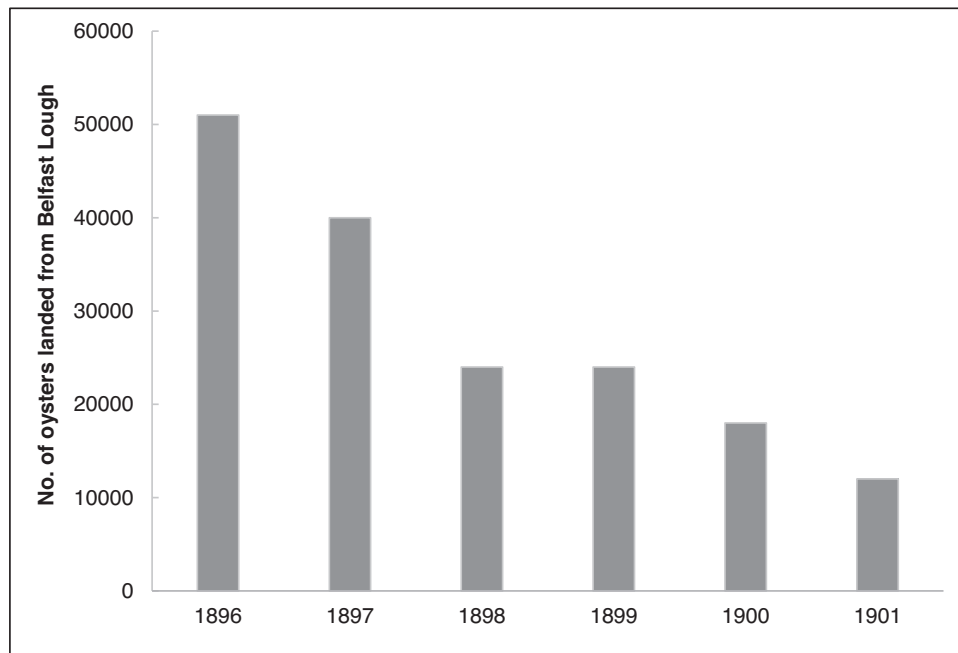


Fig. 5. Approximate quantities of oysters landed during 1896–1901, per returns made by the Coastguards to the Fisheries Department, Dublin (Browne, 1904).

means to buy fishing equipment which would increase the efficiency of oyster harvesting. Lenders were so confident in a return on their loans that payments were only requested after the harvesting season (Blake et al., 1870).

Consequently, fishing intensity continued to rise at an unsustainable rate in the Northern Irish Sea Loughs. In Belfast Lough (Fig. 5), Browne (1904) documented an annual output of 2,000 oysters from the lough in the early 1900s, a substantial decrease from that of 1888 when some 20 boats were dredging 24,000 oysters a day (McSkimin, 1839). An example of the effects of market forces was seen in Carlingford Lough where up to eight sail boats and 100 row boats were employed in dredging (Marmion, 1860). Oysters were dredged and then deposited in oyster rings described as small patches a few yards in circumference, surrounded by large stones to prevent oysters being washed away in rough weather (Fig. 6). These were positioned close to the fishermen's holdings and oysters would be kept until the highest market price could be reached (Browne, 1904).

With the development of railway networks throughout Ireland the increasingly fashionable oyster was now readily obtainable in parts of Ireland where it was once only occasionally available (Lynch & Culloty, 2023). The construction of the railway line surrounding Belfast Lough began in the mid-1800s (Royal Zoological Society of Ireland, 1904). Browne (1904) described the transport of large oysters from Carlingford Lough to Belfast, Dublin and across to Manchester and Liverpool on the mainland via railway and steamer. Demand and profits had led to a shift in what size of oyster was now considered marketable with large broodstock oysters previously not taken now being harvested and being sent to Billingsgate fish market as 'Irish natives' (Delap et al., 1903). The removal of brood oysters from the Irish beds



Fig. 6. Photograph of a possible oyster ring formation in Strangford Lough, located in close proximity to once abundant native oyster beds (D. Smyth, personal communication, 2024).

marked a dangerous juncture in over-exploitation as the beds were already overworked and now could likely no longer remain a self-sustaining stock (Thom, 1864).

Landing statistics for native oysters throughout the 1800s in Ireland were seldom recorded due to the speed that the oysters were shipped to other parts of the UK and Europe (Mac Con Iomaire, 2004). The sparse records detail landing information for specific loughs and time periods (Figs. 5 and 7) but were not consistent, this prevented direct comparisons detailing the decrease in landings between loughs of different years. However, there is a clear pattern of stock depletion, mirrored throughout all Northern Ireland's

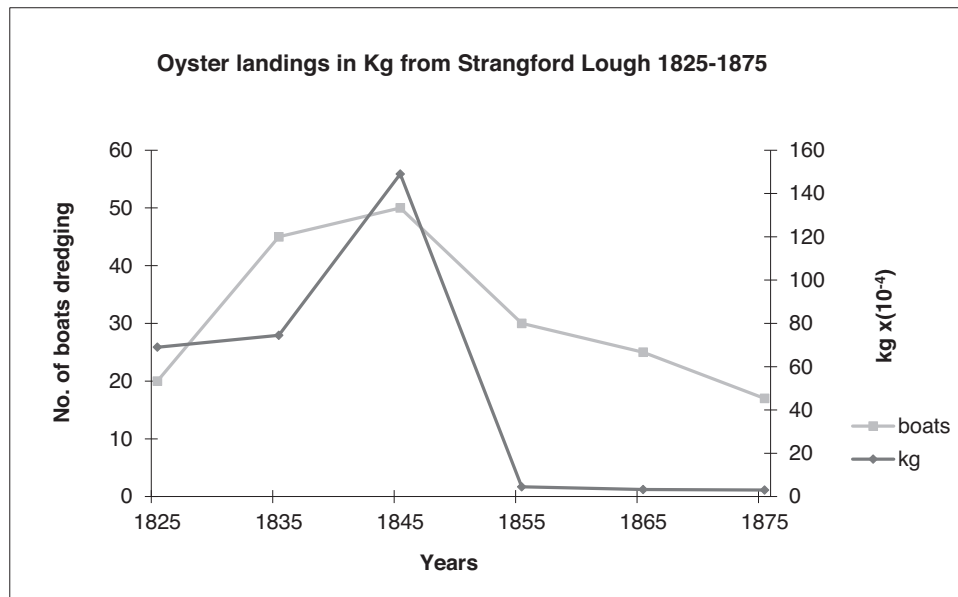


Fig. 7. Oyster landings in Strangford Lough over a 50 year period during the 1800s in comparison with dredging activity (Smyth, 2007).

sea loughs. By 1901, the Belfast Lough oyster fishery could only continue to employ six of their many men, although the depletion was speculated to be due to sewage contamination from outfalls shown in Figure 8 (McSkimin, 1839). While in Lough Foyle valves were abundant in dredge hauls but live oysters were rare (MacDonald et al., 1952) and a local dredger commented in an 1844 report that the quantity of oysters was not one-tenth of what it used to be, beds were described as exhausted due to excessive dredging (Thom, 1864). Carlingford Lough, considered the second most important natural bed in all of Ireland, was dredged out by 1874 (Went, 1963) and extensive cultivation experiments were occurring in Larne Lough (Historical Society, 1968).

Additional reasons for the scarcity of landing statistics, was the intentional lack of transparency in recording the movement of large numbers of oysters between beds in an attempt to protect “brand names” like that of the ‘English Whitsable’ (Bromley et al., 2016). Likewise, the majority of Ireland’s oyster translocations occurred between different loughs and as such it led to non-local oysters being sold for higher prices as the prized “genuine Carlingford natives” (Delap et al., 1903).

Decreases in landings (Figs 5 and 7) reflect that the Northern Irish oyster had reached phase three of exploitation and unless vital resource management was implemented the depletion of the natural wild stocks would enter a state of collapse (Mac Con Iomaire, 2004).

4.4 Phase four of exploitation, attempting to recover the oyster fishery

The fourth and final phase marking the exploitation of a natural resource is that of artificial cultivation or farming (Mac Con Iomaire, 2004). The English oyster beds reported the most rapid decline in landings across the UK and required relaying from other countries as early as 1843 to support the extraordinary public demand (Delap et al., 1903). Ireland’s

landing decline was noted in its most prolific beds only 7 years later in the 1850s, but many less significant sites remained active for years to come (Culloty & Mulcahy, 2007). Wales and Scotland had substantial decreases in landings by the mid-1870s (Hayden-Hughes et al., 2023) and 1880s (Thurstan et al., 2013).

From 1846, the Irish government had begun to issue licenses to individuals allowing exclusive rights over defined oyster producing areas. This was an attempt to halt the noted demise, which was taking place. The license holder was required to report annually on the state of their oyster bed. If the Inspector believed the bed was being worked inefficiently the license would be revoked. Although the first license was granted in 1846, re-stocking of Irish beds was virtually non-existent for years because of the famine conditions at the time (Went, 1963; Magennis et al., 1983).

Fishery restoration efforts involving translocation and spat redeployment did not commence in earnest in Ireland until the late 1840s (Thom, 1870; Delap et al., 1903).

Gradually matters improved across Ireland, and by 1862 the re-stocking of beds was under way on an industrial scale. In 1868, Carlingford Lough received high levels of restocking from Irish Arklow beds (Bromley et al., 2016) and by 1882 re-stocking had reached a colossal scale, so much so that the Inspector of Irish Fisheries reported the importation of several million French oysters for private beds in the south of Ireland (Went, 1963; Magennis et al., 1983).

However, the restoration proved insufficient to restore the fishery and the dire condition of the Irish native oyster stocks had reached such low densities that, an attempt was made in 1888 to revive the oyster industry using imported non-native species; the American oyster *Crassostrea virginica*, the Pacific oyster *Crassostrea gigas* and the Portuguese oyster *Crassostrea angulata* (Delap et al., 1903; Miossec et al., 2009). By 1904, 6 million “American” oysters were laid annually on three unlicensed beds in Carlingford Lough: Petrie’s, McDonald’s and Hardy’s shown in Figure 9 (Browne, 1904).

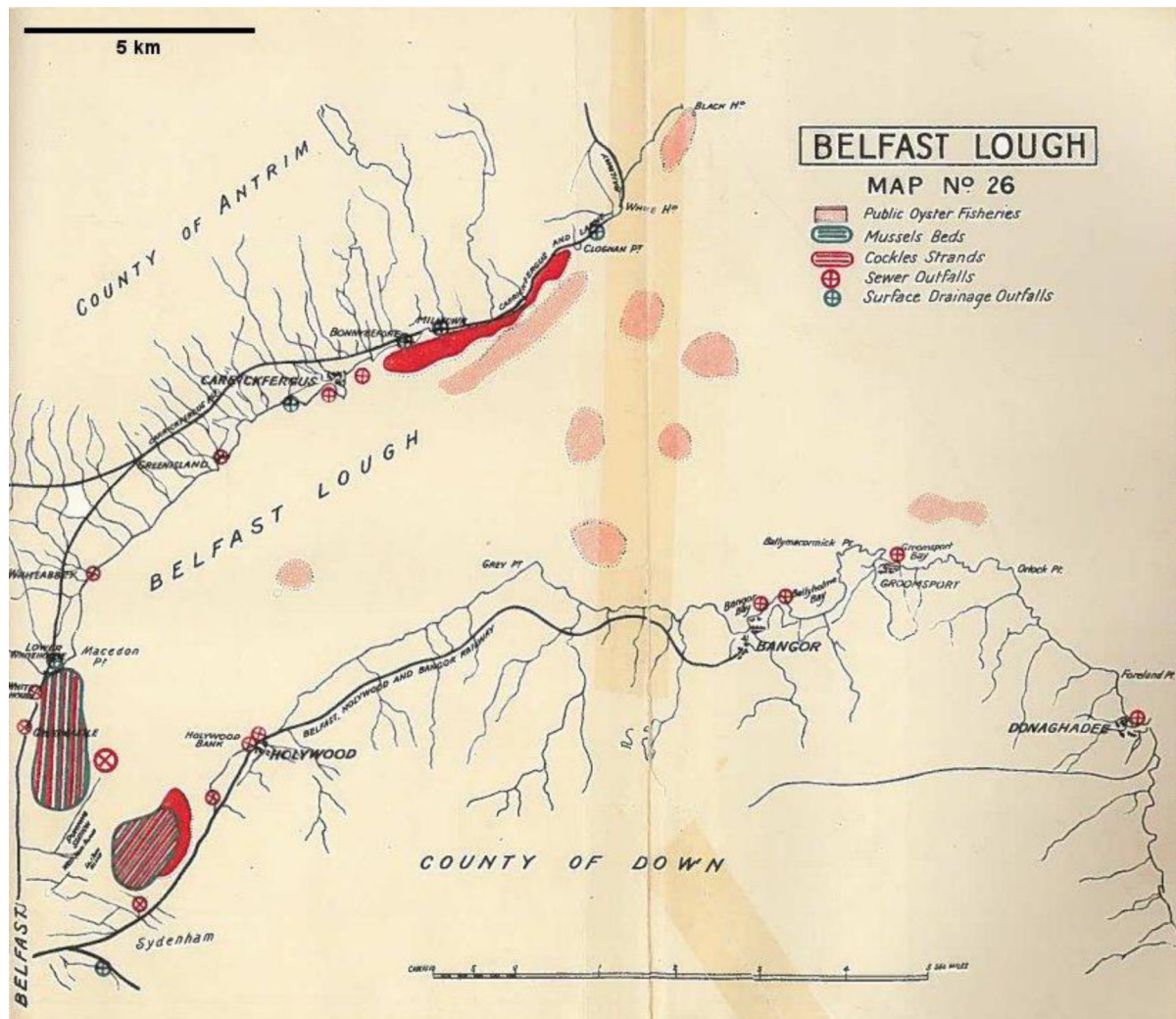


Fig. 8. Historical map detailing the public oyster beds in Belfast Lough. Natural/public beds are marked on the map in red (Browne, 1904).

The state of the Northern Irish fishery in the late-1800s was typified by landing accounts for Belfast Lough which recorded a harvest of 51,000 oysters in 1896 which dropped to 12,000 by 1901 (Browne, 1904) (Fig. 5). Contrary to this in Carlingford Lough, Browne (1904) discusses that “last season” eight boats with a crew of three men each harvested 1.5 million oysters which were sold onwards to local dealers or for re-laying within Carlingford Lough and Newry River. However, it is not clarified if the 1.5 million “oysters” were solely native oysters or a combination of the newly introduced American oyster. With an overall decline in landings the Northern Irish fisheries, with the exception of Lough Foyle, were officially closed in 1903 (Smyth et al., 2021) due to being economically unviable (Went, 1963).

In Northern Ireland stocks remained obsolete at many of the once prolific sites until the mid-1970s, when aquaculture trials in Strangford and Belfast Lough were carried out to investigate the feasibility of restoring the fishery (Kennedy & Roberts, 1999). The Pacific oyster *Crassostrea gigas* was considered a more suitable species for aquaculture due to its

faster growth rate and resistance to disease (Kennedy & Roberts, 1999) but *O. edulis* was still cultured for the gourmet market (Guy & Roberts, 2010). Records from the early 2000s show that Strangford Lough and Belfast Lough, produced 272 and 592 tonnes of *C. gigas* per lough, respectively, whereas only 50 tonnes of *O. edulis* were harvested. This is an estimated difference of over 2 million and 6 million oysters respectively based on the average weight of a table oyster (Ferreira et al., 2008). Unfortunately, in the late 1990s the halosporidian parasite *Bonamia ostreae* was detected in the Northern Irish *O. edulis* aquaculture stocks thereby diminishing the interest in culturing the native oyster (Kennedy & Roberts, 1999). While a number of wild assemblages of *O. edulis* survived the mass disease mortalities in the early 2000s in Strangford, Foyle and Carlingford, unfortunately Belfast and Larne Lough did not, and it was believed that they would not recover (Smyth et al., 2021).

However, in 2020 small settlements of native oysters were once again recorded in Belfast Lough suggesting that environmental conditions had improved to an extent whereby



Fig. 9. Details public/ natural beds marked in blue alongside both licensed and unlicensed beds. It also details the location of oyster rings, which were used to hold dredged oysters on the foreshore near low water, prior to being sold (Browne, 1904).

restoration could become feasible (Smyth et al., 2021). This discovery was the impetus for the present-day native oyster restoration initiatives currently being carried out by Ulster Wildlife, marking the final phase in the exploitation of the natural resource. There is a desire by local government bodies and interested stakeholders to restore and augment more of the native oyster's biogeographical range in Northern Ireland. Thereby demonstrating the need for historical evidence to support site selection for the planned direct seabed deployments of the future.

5 Concluding remark

A clear phased exploitation of *Ostrea edulis* in Northern Ireland was apparent in the historical timeline with “Personal use”, “Commercialization”, “Collapse” and “Recovery” all clearly recognizable. The archival study identified numerous sites of interest for consideration in future seabed deployment initiatives. The research also detailed much of the missing socio-economic history of this species in Northern Ireland, and the findings will be extremely useful in filling these lost knowledge gaps. The site-specific ecological baselines will inform habitat managers on where and what is achievable as a potential recovery target for the lost native oyster populations of the Northern Irish Sea Loughs.

Acknowledgements

This work was conducted alongside Ulster Wildlife's Native Oyster Restoration project which is funded by the Department of Agriculture, Environment and Rural Affairs Northern Ireland (DAERA). Alongside generous support from Wilson Resources Group. We would like to thank Dr Matt Service of Agri-Food and Biosciences Institute (AFBI) for his support and insight into this manuscript and to the staff at the Linen Hall Library for allowing access to their exclusive archives.

Data availability statement

The data used in this article is fully available within the main text and referenced sources.

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Cite this article as: Kirkpatrick J, Millar R, Smyth D. 2024. The history of the European native oyster *Ostrea edulis* in Northern Irish waters and the four phases of resource exploitation. *Aquat. Living Resour.* 37: 14