

Aughinish Biodiversity

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Abstract

The Aughinish Alumina (AAL) refinery is located on Aughinish Island on the shore of the Shannon Estuary 33 kilometres west of Limerick city in the South West of Ireland. The plant, commenced operation in 1983 and has a current production capability of 1.99 million tons per annum. Aughinish is located alongside Special Areas of Conservation (SACs) and Special Protection Areas for Birds (SPAs). Both SACs and SPAs are designations from the 1992 EU Habitats directive and the 2009 EU birds' directive respectively. The company is responsible for the protection of these habitats within the Aughinish ecosystem. The ecosystem around the refinery is made up of numerous habitat types from woodland, intertidal flats, grasslands to lagoons. This diversity of habitats has led to a very complex ecosystem establishing. The ecosystem at Aughinish is made up of a wide range of species from orchids, otters, peregrine falcons to lizards. All of this biodiversity is recognized by the company and embedded in the Aughinish Alumina Biodiversity Management Plan (BMP). The BMP sets out time bound objectives over a five-year period to enhance the overall biodiversity of the ecosystem. The commitment of Aughinish to community and biodiversity includes development of nature trails through the Aughinish ecosystem so that it is a wildlife haven and a place of education for future generations. This paper outlines biodiversity management so far and into the future.

Keywords: Ecosystem, Protected sites, Habitat, Species.

1. Introduction

AAL operates a long-established alumina refinery, located at Aughinish on the southern side of the Shannon Estuary near the village of Foynes, County Limerick. The refining process removes the alumina from bauxite. The bauxite, which is transported by ship from West Africa and South America, is unloaded at a dedicated Marine Terminal located in the Shannon Estuary and transferred by enclosed conveyor to the plant. It is refined using the Bayer process which results in the production of alumina and a bauxite residue, which is deposited in the Bauxite Residue Disposal Area (BRDA). Alumina is exported to smelters in other European countries, where it is used to produce aluminium.

The alumina refinery commenced operation in 1983, and has been the subject of considerable expansion and investment. The plant is now one of the most energy efficient facilities, with one of the lowest carbon footprints of any alumina refinery in the world, and the state-of-the-art facilities provide considerable employment in this region.

The Shannon Estuary is the most important geographical feature for biodiversity in Aughinish. The estuary is home to bottlenose dolphins (*Tursiops truncatus*), Eurasian otters (*Lutra lutra*), numerous species of birds, fish and bivalves. The estuary creates many habitats for flora and fauna to thrive including intertidal flats, calcareous rock slopes, siliceous rock slopes, salt marsh and the estuary itself. These habitats provide vital food sources for mammals, birds and invertebrates. The estuary allows rivers like the Robertstown River to flow into it, thus allowing adult salmon

to swim from salt water to fresh water to spawn. The main terrestrial habitats are agricultural grassland, semi natural grassland, hedgerows, scrubland and semi natural woodland.



Figure 1. Photo of Shannon Estuary and Aughinish.

The bird sanctuary located on the North West side of the island is a key habitat for numerous bird and mammal species. Large flocks of migratory winter waders descend upon the bird sanctuary for food and shelter. All variety of waders are present in the bird sanctuary in the winter months from Wigeon (*Anas Penelope*) to Shoveler (*Anas clypeata*) to Mute Swans (*Cygnus olor*). The tall reeds are used as ideal protection from large predators like buzzards (*Buteo buteo*). Another key habitat located on Aughinish is Hunt's Dragonfly Lough located along the east side of Aughinish. This lough is rich in species of dragonflies and damselflies. Common Darter (*Sympetrum striolatum*) to four spotted Chaser (*Libellula quadrimaculata*) to the Irish damselfly (*Coenagrion lunulatum*) have all been recorded in Hunt's Dragonfly lough. The lough is also used by numerous species such as mallards (*Anas platyrhynchos*), smooth newts (*Lissotriton vulgaris*) and grey herons (*Ardea cinerea*).



Figure 2. Photo of bird sanctuary SAC to the west of the refinery

2. Protected sites and their proximity to the refinery

The region (Limerick City and County) has a very rich and diverse range of natural ecosystems. From the Shannon Estuary and its tributaries, to the upland areas such as the Ballyhouras. The agricultural lowlands including the Golden Vale also contribute to the extensive biodiversity of Limerick, as does natural woodlands such as that found in Curraghchase, and the extensive natural hedgerows throughout the county.

Wetlands areas are found throughout the county on the upland bogs, and in the city at Westfields. Fens are also located in Limerick and close-by in the Askeaton area. The Loughmore Common turlough is located on the outskirts of the city at Mungret. The Barrigone SAC is approx. 2km from Aughinish. Barrigone was selected as an SAC due to the presence of three habitats listed in Annex 1 of the EU Habitats Directive. Two of these are priority habitats Limestone pavement and semi natural dry grasslands and scrub facies on calcareous substrates (*Festuco-Brometalia*) (important orchid sites). The third Annex I habitat is *Juniperus Communis* formations on heaths or calcareous grassland. The site was also designated to protect a significant population, a species listed in Annex II of the habitats Directive, namely Marsh Fritillary butterfly (*Euphydryas aurinia*).

Many of these habitats are of international importance having been designated Special Protection Areas (SPAs), Special Areas of Conservation (SACs) and National Heritage Areas (NHAs), as determined by the National Parks and Wildlife Service (NPWS), having notable species of flora and fauna. There are 19 such designations in Limerick City and County.

Aughinish is located beside the SAC of the Shannon Estuary. This is the largest protected habitat in the county of Limerick and is vitally important to the overall ecosystem functionality of the entire county. The SPA runs along the shoreline of the refinery and is hugely important to international bird populations. We also have award winning Annex 1 lowland hay meadow habitat located along the North West of the island. This habitat is hugely important on a national level as lowland hay meadows are internationally very rare.



Figure 3. Photo of the lower Shannon estuary SPA along Aughinish shoreline.

The lands of Aughinish, located along the Shannon Estuary encompass a wide array of habitats and species. The lower Shannon estuary has SAC (Special Area of Conservation) and SPA (Special Protection Area) designation. The habitats which are designated as Annex 1 which occur at Aughinish are estuaries, intertidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, siliceous rocky slopes, calcareous rocky slopes, floating river vegetation, coastal lagoons, limestone pavement, saltmarsh, intertidal flats, low land hay meadow and calcareous grassland. The habitats included into the SAC in Annex 2 are controlled by protected species. The protected species in the area are the Eurasian otter (*Lutra lutra*) and the bottle-nose dolphin (*Tursiops truncatus*).

3. Habitats (Protected and non-protected)

3.1 Lower Shannon Estuary Special Area of Conservation (SAC)

The lower Shannon estuary Special Area of Conservation (SAC) is a large site that encompasses the lower reaches of the River Shannon extending from just south of Lough Derg at its eastern end to a line drawn from Loop Head to Kerry Head at the west. The Mulkear and Maine rivers are included in the site as well as the lower portions of others, such as the Fergus and Maigue. The Lower River Shannon SAC is designated for the Annex I qualifying interests of large shallow inlets and bays, estuaries, mudflats and intertidal flats not covered by seawater at low tide, sandbanks which are slightly covered by sea water all the time and reefs and the Annex II species bottle-nose dolphin (*Tursiops truncatus*).

The Annex I habitat shallow inlets and bays is a large physiographic feature that may wholly or partly incorporate other Annex I habitats including reefs, sandbanks and intertidal flats within its area. This is also the case for estuaries, which may wholly or partly incorporate other Annex I habitats including reefs and intertidal flats within its area.

3.2 Lower Shannon Estuary Special Protection Area for birds (SPA)

The lower Shannon estuary Special Protection Area for birds is a large site that extends across the entire lower Shannon estuary. Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds provides for the conservation of wild birds by, classifying important ornithological sites as Special Protection Areas. The bird species protected under 4(1) and (2) of the Directive are Cormorant (*Phalacrocorax carbo*), Whooper Swan (*Cygnus cygnus*), Light-bellied Brent Goose (*Branta bernicla hrota*), Shelduck (*Tadorna tadorna*), Wigeon (*Anas penelope*), Teal (*Anas crecca*), Pintail (*Anas acuta*), Shoveler (*Anas clypeata*), Scaup (*Anas marila*), Golden Plover (*Pluvialis apricaria*), Ringed Plover (*Charadrius hiaticula*), Grey Plover (*Pluvialis squatarola*), Lapwing (*Vanellus vanellus*), Knot (*Calidris canutus*), Dunlin (*Calidris alpina*), Black-tailed Godwit (*Limosa limosa*), Bar-tailed Godwit (*Limosa lapponica*), Curlew (*Numenius arquata*), Redshank (*Tringa tetanus*), Greenshank (*Tringa nebularia*) and Black-headed Gull (*Larus ridibundus*). All of these species have been recorded at Aughinish.



Figure 4. Photo of Black-tailed Godwit (*Limosa limosa*) along Aughinish shoreline.

3.3 Intertidal flats

Intertidal flat habitats are found between the low water and mean high water tide marks. The finer river silt and clay sediments are dominant in intertidal flats and the larger sand particles are associated with areas exposed to greater wave forces. In addition, changes can occur in salinity, temperature, and exposure to air. The fine sediment of intertidal flats are typically deposited in estuaries. These sediments are often rich in nutrients but the depth of suitable habitat for fauna is limited by the access of oxygen rich seawater. Where tide and wave exposure conditions are suitable, the sediment can form into stable mixed sediment flats. In areas exposed to large waves with little riverine influence, the habitat is lacking binding silt or mud and is mostly composed of larger sand grains.

3.4 Atlantic Salt Meadows

Atlantic salt meadows are communities of herbaceous halophytic (salt-tolerant) plants growing on the margins of tidally inundated shores. They lie at the upper end of a succession between the early colonising species such as common glasswort and transitions to vegetation where tidal influence is limited. Salt marshes and coastal meadows are key habitats for several bird species listed in Annex I of the EU Birds Directive. Their occurrence is often the main justification for their designation as Special Protected Areas (SPAs).

Salt meadows still host viable populations of various widespread bird species not listed in Annex I of the EU Birds Directive but with an unfavourable conservation in Europe due to recent declines in the agricultural landscape. They include wader birds such as northern lapwing (*Vanellus vanellus*), common snipe (*Gallinago gallinago*), black-tailed godwit (*Limosa limosa*) and common redshank (*Tringa tetanus*). At least at a local and regional level, salt meadows are sometimes the only remaining habitats where these birds can still be found in important numbers.



Figure 5. Photo of Curlew (*Numenius arquata*) on Atlantic salt meadow along AAL coastline.

3.5 Lowland hay Meadows

Lowland hay meadows are represented in Ireland by mesotrophic semi-natural grasslands that are almost always managed as traditional hay meadows (cut only once a year in late summer or autumn with the hay crop removed). These meadows are closely associated with the fertile plains of the larger river systems, such as the Shannon. However, they are also found on flatter ground amongst low hills and drumlins, and there are some sites on the coast.

Lowland hay meadows are composed of grasses and broadleaved herbs which are tolerant of annual mowing. Although the vegetation will be tall in mid-late summer, there is generally little leaf litter remaining from the previous season's growth. Plants found frequently in this habitat in Ireland include red clover (*Trifolium pratense*), ribwort plantain (*Plantago lanceolata*), meadow buttercup (*Ranunculus acris*), common knapweed (*Centaurea nigra*), common bird's-foot-trefoil (*Lotus pedunculatus*), meadowsweet (*Filipendula ulmaria*), cat's ear (*Hypochaeris radicata*), yellow oat-grass (*Trisetum flavescens*) and meadow foxtail (*Alopecurus pratensis*). Plants which indicate that the habitat is of better quality include smooth brome (*Bromus racemosus*), field scabious (*Knautia arvensis*), ox-eye daisy (*Leucanthemum vulgare*), greater burnet-saxifrage (*Pimpinella major*), yellow rattle (*Rhinanthus minor*), great burnet (*Sanguisorba officinalis*), Goat's-beard (*Aruncus dioicus*) and orchids such as common spotted-orchid (*Dactylorhiza maculata*), bee orchid (*Ophrys apifera*) and early purple orchid (*Orchis mascula*).

In 2012 as part of the All-Ireland semi-natural grassland survey undertaken by the National Park and Wildlife service (NPWS) awarded the lowland hay meadows on Aughinish as the best example of semi-natural grassland in all of Ireland.



Figure 6. Diversity of plant species present in the lowland hay meadow sward.

4. Flora and Fauna (Protected and Invasive)

4.1 Bottlenose Dolphin (*Tursiops truncatus*)

The Shannon Estuary is the most important site in Ireland for bottlenose dolphins (*Tursiops truncatus*) and was designated as a SAC for this species in 1999. This is one of only two sites designated for this species in Ireland and one of only about 20 in Europe. A study on genetics of bottlenose dolphins in Ireland suggested that the bottlenose dolphins in the Shannon Estuary are genetically discrete and thus of very high conservation value.

As part of the Strategic Integrated Framework Plan (SIFP) for the Shannon Estuary, long-term Static Acoustic Monitoring (SAM) was carried out at 4 deep water jetty sites in the Shannon Estuary. A C-POD (Cetacean Acoustic Hydrophone Network) was deployed from the jetty at Aughinish for a period of 225 C-POD days and at the jetty at Foynes for a period of 288 days from November 5th 2011 to November 4th 2012. The C-POD had a range of c. 800m. Bottlenose dolphins were detected on 31% of the days (70 days) at Aughinish and on 47% of the days (135 days) at Foynes. The population density of bottlenose dolphins has been estimated at approximately 150 individuals.



Figure 7. Photo of two bottlenose dolphin escorting a tug boat off the coast of Aughinish.

4.2 Eurasian Otter (*Lutra lutra*)

Ireland is considered to have the healthiest otter population in Europe. Surveys show that Eurasian otters (*Lutra lutra*) are present in more than ninety percent of our inland waterways and coastal waters. The species, already extinct over much of its former range, are listed as “vulnerable to extinction” by the IUCN (International Union for the Conservation of Nature) and the thriving Irish otter population is of international importance in terms of otter conservation. The riparian zone around Aughinish is designated as a Special Area of Conservation (SAC, site code 002165) along with the freshwater lough within the Bird Sanctuary.

The otter is a top predator in many European freshwater systems and thus has an important role in ecosystem functioning. Otter population density, seasonality of breeding, reproductive success,

carrying capacity, foraging behaviour and local rates of mortality may be linked to prey availability and, hence, reflect the overall status of an ecosystem.

The sea defense wall on the North West side of Aughinish is a common location for Eurasian otters to be observed. The sea wall has had maintenance works carried out over the last 60 years to ensure its longevity into the future. Due to the location of the sea wall between an SAC (Special Area of Conservation) and an SPA (Special Protected Area for Birds), these works are undertaken with the utmost care and attention, outside of the nesting season for birds and breeding season for otters. Otters have been recorded along the riparian zone at Aughinish through camera trapping and also otter spraints. There are also three artificial otter holts built by Aughinish Alumina along the western side of the island that otters frequent.



Figure 8. Photo of a Eurasian Otter along the shoreline of Aughinish.

4.3 Great Burnet and Meadow Barley

The Great Burnet (*Sanguisorba officinalis*) and Meadow Barley (*Hordeum secalinum*) were identified in 2004 in the meadows in the proposed foot print of the phase 2 extension of the Bauxite Residue Disposal Area (BRDA). These plants are protected under the Flora Protection Order 1999 now 2015.

AAL applied for a licence in 2006 to translocate these protected plants from National Park and Wildlife Services under the guidance of BEC (Botanical and Ecological Consultants). One of the conditions of the license was that monitoring of the translocations would be carried out for five years. The monitoring of these translocations was undertaken by BEC on behalf of AAL.

Part of the long term care of these translocations was the development of a management plan. The management plan states that the meadows to the north of the BRDA are cut and baled in late August or September to allow flower heads to go to seed. Under this management The Great Burnet and Meadow Barley have seen their population density increase by approx. 5% over the last 10 years.

These translocations are important as examples of the level of success which can be obtained with a long term commitment to a project, suitable long term and short-term management, and a management plan/structure that clarifies responsibilities and facilities necessary modifications to the prescribed management. As such the success of these translocations are indicative of the commitment from AAL to protect the natural world.



Figure 9. Meadow Barley



Figure 10. The Great Burnet

4.4 American Mink (*Mustela vison*)

Introduction of the American mink (*Mustela vison*) species to Ireland although accidental has added to our mammalian species diversity whilst not affecting any resident species too greatly. In other European countries which had established populations of European minks the spread of the more successful American mink has directly led to that species decline.

In Ireland the effects on prey species can be damaging when minks come into contact with animals which are being captively reared such as farmed salmon, game birds and poultry. Wild populations of ground nesting birds and waterfowl will suffer increased losses if the American mink continues to spread. Smaller mammals such as bank voles and pygmy shrews may also be affected if the American mink numbers continue to increase. The Irish otter is the native species which is most directly in competition with the mink both for prey items and habitat preference, their effects on the Irish otter are not yet fully known.

As the American mink is an introduced mammal species it is not protected legally so it can be trapped to reduce its numbers if they threaten game fish or game bird populations. American Mink have been observed at Aughinish. American Mink can become a severe problem to native bird and mammal species in high valuable habitats which exist on Aughinish Island.

5. Aughinish Alumina Biodiversity Management Plan (AALBMP)

The AALBMP identifies opportunities for biodiversity enhancement, conservation and recommends practical measures aimed at conserving and enhancing the natural heritage of Aughinish.

The main aims of the plan are:

1. Identify habitats, areas of local biodiversity importance and ecological corridors.
2. Strengthen the knowledge base for conservation and management of biodiversity.
3. Increase awareness and appreciation of biodiversity and ecosystems services.
4. To conserve and/or enhance biodiversity and ecosystem services.

The AALBMP is consistent with this 'ecosystem approach'. The ecosystem approach ensures that all of the essential processes, functions and interactions between species, their habitats and their local, non-living environment have been taken into account when promoting best practice management and guidelines for biodiversity conservation. While the size of different ecosystems varies, we must ensure that we protect them in their entirety in order to ensure critical relationships are maintained. The AALBMP includes objectives and targets associated with native species, vegetation management, habitat management, improving ecological connectivity and increasing biodiversity awareness.

AAL has achieved many milestones including placing first in the all-Ireland semi-natural grassland survey, the successful relocation of meadow barley (*Hordeum secalinum*) and the Great Burnet (*Sanguisorba officinalis*), building otter holts and bird hides, and planting over 100,000 trees. These milestones are the foundations that the AALBMP can draw from to maintain this momentum into the future.

The following targets are focused on improving the overall biodiversity of the Aughinish ecosystem over the next 5 years:

1. Complete baseline study of mammals.
2. Develop biodiversity training tool.
3. Install bat roosts and hedgehog houses.
4. Monitor populations of migratory winter birds.
5. Upgrade existing bird hides.
6. Install bird boxes and feeders.
7. Continually monitor and manage our tree plantations.
8. Participate in Dragonfly Dash, All Ireland Pollinator plan and in the national butterfly monitoring scheme.
9. Create species rich grassland on site.
10. Control population of American mink.

6. Conclusion

Aughinish Alumina has been part of Aughinish Island since 1973. Not only has Aughinish Alumina been part of the island for nearly 50 years, it has actually been its protector and steward. Over the last 40 years habitats in Ireland have been trending in a negative direction. There are many reasons for this including artificial fertilizer, non-native forestry and overgrazing.

Aughinish Alumina has been vital in the preservation and ongoing maintenance of the lowland hay meadow on Aughinish. The installation of otter holts around Aughinish has helped to expand the population of the Eurasian Otter (*Lutra lutra*) across Aughinish. The active management from Aughinish of American mink populations has led to stable and expanding native wildfowl populations.

Protecting the habitats and species on Aughinish is only part of what Aughinish (AAL) is going to achieve as part of the AALBMP. Education of its workforce and the wider community to understand the biodiversity of Aughinish and why it is so important is a vital part of the AALBMP.

Aughinish Island under the stewardship of Aughinish (AAL) has seen its habitats trend in a positive direction. The monitoring of these habitats has been vital for Aughinish Alumina to understand and address the needs of individual habitats and species. The AALBMP is leading Aughinish Alumina forward to not only protect the habitats and species but also improve and expand the biodiversity that forms the Aughinish ecosystem.

7. References

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