SHERKIN COMMENT

Issue No. 64 Environmental Publication of Sherkin Island Marine Station *2017*

FOXES

A Photographic Study

(Centre pages)

A curious fox on Sherkin Island.
Photograph: Robbie Murphy

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Editorial

Documenting Everyday Life

By Matt Murphy

I CONSIDER myself blessed to be a hoarder. My family however would not consider it such a blessing and tease me a lot about it. Yet it is thanks to this hoarding that I have accumulated a vast "collection" of my earlier life on the mainland before coming to live on Sherkin in 1971. Prior to that we lived in Knockbrack, Banteer in North Cork, and before that we live in Cork City, where my late wife Eileen and I grew up. I was involved in many adventures before island life, including building my own canoes and horse drawn caravans, buying horses, breeding pigs and fattening them for the factory and producing souvenirs. I have saved many records from these businesses, some of which stretch back over 60 years. They give a real insight into what it cost to run a business back then but also give an idea of what everyday items cost. What is interesting is that when you received your monthly statement from banks you also got the cheques you issued in that month. These in themselves tell fascinating stories. In this digital age, paper copies will more and more become things of the past and personal memorabilia will also become scarcer and scarcer.

The importance of collecting local and personal material is one that is close to my heart and one that I have mentioned a number of times in *Sherkin Comment*. The late Tim Cadogan, Executive Librarian at Cork County Library, was an immense help to thousands of people, including myself, who turned to him when they were researching many aspects of local history. Tim in his article "Keeping Records of the Past for the Future" in *Sherkin Comment* No. 25 wrote:

"The most valuable historical records are often those that were created without any notion of their historical value. These include all varieties of business records, diaries and journals, correspondence and photographs. There are many collections in these categories preserved in archives and libraries, but their geographical variety and range is far from impressive. The general public has a key role to play here. Every family has its own collection of family memorabilia; every community its local long-serving business. Every effort should be made to preserve locally-generated documents of that type for the long-term benefit of the community.

"It is only in the long-term that the value of collections of local material is appreciated, usually when they are only a memory. Do you know of a potential historical treasure throve of material? If you do, encourage its caretaker to take measures to preserve it for future historians, now!"

Throughout the country there are a number of historical societies that have and are doing Trojan work in recording times past. Many of these societies hold talks within the community on local history and arrange field trips and other events of interest. They also produce Journals – some are published annually and others every few years – giving people an opportunity to document local stories of interest. A few in West Cork include: *Rosscarbery Past and Present*, *Skibbereen and District Historical Society Journal*, *Ardfield/Rathbarry Journal* and *Bandon Historical Journal*. Each has superb articles of local interest.

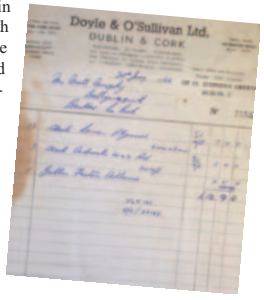
I recall one particular article from *The Mizen Journal* – sadly no longer published. It was about Julius Reuter, who set up the SW of Ireland Telegraph Co. that collected news from steamers that crossed the Atlantic. Reuters, as we know today, is a huge international news-gathering company. Another volume of the Journal that also contained articles on Archaeology projects researched by transition year students at Schull Community College.

An article in the *Skibbereen and District Historical Society Journal* called "Time Capsule 1st January 2014" preserves a snapshot of Skibbereen, a small West Cork town, as it was on 1st January 2014, with most of the statistical information coming from the CSO 2011/2013 Census report.

Rosscarbery Past and Present featured a most interesting article on Charlies Orr Stanley who lived at Lisselan near Clonakilty. He owned the radio manufacturing company W.G. Pye, which was the biggest name in the world of radio. The same Journal paid tribute to the Sisters of Mercy as they said farewell to Rosscarbery where they made a huge contribution to the educational needs of the area. My own children went to secondary school there and it was a happy experience for them.

In the *Ardfield/Rathbarry Journal* there is an example of someone documenting personal memories. Mary Theresa Nyhan of Dunowen and Greenanes was born in 1922 and in conversation with Audrey Harris, she recalled the simple days of her youth and gives a real insight into everyday life back then.

Tim Cadogan pointed out in his article that *"the Irish experience of preserving records of the past has been far from impressive. The destruction of the Four Courts, the location of the Public Records Office of Ireland (P.R.O.I), in the opening salvos of the Civil War in 1922, is the darkest in the story. Records dating back to the early centuries of English administration in Ireland disappeared in the conflagration. Perhaps the most dramatic loss in terms of broad interest to the general public, however, was the 1851 Census returns, as well as those for the three preceding censuses in 1821, 1831 and 1841. Had the census for 1851 survived, providing a base-line record of every person then living in Ireland, its value to genealogists and social historians today would be enormous. Its absence means that other less satisfactory sources have been pressed into service as substitutes."*



An invoice from 1966, for materials to build horsedrawn caravans.

If you are interested in donating personal memorabilia, contact the local studies department of your county or city library and they will be able to direct you.

Matt Murphy, Director, Sherkin Island Marine Station, Sherkin Island, Co Cork.

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Sălaj County

Off the beaten track in N.W. Romania

John Akeroyd explores one of Sălaj's wildflower-rich meadows.

Image courtesy of Laura Chirila

Image courtesy of Laura Chirila

Pyramidal Orchid (*Anacamptis pyramidalis*).

Image courtesy of Pandrina ADEPT

Purple Viper's-grass (*Scorzonera purpurea*).

By John Akeroyd

FOR the last 15 years I've worked in Transylvania with Fundația-ADEPT, an Anglo-Romanian conservation NGO. Based south of the medieval town of Sighișoara, in countryside where farming still coexists with wild plants and animals, ADEPT seeks to protect both the rich biodiversity and livelihoods of local people via sustainable economic development – promoting farming for high-value food production, 'green' tourism and local crafts and skills. This conservation model, putting farming families and communities at its heart alongside biodiversity, has proved influential in Romania and elsewhere in the Carpathians and further afield. The Saxon Villages or Târnava Mare Special Area for Conservation, where ADEPT is based, is nature-rich and visitor-friendly, but much of Transylvania has traditional foods, history and culture, wildlife and wildflowers, and the ADEPT model readily transfers to other projects.

In July I took up a long-standing invitation to see one such project in a lesser known district, travelling 300 km north to Sălaj County, some 60 km beyond the historic university city of Cluj-Napoca. I spent an enjoyable weekend among friends and colleagues in the small town of Jibou, near the county town Zalău, based at Vasili Fati Botanic Garden, created in the 1960s and with Romania's second largest plant collection. The 30-ha terraced garden lies in the grounds of a handsome, unoccupied 18th-century Hungarian palace – Hungarians remain a strong ethnic minority in Sălaj. The Garden includes laboratories, a glasshouse range including two geodesic domes (built not long after the first such plant house, at Missouri Botanic Garden in 1960), a Japanese Garden, a herb and medicinal plant collection, beds and rockeries displaying Romanian, Balkan and other European wild plants, and a wild area of semi-natural vegetation.

I was the guest of Sălaj Plus (www.salajplus.ro), a council-funded tourism and rural development group based in Zalău that works closely with the Botanic Garden. Sălaj Plus aims to conserve traditional decorated village houses, wooden churches (of which Sălaj has more than any other Romanian county), old castles, the countryside, biodiversity and geology, as well as promoting museums and other visitor attractions, traditional crafts and food products. Wildflowers are varied and abundant, and in spring there are meadows of Fritillary and Narcissus. This rural county of rolling, often steep-sided and well-wooded hills, low population density and quiet roads remains a farmed landscape of villages, arable land, hay-meadow, pasture and woodland. Semi-traditional mixed farming, now modernizing but without too much intensive agriculture and agro-chemical use, has been kind to the wildflowers and wildlife. The land rarely rises over 600 m but the county has a remote mountainy feel.

On the first afternoon we explored the nearby remains of the Roman town of Porolissum, which each summer hosts a 'Roman Festival' and is an obvious focus for tourism. Set on a commanding ridge, in the 2nd to 3rd centuries AD Porolissum was the nerve centre for forts and earthworks of the Limes or fortified frontier of Dacia province, impeding barbarian incursions from north and east at this furthest limit of Empire. A restored gate and flanking towers give a glimpse of the Roman garrison and market town, still with remains of paved roads, walls and buildings, and an amphitheatre built into the hillside. From 271 AD the Romans retreated beyond the Danube but they and the Dacians had together bequeathed Romania an identity.

Image courtesy of Sebi Olaru

(Left to right) Laura Chirila from Sălaj Plus, honey producer Alin Prunean and John Akeroyd watch Sălaj chef Mircea Groza add Sorrel to his 'Romano-Dacian' goat stew.

Image courtesy of Laura Chirila

John Akeroyd and village ladies in traditional dress outside the church after the blessing of the crops.

Sunday morning began with a country breakfast: local bread, cheese and sausage, home-cured ham and slănină or fat bacon, tomatoes and scallions. We then drove through peaceful green countryside to the village of Tămaa, home of Dr Cosmin Sicora, Director of the Botanic Garden. His own small hay-meadows were full of wildflowers I've come to know well in the 'Saxon Villages', but with a more upland feel. In a damp meadow Globeflower was over but there was Sorrel, Betony and Spreading Bellflower. A horse and cart took us up through woods to a flowery hillside with vistas of woods, hills and distant mountains, and an eclectic floral mix: Deptford Pink, Dyer's Greenweed, Grass Vetchling, Sticky Catchfly, wild roses (Provence Rose and Small-flowered Sweet-briar), Purple Viper's-grass and more. Descending to the village church we caught the end of a service to bless the crops, receiving holy water, a blessing and green stems and ears of wheat. A companionable outdoor buffet lunch included assorted traditional products, roast pork and salads, wine, pălinca or plum brandy, the Director's elderflower cordial, and delicious brown honey, the best I've ever tasted. Rural Transylvania remains one of few places in Europe where the food and drink at the table all comes from local small or home producers, with the added value of a healthy, biodiversity-rich landscape.

In the afternoon we travelled 15 km south-east to a botanical 'hot spot' amid pasture and arable land between the villages of Sfăra and Jebucu. Investigated by botanists only recently, soft limestone and gypsum bluffs hold an array of steppic and dry grassland plants: Small Allysum, European Michaelmas-daisy, Siberian Bellflower, Gypsophila, Jurinea, Nodding Sage, Bastard-toadflax and many others, not least Garland Flower (Daphne cneorum), a low shrublet with scented pink flower-heads in spring, which I'd hardly ever seen. On the way back to Jibou we examined more dry grassland, which yielded fine Pyramidal Orchids and other species. Finally, the next morning, a Sălaj Plus press conference, gratifyingly widely reported online and on social media, was a chance to present the value of conservation projects for local communities; and then the long return leg to the Saxon Villages. I'll certainly be back in Sălaj and I hope others will follow.

Dr John Akeroyd is a botanist, conservationist and writer, with a special interest in conservation of farmed landscapes in Romania and elsewhere.

Looking to the Sea as an Alternative Energy Source

By Val Cummins

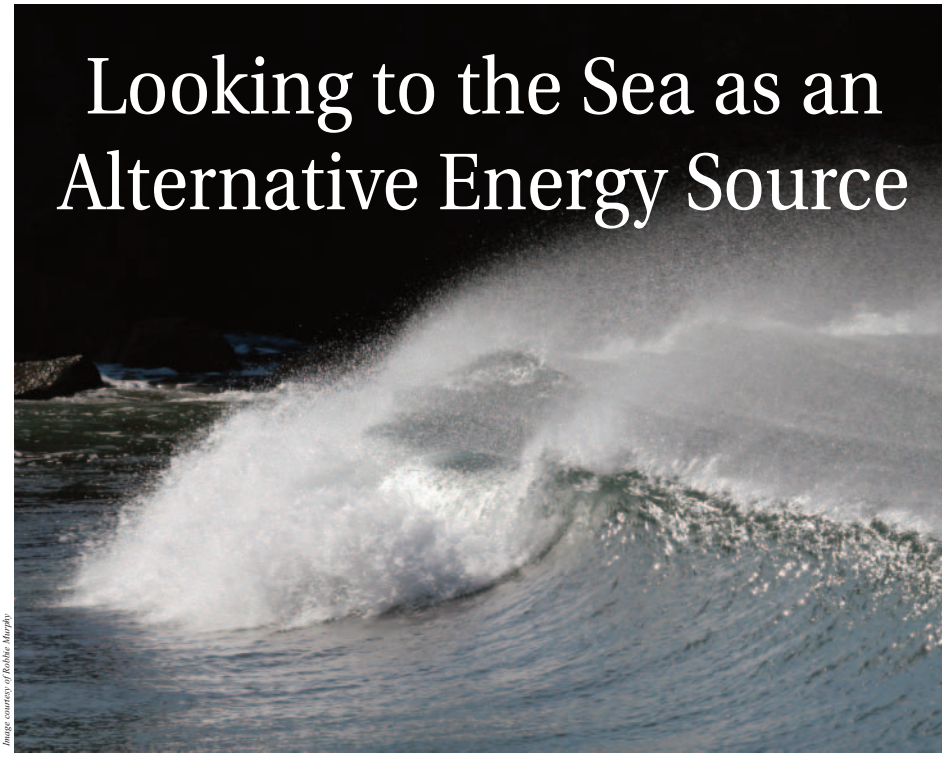


Image courtesy of Robbie Murphy

DESPITE the withdrawal from the Paris Agreement on climate change by the United States, under the presidency of Donald Trump, it is now widely accepted that there must be a paradigm shift from fossil fuels to alternative energy sources. Alternatives such as solar energy, biofuels and wind energy, can offset the production of harmful Green House Gases (GHG) from the burning of oil and gas. The marine environment presents an abundant, untapped source of clean, renewable energy. As well as mitigating the effects of climate change, the exploitation of energy from the sea also has the potential to address global energy scarcity, security of energy supply, and the development of new supply chains.

Our vast marine resource is gaining increasing attention. As a country that was traditionally sea-blind, Ireland is awakening to new opportunities from marine data, fishing and offshore aquaculture, and marine biotechnology, among others. Research published by the Socio-Economic Marine Research Unit (SEMRU) in NUI Galway in June, indicates that Ireland's 'blue economy' has grown more rapidly than the wider economy in recent years. However, the post-modern marine sector in Ireland is still relatively small, and the economic footprint from marine renewables has big shoes to fill. It is not a one size fits all. Marine renewables are nuanced according to the source of the energy (i.e. offshore wind, wave, tide) and the status of the Technology Readiness Levels (TRLs) required to capture the requisite benefits.

Our marine environment, which represents ten times our land mass, is Ireland's greatest energy resource. The Offshore Renewable Energy Development Plan (OREDP), (currently under mid-term review), provides a policy framework for offshore wind, wave and tidal energy in Ireland. Offshore wind is relatively well-established in the sheltered and shallow sea basins of much of Europe. The OREDP sets out an optimum scenario of 4.5GW of offshore wind in Ireland, including floating wind, by 2030. The relatively shallow waters of the east coast are prime locations for fixed bottom offshore wind turbines. The Arklow Bank, a 25MW partnership venture between Airtricity and GE Energy, was the first offshore wind farm in Ireland, and the world's first windfarm with turbines over 3MW each. Yet, subsequent to that development, other projects in the Irish Sea including the Oriel Wind Farm (330MW), Dublin Array (725MW), and Codling Wind Park (1.1GW), remain under consideration. Unresolved issues around grid connection, licensing, and the Renewable Energy Feed-In Tariff (REFIT), prevail.

Floating wind turbine technology opens the industry to previously undeveloped, resource-rich areas such as the south and west coasts of Ireland, in deeper waters (>50m). As costs reduce and technology advances, floating offshore wind is expected to become more competitive and ubiquitous. The world's first floating wind farm, Hywind, consisting of five floating 6 MW turbines, was deployed off the East coast of Scotland this summer. This multi-turbine array, paves the way for more expansive development, which is expected to accelerate in Europe as this technology becomes more cost effective.

Evidence suggests that a fully developed ocean energy sector in Ireland (wave and tidal) would deliver a total net present value of €9 billion, as well as providing many thousands of jobs to the economy. Ireland's tidal energy resource is limited to areas with considerable tidal streams, such as off the coast of Northern Ireland. It is anticipated that up to 3GW of tidal energy can be harnessed. Some tidal energy technologies have reached the stage where technology developers and utilities are collaborating on commercial demonstration projects. Open Hydro, based in Greenore, County Louth, is a prime example, with a significant 2MW project delivered off the north coast of Brittany, and further projects under development in the Bay of Fundy, and in the Naru Strait in Japan. Closer to home, Fair Head Tidal is a 100MW scheme currently in the planning with Cork based DP Energy and Belgian company Bluepower NV.

Models shows that energy from the ocean waves converging on our shores, has the potential to deliver 75% of the Republic's total electricity requirement. However, the engineering challenge required to deliver a commercially viable Wave Energy Device (WEC), means that this potential will remain unfulfilled until wave energy technology matures along the TRL scale. Ireland could be poised to accelerate in the development of wave energy, thanks to government support in the form of essential testing facilities in recent years. These include the Lir National Ocean Test Facility in UCC's Beaufort Building in Ringaskiddy; the quarter scale test site in Galway Bay, which allows companies to test in an operational environment without incurring the cost of building a full scale model; and the full scale Atlantic Marine Energy Test Site (AMETS), edging towards completion, off the coast of Belmullet.

WEC developers require a myriad of supports. Industry calls for access to the testbed facilities, access to R&D capacity such as the MaREI Centre, and access to prototype development funds, have been channelled through the Marine Renewables Industry Association (MRIA), which has highlighted the need for relevant research, and the challenges associated with accessing appropriate funding models. The industry has been vocal on the issue of foreshore licensing, the elephant in the room for the development of the marine as a whole in Ireland, most recently evidenced by the controversy surrounding the granting of a licence for the Galway Bay demonstration site, known as SmartBay.

Many commentators have highlighted factors such as the Levelised Cost of Energy (LCOE), TRLs, or grid interconnection for the slow emergence of marine renewables on the horizon. However, the SmartBay issue indicates that the key challenge in the transition towards a marine renewables future for Ireland is one of governance, the arena where the interplay between government, industry and civil society plays out. The deployment of infrastructure at sea needs to be regulated in an efficient and transparent manner, to the benefit of both developers and coastal stakeholders. Our archaic foreshore licensing system needs to be dealt with as a matter of urgency in order to achieve this. We cannot afford to let this precious opportunity of Ireland's maritime awakening slip through our grasp. The opportunity to become a global leader in marine renewables is within our reach for offshore wind and tidal within the next five years, and for commercially viable wave energy by 2030.

Val Cummins, Lecturer, School of Biological, Earth and Environmental Sciences, UCC, Cork. 9th August, 2017.

Dedicated to Protecting Our Water Courses

Donal Daly – *An Appreciation*

Donal Daly, second from the right, with other conference speakers, when they visited the then Deputy Lord Mayor of Cork, Cllr. John Dennehy, at City Hall in 2000.

By Matt Murphy

THROUGHOUT my long life I have been very fortunate in meeting people who, over a number of years, have influenced my thinking on many issues. Their advice and input on the research we carried out, articles for *Sherkin Comment*, topics and papers for conferences have always been given after much thought and consideration. These contributions have been from people whose commitment to the environment has been evident and I have always appreciated their help in our work and in our efforts to educate people on the environment.

This article is a tribute to one of those people – Donal Daly, who recently retired from the Environment Protection Agency. I first met him when he attended one of our early environmental conferences in Cork City. At that stage he was working for the Geological Survey of Ireland, based in Dublin. We got talking during one of the breaks and he hooked me immediately when he started to talk about the siting of septic tanks and groundwater protection. I knew very little about groundwater and pollution and within a few minutes I asked him if I organised a future conference on the issue of sewage disposal would he give a paper? Two years later it came about and Donal gave a paper "Septic Tank Effluent and Groundwater Pollution". That paper led to further conferences by him and papers which included "The Importance of Rocks and Groundwater in preparing an EIS", "Practical Approaches to Preventing Pollution in Wells" to Chemical Pollutants in Groundwater – A Review of the Situation in Ireland". The obvious next move for me was to get Donal to write articles for *Sherkin Comment*. This he has done with over 18 articles ranging from the importance of aquifers, to the issue of septic tanks, to his latest article in this issue "The health of our waters is the principal measure of how we live on the land" (page 11).

Through some of his friends I got some further information about Donal. He completed a BSc in Geology at NUIG (or UCG as it was then) in 1975. In the final year of his geology degree he opted to take Dr. David Drew's week long hydrogeology module, which maybe played a part in his career choice. It was to become evident from his career path that Donal has a very strong commitment to public service. He went on to complete an MSc in hydrogeology in Birmingham in 1976. After that he worked for Severn Trent Water Authority. In 1978, he came back to Ireland and joined the Geological Survey of Ireland where he worked with Bob Aldwell, Geoff Wright, Eugene Daly and where many more Irish hydrogeologists started their careers under his guidance.

During the 1990s, Donal was slowly starting to formalise groundwater protection based on his experience gained during, and prior to, his Geological Survey Ireland years. By the end of the 1990s, the 'Groundwater Protection Scheme' process seemed like a well-oiled machine churning out county schemes. By then, the jointly produced Groundwater Protection Schemes document was conceived, researched, developed and being tested with the, then, near completed schemes (e.g., Offaly, Limerick).

Donal was one of the early members of the International Association of Hydrogeologists (Irish Group), which was established in 1976. He made a significant contribution to the IAH Annual Conference and was conference secretary in the 1990's. He was instrumental in the organisation of Technical Discussion Meetings (TDMs) for many years. The TDMs are a great opportunity for those with an interest in groundwater to meet and discuss the latest developments in the fields relevant to hydrogeology in Ireland and beyond and are open to all involved with groundwater.

Ten years ago (2007) Donal moved to the Hydrometric and Groundwater Section of the Environmental Protection Agency (EPA) and three years ago to the newly formed Catchment Science and Management Unit, whose role is to lead and facilitate characterisation to support EPA Water Framework Directive (WFD) implementation, including reviewing the impact of human activities, designing management strategies and contributing to the River Basin Management Plan.

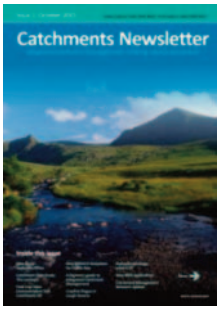


Image courtesy of EPA

The Catchments Newsletter.

His publications are numerous but 'Groundwater the Hidden Resource' Biology and Environment: Proceedings of the Royal Irish Academy Vol. 109B (2009) - Special Edition on the Water Framework Directive, and more recently 'Progress and Challenges in Managing our Catchments Effectively' Biology and Environment: Proceedings of the Royal Irish Academy, Vol. 116B, No.3 (2016), are two to mention.

He was editor of the 1st Groundwater Newsletter in 1986, where its objective was to 'bring together news, developments, review and opinion on all areas of groundwater… to promote a proper appreciation of the value and importance of groundwater.'

In November 2015, the Catchment Unit of the EPA published the first Catchment Newsletter for which Donal was Editor from the beginning issue until his retirement. The autumn issue No 6 has just been published and is available online at https://www.catchments.ie/catchments-newsletter/

It is clear that Donal's contribution to the understanding of hydrogeology and promotion of groundwater protection in Ireland is vast.

I wish Donal well in retirement but I know I'll be talking him into writing articles for *Sherkin Comment* every so often. His wonderful understanding of our natural resources – water, cannot go into retirement.

Matt Murphy, Director, Sherkin Island Marine Station, Sherkin Island, Co Cork.

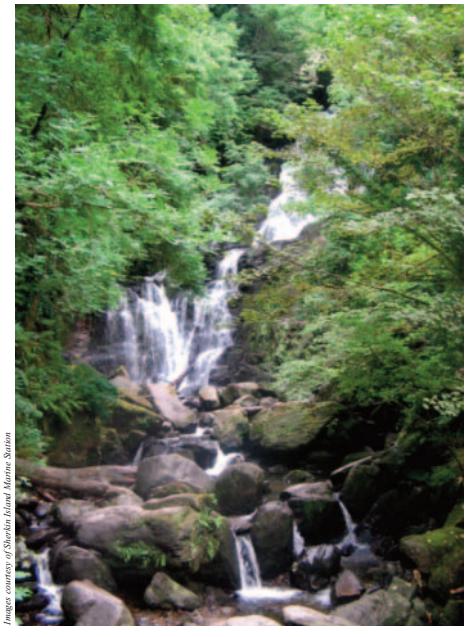


Image courtesy of Sherkin Island Marine Station

Donal has made a vast contribution to the understanding of hydrogeology and promotion of groundwater protection in Ireland.

A Shad Story

Alosa in Irish Waters

By Declan Quigley

SHADS belong to a relatively small sub-family (Alosinae) of a much larger order (Clupeiformes) of marine, freshwater and/or anadromous fishes. The Clupeiformes are represented worldwide by 5 families, 84 genera and 364 species and include many familiar and commercially important species such as Herrings, Sprats, Sardines, Pilchards, Anchovies, and Shads. The Alosinae (Shads) are represented worldwide by 7 genera (*Alosa, Brevoortia, Ethmalosa, Ethmidium, Gudusia, Hilsa*, and *Tenualosa*) and 31 species. Although the systematics of *Alosa* is in need of critical review, at least 14 species are thought to occur in Eurasian waters, including 3 in Irish waters (Table 1).

Twaite Shad (*Alosa fallax*), maximum SL 60 cm and 1.8 kg, is an anadromous species which was formerly common throughout NW Europe, the Mediterranean and Black Sea. However, during the early 20th century the species experienced a drastic decline due to pollution and the impoundment of many large European rivers. Indeed, prior to construction of impassable dams, spawning populations previously ascended the Rhone for up to 600 km.

Although small numbers of Twaite Shad have occasionally been recorded as a by-catch in coastal fisheries, the species is currently only known to spawn in three Irish rivers: Barrow (St Mullins), Suir (Carrick-on-Suir), and the Munster Blackwater. Since the late 1970s, anglers have been specifically targeting spawning Twaite Shad at St. Mullins during April, May and June each year.

A. fallax is currently classified as 'vulnerable' in the Irish Red Data Book of Vertebrates (1993), and under *Appendix III of the Bern Convention* (2002) and *Annex II & V of the EC Habitats Directive* (2007).

Killarney Shad (*Alosa killarnensis*), maximum SL 20 cm, is an endemic non-anadromous lacustrine species of shad, unique to Ireland, and only known from Lough Leane, Killarney, Co Kerry.

During a visit to Killarney in 1853, Mr Ffennell (Inspecting Commissioner of Fisheries) reported 'On the occurrence of herrings in the Lakes of Killarney'. He noted that the fish were known by the local fishermen as "Goureens" and were frequently taken in the salmon nets. Although Ffennell suggested that the fish might be Pollan (*Coregonus* sp.), 63 years later, Tate Regan (1916) formally recognised them as a type of Twaite Shad. For many years thereafter, the Killarney Shad was considered to be a dwarf 'sub-species' of *A. fallax*, but recent genetic evidence supported its species specific status, resulting from geographical and genetic isolation since at least the end of the Last Glacial Maximum (c.10k years ago).

Due to its uniqueness and the on-going impact of pollution on Lough Leane, *A. killarnensis* is currently classified by CITES (2013) as 'critically endangered', as 'endangered' in the *Irish Red Data Book* (1993), and as 'vulnerable' under the *Bern Convention* (1982) and *EC Habitats Directive* (1992).

Allis Shad (*Alosa alosa*), maximum TL 83 cm and 4 kg, is an anadromous species which was formerly common throughout NW Europe and the western Mediterranean Sea. Spawning populations previously ascended many large European rivers, including the Rhine as far as Basel (Switzerland), a distance of 850 km. However, due to pollution and the impoundment of rivers, the species is now considered to be critically endangered throughout its European range.

Although small numbers of Allis Shad have occasionally been recorded as a by-catch in coastal fisheries, no indigenous self-supporting spawning populations are currently known to inhabit Irish rivers. Nevertheless, circumstantial evidence based on the discovery of a couple of maturing adults c.25 km upstream in the Munster Blackwater, as well as some juveniles in its estuarine region, and the occurrence of adult Twaite x Allis Shad Hybrids in the nearby River Barrow at St Mullins, suggest that at least some Allis Shad probably spawn in both of these rivers. Elsewhere, there are only two historical records of Allis Shad occurring in Irish rivers: River Shannon (Killaloe, 1861) and Upper Lough Leane (Killarney, 1953).

A. alosa is currently classified as 'endangered' in the *Irish Red Data Book* (1993), and as 'vulnerable' in the *Bern Convention* (1982) and *EC Habitats Directive* (1992).

Attempted introduction of American Shad into the R. Shannon

During 1900, it was reported that Mr Moreton Frewen had imported 100,000 American Shad (*Alosa sapidissima*) eggs for stocking the River Shannon with the intention of developing a commercial fishery for the species in Ireland. Fortunately, all of the eggs perished on their way to Ireland from the USA.

Global Exploitation of Shads

Although at least 6 species of *Alosa* are commercially exploited throughout the world, since 1950 the American Shad has accounted for almost 80% of the total recorded landings, with Allis Shad and Twaite Shad only accounting for a combined total of 0.1%. Since the late 1960s, global landings of all *Alosa* species exhibited a dramatic 90% decline from a peak of 86.5k tonnes in 1969 to only 8.5k tonnes in 2015 (Fig. 1).

Angling for Shad in Irish Waters

Shad are considered to be a worthy, albeit short-term seasonal quarry by anglers due to their strong fighting ability accompanied by frequent acrobatic aerial displays, particularly when captured on light tackle (56% taken on '*Tasmanian Devil*' & 10% on 'ABU Toby'). Indeed, since 1979, the *Irish Specimen Fish Committee* (ISFC) has recorded a total of 893 rod-caught specimen Shad weighing >0.68 kg (1.5 lbs) [858 *A. fallax*, 35 *A. fallax* x *A. alosa* hybrids, but no *A. alosa*], including the current Irish Record Twaite Shad, weighing 1.64 kg, captured from the River Barrow (St. Mullins) during May 2015. Indeed, all of the specimens, except two were captured at St. Mullins. A single specimen was captured in the River Suir at Carrick-on-Suir during May 2011, and another at Quilty, Co Clare during December 1982.

The current ISFC minimum qualifying specimen weights for Twaite Shad and Allis Shad is 1.2 kg and 1.814 kg respectively. Only 7.5% of the recorded specimens weighed >1.362 kg (3 lbs). Although the annual number of specimens recorded has fluctuated on an apparently cyclical basis over the last 4 decades (Fig. 2), the annual out-take may be influenced by a multitude of factors, including angling effort, stock levels, and environmental conditions (e.g. tides and water temperature). Based on the monthly frequency distribution of specimens, the arrival of the annual upstream spawning run at St Mullins appears to begin during early April when the water temperature average about 10°C, peaking during May, when over 90% of the specimens are captured, and quickly tailing off during the first two weeks of June (Fig. 3).

Considering their national, EU and internationally recognised conservation status as 'vulnerable' 'endangered' and 'critically endangered', the wisdom (and legality) of condoning and promoting targeted exploitation of shad (particularly on their spawning beds) by recreational anglers is debatable.

Twaite Shad and Allis Shad have both been on the ISFC's list of eligible species since its inception in 1955 with initially set minimum qualifying weights of 2.5 lbs and 4.0 lbs respectively. Presumably in order to drum up some interest in shad fishing, the specimen weight was reduced to 2.25 lbs in 1969, and when this yielded no returns, a more significant reduction was implemented in 1978 (1.5 lbs.). This revision led to the ratification of the first specimen Twaite Shad in 1979. Since then, and presumably conscious of the species vulnerable status, the ISFC has endeavoured to regulate the out-take of shad specimens by cautiously increasing the specimen weight on no less than 6 subsequent occasions (1983, 1985, 1993, 1999, 2000 & 2014) to its current level (1.2 kg, 2.65 lbs). However, despite the gradual increase in minimum specimen weights and the introduction of the '3-specimen rule' in 1983 (anglers can only claim a maximum of 3 specimens of any given species in any one year), the annual out-take of specimen Shad does not appear to have decreased. Meanwhile, the minimum specimen weight for Allis Shad has remained unchanged for over 60 years !

Up to 2008, specimen shad (and claims for several other species) had to be sacrificed and the body sent to the ISFC for formal identification, mainly on the basis of gill raker counts. However, in the interests of conservation, and following the development and availability of DNA barcoding techniques in UCD (Dublin), the ISFC revised there rules during 2009. A sample of 3 scales is now required for confirmatory DNA analysis, along with photographic evidence.

Although the majority of conservation-orientated anglers practice 'catch-and-release', nothing is known about the post-release survival rate of Irish rod-caught shad. A post-release mortality rate of 31% was reported for rod-caught American Shad. Shad are relatively delicate fish and are particularly intolerant to handling. The additional handling required in order measure, weight, photograph, and take a sample of scales from specimen shad (all current ISFC requirements), may result in an even higher post-release mortality rate. Specimen-size Shad represent the largest and most fecund individuals in the population (whose overall stock status is unknown) and their removal via cryptic post-release mortality is likely to have a disproportionately negative impact on the overall reproductive capacity of what is already a designated vulnerable or endangered species. Alas, a shad state of affairs.

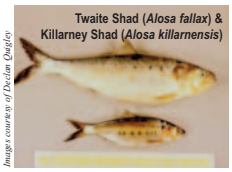
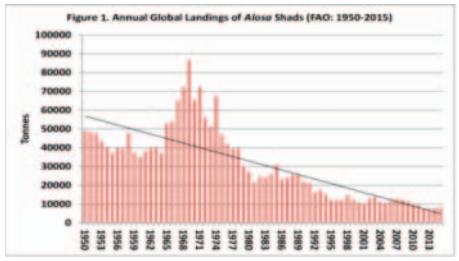
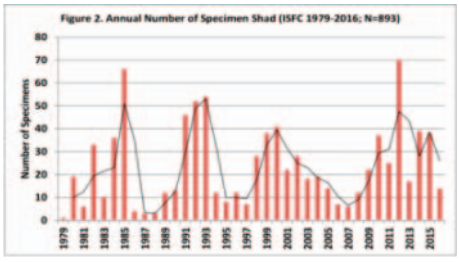


Image courtesy of Declan Quigley

Declan T. Quigley: Dingle Oceanworld (Mara Beo Teo), The Wood, Dingle, Co Kerry. Mobile: 087-6458485 Email: declanquigley@eircom.net





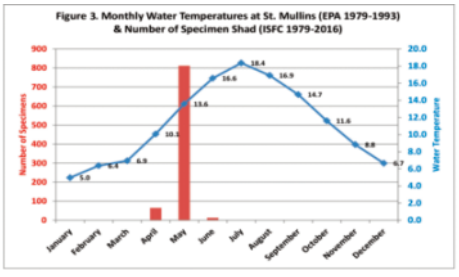


Table 1. Eurasian species of *Alosa* Shads

Common Name	Species	Habitat	Distribution
Allis Shad	*Alosa alosa* (L.)	anadromous	NW Europe (including Ireland) & W Mediterranean
Twaite Shad	*Alosa fallax* (Lacepède, 1803)	anadromous	NW Europe (including Ireland), N Mediterranean & Black Sea
Killarney Shad	*Alosa killarnensis* Regan, 1916	lacustrine	Lough Leane (Killarney, Co Kerry, Ireland)
Caspian Shad	*Alosa caspia* (Eichwald, 1838)	anadromous	Caspian Sea
Volga Shad	*Alosa volgensis* (Berg, 1913)	anadromous	Caspian Sea
Black Back Shad	*Alosa kessleri* (Grimm, 1887)	anadromous	Caspian Sea
Pontic Shad	*Alosa immaculata* Bennett, 1835	anadromous	Black Sea & Sea of Azov
Azov Shad	*Alosa maeotica* (Grimm, 1901)	anadromous	Black Sea & Sea of Azov
Black Sea Shad	*Alosa tanaica* (Grimm, 1901)	anadromous	Black Sea & Sea of Azov
North African Shad	*Alosa algeriensis* Regan, 1916	lacustrine & anadromous	Lake Ichkeul (Tunisia), Sardinia & SW Mediterranean (Morocco & Tunisia)
Agone	*Alosa agone* (Scopoli, 1786)	lacustrine	Lakes Como, Iseo, Garda & Orta (Italy); Maggiore & Lugano (Italy/Switzerland)
Macedonian Shad	*Alosa macedonica* (Vinciguerra, 1921)	lacustrine	Lakes Volvi (Besikia) & Koronia (Greece)
Thracian Shad	*Alosa vistonica* Economidis & Sinis, 1986	lacustrine	Lake Vistonis (Greece)
Skadar Shad	*Alosa sp.*	lacustrine	Lake Skadar (Montenegro/Albania)

TOADFLAX
The Genus Linaria

By Tony O'Mahony

WITHIN the family **Veronicaceae**, the visually attractive, but taxonomically difficult genus *Linaria* (Toadflax), contains approximately 70 species native to mainland Europe, where they have their centre of distribution in the Mediterranean region. The flowers of all Toadflax species and hybrids bear *basal spurs* (of various shapes) which contain varying amounts of nectar (derived from the base of the ovary), while the distal end (i.e. the front of the flower) is distinctively *2-lipped*. The main pollinator species are heavy-bodied, long-tongued bees, who access the pollen and nectar within, by skilfully alighting on, and depressing, the lower lip of the flower. In the process of foraging, they are liberally dusted with pollen, which is then transported to other flowers, thus ensuring the pollination and fertilisation of these. No doubt the bees eat some of the pollen (which is a high-protein food), while the carbohydrate-rich nectar is a potent energy-source. Where two or more Toadflax species cohabit (as in gardens), this incessant bee activity inadvertently transfers pollen from one species to another – not infrequently resulting in the production of hybrid seed. When mature, the flowers of these hybrid offspring display a bewildering mix of parental characters – a delightful novelty for the gardener, but a source of identification difficulty for the botanist!

Images courtesy of Tony O'Mahony

Left: Anomalous Garden Toadflax (Linaria species). Right: Yellow Toadflax (*Linaria vulgaris*).

Linaria species and hybrids in Britain and Ireland

In stark contrast to the wealth of Toadflax species that occur on the European mainland, only a *single* species can be claimed with confidence as indigenous to Britain and, possibly, to Ireland also, namely: Common Toadflax (*Linaria vulgaris*). This beautiful perennial species has a spreading, rhizomatous growth-habit, blue-green leaves and lemon-yellow flowers (produced from July to September) that bear a contrasting orange boss on the lower lip. While Yellow Toadflax is of widespread and common occurrence over most of Britain, its delightful flowers are, most regrettably, a *rare* sight in Ireland, where this species is of very local occurrence, and apparently in decline. (My photograph of Yellow Toadflax was taken on an embankment bordering a section of the long-defunct Cork-Crosshaven Railway Line (now a public walkway) in Blackrock, Cork City.)

Britain also boasts seven naturalised Toadflax species (while some fifteen additional species are grown in gardens, and occasionally occur as casuals in the wild), of which *just two* are also established in Ireland: Pale Toadflax (*Linaria repens*) and Purple Toadflax (*L. purpurea*). Of these, Pale Toadflax (native from North Spain and NW Italy to NW Germany) has been established in both islands since 1830 at least. It is a rhizomatous species (occasionally running wild in some gardens) bearing beautiful, white or pale-mauve flowers decorated with violet veins, and a yellow boss on the lower lip. Purple Toadflax (endemic to Sicily and to central and south Italy) – a popular garden plant – was also established in the wild in Britain by 1830, and in Ireland mostly from the 1890s onwards to the present day. It is a clump-forming species, lacking the spreading rhizomes of Pale Toadflax, though it can quickly attain weed-status in gardens by means of its abundantly produced seeds. In addition to the normal purple-flowered plant, pink-flowered cultivars are also to be found in gardens, and occasionally become naturalised. As mentioned previously, *any* two Toadflax species growing close to each other, are capable of producing hybrid progeny, through pollen-transfer by bees. Consequently, it is no surprise to discover that the interspecific hybrid between Pale Toadflax and Purple Toadflax (= *Linaria* x *dominii*), occurs occasionally in gardens, while it is of rare and scattered occurrence in the wild in Britain. (The photograph I provide of this hybrid and its parents, was taken in my own Cork City garden in 2017, where both species have been in cultivation for years, and where their hybrid arose spontaneously in 2016. It is the only record for this hybrid in Ireland at the present time.)

Some observations on an anomalous garden Toadflax

As noted at the beginning of this article, the **taxonomy** of the genus *Linaria* in Europe, is both complex and difficult – so much so, that even after 200 years of observations by botanists, there are *still* doubts as to the number of true Toadflax species present in Europe. (**Note**: No doubt the frequency of fertile hybrid swarms, in addition to the considerable morphological variation in certain species-groups, largely accounts for this state of affairs.) I had my own personal experience of this type of problem in the 1990s, when, on visiting a local plant nursery, I observed an unknown Toadflax species occurring as a weed in some plant-pots. Piqued by this fascinating find, I purchased the tub in which it occurred, and subsequently planted this puzzling Toadflax in my garden. In later years, this intriguing, self-fertile Toadflax species seeded itself throughout the garden with abandon, though it never became a pest species, or had to be restrained. While access to the comprehensive account of the genus *Linaria* in *Flora Europaea 3* (1968) considerably reduced the number of likely candidates, ultimately I found that my garden plant failed to accord with the description of any species in that work! Particularly fascinating was the fact that not a single European species displayed the colour variation exhibited by this garden plant – my photograph (taken in August 2017) showing just three of the many multicolour forms its 'artistic palette' produces year after year.

Tony O'Mahony, 6 Glenthorn Way, Dublin Hill, Cork.

Pale Toadflax (*Linaria repens*), Hybrid Toadflax (*L.* x *dominii*) and Purple Toadflax (*L. purpurea*).

Windswept Islands of the North Atlantic

Tinganes, Tórshavn, Faroe Islands.

Faroe Islands.

By Anthony Toole

THE southern sea cliffs of Vágar, the second most westerly of the Faroe Islands, looked impressive enough through the window, but as the plane banked to enter the fjord, the serrated, knife-edge summit of Tindholmur and those of smaller sea stacks raised the view into a higher league altogether. The drama continued as the plane came in low over the water, with the walls of the fjord drawing closer, until we landed at the tiny Vágur airport, surely one of the most bleakly situated in Europe. But this was my kind of country, and with my five companions, I was eager to immerse myself, if for just a few days, in the wild ambience of these beautiful islands.

The eighteen Faroe Islands lie in the North Atlantic, roughly half way between Norway and Iceland. They are separated by narrow sounds and cut by deep fjords, and are the eroded remains of a plateau of volcanic basalt, created during a series of tectonic movements between 60 and 54 million years ago. Other remnants are found in Scotland and Northern Ireland, notably at Fingal's Cave and the Giant's Causeway.

Sea stack, Streymoy sea cliffs.

Tinganes, Tórshavn.

Oystercatchers.

Images courtesy of Anthony Toole

Though the islands share their latitude with South Greenland, they are washed by the Gulf Stream, which gives them relatively warm winters and cool summers, and a climate described as maritime sub-arctic that brings strong winds and frequent rain. They are thus more likely to appeal to a visitor who seeks a measure of mild adventure rather than relaxation in the sun.

Having booked into Hotel Hafnia in Tórshavn, the smallest capital city in Europe, we were taken on a short guided tour of our environs. This brought us to Tinganes, a small peninsula jutting into the harbour, which houses Logting, the Faroese parliament. Since 1948, the Faroe Islands have been a self-governing country within the kingdom of Denmark, but outside the European Union. The parliament building and government offices consist of a series of red-painted wooden houses around which anyone can wander freely. We saw not a single guard or policeman, or indeed any kind of security evidence on our stroll.

On reaching the rocky point of Tinganes, we spent some time photographing black guillemots and eider ducks that bobbed about in the harbour. It was largely an interest in the birds of the Faroes that had drawn me here as well as David, one of my companions.

There are an estimated two million breeding pairs of sea birds on the islands. About half of these are puffins, while the rest consist of kittiwakes, guillemots, razorbills, fulmars, shags, skuas, terns, gannets, shearwaters and the world's largest colony of storm petrels. Some of these, such as the black guillemots, are a subspecies, endemic to the islands. The only breeding sea ducks are red-breasted mergansers and eiders, the latter, also a sub-species, being perhaps the most abundant bird that we saw during our short stay.

The following day, we drove to Vestmanna, on the largest island, Streymoy, and boarded the ferry that would take us along the base of the western cliffs. Black guillemots and eiders floated in the harbour along with a pair of red-throated divers.

We passed a salmon farm consisting of a dozen circular pens, each holding ninety thousand fish. The clean waters here are ideal for high quality fish farming. Indeed, sea food makes up around 95% of the Faroes' exports. Aware of the dependence of the economy on ocean products, the government ensures that stocks are harvested sustainably, using the most modern ships, and with careful consideration for the marine environment. Prudent management relies not on a quota system, but on allowing the ships to fish only on a certain number of days each year. A 200-mile exclusion fishing zone operates around the islands.

We sailed out of the sound into the open sea, clinging to the northern cliffs which, though steep, were not vertical, and so held grass that was being cropped by many sheep, some of which ventured down to the water's edge. The soil is thin in the Faroes, so here, as elsewhere, countless streams had scoured shallow channels, and coursed down the exposed bedrock. Out of the shelter of the land, the sea became choppy, and spray blew frequently over the deck.

As we progressed, the cliffs became steeper, more rocky and taller, approaching 700 metres in height. Seals lay on the rocks and kittiwakes crowded onto tiny ledges. We had come here before the nesting season had fully arrived, so the numbers of birds on the cliffs were tiny compared with what they would become in a few weeks. Nevertheless, puffins, shags and guillemots flew low over the waves and a small raft of razorbills bobbed close to the cliffs. A great skua flew past, perhaps looking to make a meal of an early chick.

We passed small caves and navigated narrow channels between the cliffs and huge, shark-fin stacks. We approached a cave that looked ridiculously small, but sailed into it and through an archway, to emerge in a gully, the walls of which appeared to impend over the boat. We repeated the performance farther along the cliffs, this time passing through a tunnel perhaps a hundred metres long. The walls seemed to reach higher as we progressed. Cameras clicked incessantly. After about an hour-and-a-quarter, we reached the limit of our trip and turned back toward Vestmanna. We had probably seen as much magnificent scenery as we could cope with for one day.

Not all of the birds in the Faroes cling to the coastal cliffs. Indeed the country's national bird, the oystercatcher, despite being a tideline wader, is more likely to be seen on the hills than by the shore. Other birds, such as the resident starlings and wrens, have been isolated on these islands for sufficient generations to have evolved into distinct sub-species, both slightly larger and of darker plumage than their continental mainland relatives.

After a night in Gjaargardur guest house, in Gjógv, a pretty village with a dramatic harbour guarded by cliff-nesting fulmars, in the north of Eysturoy island, David and I accepted the offer of a trip with bird expert, Silas Olofson. To meet him, we were driven through an undersea tunnel to the island of Borðoy and the town of Klaksvik, the second largest on the archipelago.

Silas informed us that the eastern island of Svínoy was his favourite place to study birds, but the low cloud, drizzle and rough sea crossing would preclude a visit that day. Instead, he took

Faroese wren.

Male and female eiders.

Faroese starling.

us through some single-carriageway tunnels, with occasional passing places, and on up to Viðareiði, the most northerly village in the Faroes.

Villingsdalsfjall mountain rose gently above the village to a height of 844 metres, before plunging down the Enniberg sea cliffs, the second tallest in Europe. Despite the increasingly heavy rain, we ventured a short distance up the hillside. David and I thought it was windy, but Silas assured us of the contrary: "It's windy when the waterfalls don't reach their bases." We were rewarded with sightings of a whimbrel, great skua, arctic skua, pairs of oystercatchers and small flocks of dunlin and barnacle geese. On our way back to Klaksvik, we paused for half-an-hour at the head of the fjord at Árnafirði where we added a common scoter and a long-tailed duck to our total.

Our final day saw us following a mountain footpath from Tórshavn to Kirkjubour, accompanied by the piping calls of oystercatchers, and the occasional whirring wingbeat of a snipe. Kirkjubour is thought to be where the first inhabitants of the Faroes, Irish monks, built their earliest monastery. It is now the site of Roykstovan, the oldest inhabited wooden house in Europe.

Late in the afternoon, we returned to Vágur for our flight back to Edinburgh. As we taxied to our take-off, small flocks of greylags and oystercatchers foraged in the grassy areas to the sides of the runway.

Anthony Toole, 65, Cheswick Drive, Gosforth, Newcastle upon Tyne, NE3 5DW, U.K. E. anthonytoole@fsmail.net
http://myweb.tiscali.co.uk/anthonytoole

Useful information

I travelled from Edinburgh to Vagar as a guest of Visit Faroe Islands http://www.visitfaroeislands.com/ and Atlantic airways https://www.atlantic.fo/en/
The 4th edition of Faroe Islands by James Proctor, published by Bradt www.bradtguides.com is a comprehensive guide to the islands.

Western sea cliffs, Streymoy.

Salmon farm, Vestmannasund.

Images courtesy of Anthony Toole

IN DEFENSE OF SCHOLARLY PUBLICATIONS

Looking back before lurching forward

By Sandra E. Shumway

WHAT are we losing? Over the past few years I have lost several good friends and outstanding scientists in the global arena – and along with them, the world has lost not only their continued input of wisdom and vision, but their accumulated libraries are being thrown into dumpsters with nary a twinge of conscience! Why? Because no one seems to recognize the importance and significance of historic documents, hard-to-obtain publications, or perhaps most salient - the need to know what has been done previously and by whom.

This isn't a new problem, but it is a rapidly escalating one. Over 30 years ago as I took up a new position I noted box after box of books and reprints being tossed in the dumpster outside my office window. When I checked I realized that they were from two individuals who had amassed very impressive libraries during their accumulated 70+ years of research. When I inquired they told me that they were retiring and no longer needed the material - and not a thought that the material might be valuable to the library or other individuals or future researchers. I was appalled, but also thrilled – dumpster diving it was - and I just about tripled my own library resources. I not only used that material for my own efforts over the years, but my library quickly became known to others as a useful and accessible source of references. Over the ensuing decades, I have been able to provide colleagues in many arenas with those hard-to-locate papers, books, proceedings, and other materials.

Scientific research should build on prior knowledge, yet more and more of the published literature is nothing but are hash of old studies, or worse, complete repeats of prior studies, and all because the authors either couldn't be bothered to look at the historical literature or don't know how to carry out a proper literature survey. Only two years ago I received a paper for consideration and realized that it was almost a carbon copy of a prior study done in1958. Did I think the authors had plagiarized the effort? No, I assumed (correctly as it turned out) that they simply had not done their due diligence. The paper was rejected, but sadly that represented almost 2 years of a student's efforts, the funds to pay them, and it resulted in an unpublishable effort that could so easily have been avoided had they taken the time to do some reading. Their time could then have been spent moving that prior study forward. Not only is this practice an affront to those who have gone before, it is a waste of time, effort, and precious research funds - and it is becoming all too commonplace.

As an editor for the past 30+ years, I have seen far too often the results of poor literature research, knowledge, and understanding. Authors now routinely site what I refer to as 'references of convenience', i.e. any old paper that they happen to have on hand that cited one or two other irrelevant or even incompetent papers rather than the key references - or even pertinent references - to the statement made. Why? Because their computer or telephone search didn't provide them with the most important works. Because they don't know how to differentiate good studies from others. Or because they couldn't be bothered going to the library to actually look at the documents and browse other materials or investigate older reference lists to locate the original works. Or because they never actually obtained and read the papers in question, just added them to the reference list. It may be surprising to some that papers from the early days (meaning a century or more ago, not 10 years!) contain highly relevant observations and insight, not to mention the issue of giving credit where it is due.

I have raised my concerns with librarians and asked for guidance as to where one might deposit long runs of scientific journals, large collections of invaluable offprints, and books. It seems there is no accessible graveyard for these materials and much of the material is put in the trash. Most recently I was told by one librarian that they "liken it to the Nazi book burning in the 1930s", and to "reinventing the wheel over and over again, as all the old research gets lost".

What should be done? What can be done? Students should be trained to carry out a comprehensive literature review and required to do so before they embark on any research effort. That means libraries and reference lists and resources beyond their iPad and telephone screens. Scientists and advisors should do the same and pass along that guidance and influence to their students. Granting agencies should engage more reviewers who know the literature and can identify duplication of effort before it is funded for the second and third time. Overall, there needs to be a concerted effort to instill in students and researchers the appreciation that scientific literature is an important historical entity and needs to be used and preserved.

Scientific research and scholarship are accumulated over time and the new era of 'rush to publication' to enhance personal statistics and feed publishers' greed has severely hampered, if not squashed, the basic quest for knowledge and understanding and scholarship. The value of prior knowledge needs to be preserved and that can only happen if scientists acknowledge that value and pass that sentiment on to ensuing generations. As I sit here perusing my hard-won collection of over 100,000 offprints and 150 linear feet of books, I can only hope that it isn't dumpster bound.

Sandra E. Shumway, Editor,
Journal of Shellfish Research
http://www.shellfish.org/
This article, which has been reprinted with permission, originally appeared in the Journal of Shellfish Research - the National Shellfisheries Association Quarterly Newsletter 2017 (2).

Cryptosporidium in Ireland

Image courtesy of @EPAEcology

Cattle accessing a river that is a water supply source increases the risk of *Cryptosporidium* entering the drinking water

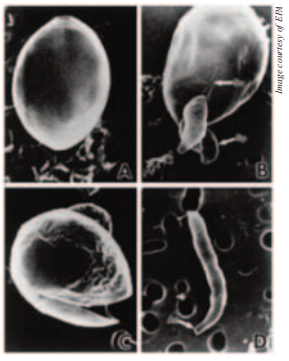


Image courtesy of EPA

Excysting *Cryptosporidium* sporozites.

Image courtesy of IDD Dublin/Raptor LIFE

Fencing along rivers to prevent cattle access and reduce the risk of *Cryptosporidium* entering water.

By Ruth Barrington

What is *Cryptosporidium*?

Cryptosporidium is a waterborne parasite which lives in the intestine of humans and animals. If passed in the stool of an infected person or animal it can cause gastro-intestinal illness called cryptosporidiosis in humans. This illness can be severe with prolonged diarrhoea, nausea and fever. In the case of some immuno-compromised individuals the illness can even be life threatening. The infection can be spread directly between people, by contact with animals (especially at calving and lambing time), or by drinking water or from ingesting water at swimming pools that are contaminated with the parasite.

The coagulation and filtration treatment steps in a drinking water treatment plant will remove *Cryptosporidium* if properly operated. The parasite is very resistant to chlorine disinfection, although suitable UV disinfection will inactivate it to prevent it being infectious.

Cryptosporidiosis is a notifiable disease in Ireland. This means GPs are obliged to report cases of illness in the community to the HSE to ensure appropriate health protection actions can be taken. In the case of an outbreak linked by the health services to drinking water, the action may be that a Boil Water Notice is placed on the supply to kill or inactivate the parasite.

Who is affected?

The *Cryptosporidium* parasite is common in rivers and lakes where most of Ireland's drinking water comes from. In most public water supplies, suitable treatment is in place to remove or inactivate the parasite and prevent its entry into drinking water. However, the EPA's Remedial Action List still identifies 25 public water supplies nationally which are considered at risk because they do not have suitable water treatment to prevent *Cryptosporidium* from entering the water supply. Programmes of work are planned by Irish Water at each of these supplies to install the treatment that is needed.

Cryptosporidium can also get into well water if the well is not protected and there are nearby sources of the parasite: like grazing animals, slurry spreading or a septic tank which has not been maintained. This is a particular risk for private wells, which supply almost two out of every 10 people in Ireland. Such wells typically do not have treatment which will remove or inactivate *Cryptosporidium*. They may also serve vulnerable populations such as nursing homes, schools or crèches.

What can we do about it?

We should aim to lower the risk of *Cryptosporidium* entering our rivers and lakes. Good farming practices include fencing along watercourses and providing drinkers for grazing animals, rather than allowing them access into the river. Also, the proper management of slurry spreading by adhering to buffer zones and keeping slurry away from watercourses will contribute to reducing the risk. In addition, the location and upkeep of septic tanks and other domestic wastewater treatment systems is very important.

The EPA promotes an approach known as Drinking Water Safety Planning to manage all kinds of risk to drinking water supplies. Applied to *Cryptosporidium*, it will focus on firstly managing the catchment to reduce the amount of *Cryptosporidium* entering source waters. Since it is not possible to completely eliminate this risk, suitable treatment of drinking water is also required to remove or inactivate *Cryptosporidium*. While led by the water supplier (Irish Water or a Group Scheme) the Drinking Water Safety Plan approach requires co-operation and action from everyone in the community to do their bit and reduce risk to ensure their drinking water sources are kept free from contamination as much as possible.

The public water supplies at risk of *Cryptosporidium* are known, and are the focus of upgrade works by Irish Water under the Remedial Action List. Completion dates for these works are published, alongside updates, four times per year on the EPA's website. A Remedial Action List also exists for Group Water Schemes to allocate funding for treatment to those supplies at risk from *Cryptosporidium*.

However, if you have a private well, you need to make sure that the water is safe to drink and not contaminated. The well should be properly located away from sources of contamination, and the well water should also be tested at least once per year. While the standard microbiological test does not include *Cryptosporidium*, the presence of bacteria for example *E.coli* or *enterococci* would indicate a route for faecal contamination to your well. Treatment such as UV may be required, or a connection to a nearby public or group water supply if treatment is not an option or is unsuccessful.

If your well supplies a commercial or public premises, such as a nursing home, school or crèche, you have a legal responsibility to make sure that the water is clean and wholesome. The well will be considered as a regulated supply, enforced by the relevant local authority, and you will be subject to the same quality requirements as any other water supplier.

Excysting *Cryptosporidium* sporozites.contamination from poorly located or constructed septic tanks increases the risk of Cryptosporidium in nearby drinking water abstractions

Ruth Barrington, Environmental Protection Agency. www.epa.ie

Where can you find out more?

EPA Drinking Water Report for Public Water Supplies 2016:
http://www.epa.ie/pubs/reports/water/drinking/drinkingwaterreportforpublicwatersupplies2016.html
EPA Remedial Action List at http://www.epa.ie/water/dw/ral/
EPA website www.protectyourwell.ie
For health concerns, please contact your GP

The health of our waters is the principal measure of how we live on the land[1]

By Donal Daly

Context

THE reality is that we are not 'living on the land' in a way that is ensuring 'healthy waters'. Of the almost 5,000 river, lake, estuary, coastal and groundwater bodies in the country, over 30% are unsatisfactory. The main human activities impacting on our water quality are given in the diagram below. Farming is shown to be impacting on more water bodies than any other activity, although it is worth keeping in mind that it takes place over a far higher proportion of the landscape than any other landuse, and therefore proportionally it can be said to have less relative impact than several of those other landuses.

So, how do we ensure that we 'live on the land' in a way that keeps our waters 'healthy' as is the case in many areas in Ireland, and to ensure that our 'unhealthy' waters are diagnosed and cured as soon as realistically possible? I am taking farming as my example in this article. Up until now our main emphasis in environmental protection and achieving 'healthy water' has been on 'one size fits all' national regulation and on the 'command and control' approach, using inspections and compliance checking. But they have not worked and are not working sufficiently, although there is no doubt that they are an essential 'tool' to have in the 'toolkit'. It is proposed here that they should be used as the ultimate means, and in parallel with other approaches.

Virtually all farmers appreciate the environment in which they live and which they are custodians of. However, at the moment for most farmers, the interaction with environmental protection is through inspections, either by the Department of Agriculture, Food and Marine or local authorities. As a consequence, for many farmers the 'environment' is off-putting. Farmers are fearful of inspections even when they feel that the situation on their farms is satisfactory. But, fear is not an effective means of bringing about the understanding, actions and behavioural change needed. So, what are the alternatives?

Having those with the challenge leading their response to addressing it

In my view, without the involvement, cooperation and co-ownership of water management by farmers, and the opportunity to engage with and learn from farmers, Ireland's water quality objectives will not be achieved in the foreseeable future. So, what do those of us who are scientists and engineers involved with catchment management need to do?

- Acknowledge this point.
- Put ourselves 'in the shoes' of farmers and local communities.
- Listen and have empathy with farmers, appreciate their need to 'make a living', genuinely engage, develop a common language, keep the message simple, be objective (scientists with narrowly focussed agendas either personal or based on their discipline are a turn-off), be transparent, appeal to both the emotions and the senses, and avoid criticisms of past activities while learning from them.
- Putting emphasis on 'can' not 'can't'; in other words, put emphasis on what farmers can do. Also, 'ask' not 'tell', and 'talk with', not 'talk to'.
- Change the traditional top down, linear model of research from advisory body to farmer using a more balanced bottom up–top down knowledge exchange approach (see EPA publication http://bit.ly/agimpact for development of this point)
- Pay farmers for what are called 'ecosystem services' derived from our plants, animals and landscape, particularly in areas of high nature value farming (see EPA publication at: http://bit.ly/eparesearch209).
- Use farm advisors, who already have training and experience on production but would be specifically trained on environmental protection, as a link between regulators and farmers where water quality problems are present; farm advisors are trusted by farmers in a way that regulators will never be.
- Amend and improve the Bord Bia Sustainable Dairy Assurance Scheme to take more account of water quality.
- Pay farmers a premium for producing high quality food in a genuinely sustainable manner.

Images courtesy of Environmental Protection Agency

A different approach is needed to bring about change with regard environmental protection.

These are not a panacea, they may not work in all circumstances and expecting alignment between farmers and environmental regulators on all issues is not realistic; however, they are a means of enabling those with the issues, i.e. farmers, to either lead the challenge or, if not always leading, at least helping and actively working together to find and undertake solutions.

Smart Farming – An Exemplar

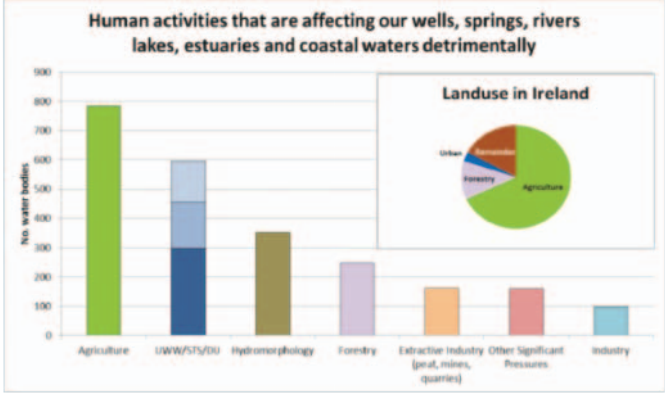
This is an initiative, led by the Irish Farmers Association and involving several relevant bodies such as the EPA, Teagasc and SEAI, which is designed to use existing knowledge and expertise to improve farm returns while also delivering environmental benefits – the 'double dividend'. The key to Smart Farming is that it is farmers who are leading the response to environmental challenges. For further information, check: https://www.ifa.ie/smart-farming/#.WXWvP02WyUl

Conclusion

Our water is a natural resource and heritage that is essential to the wellbeing – physical, mental, economic, environmental – of this country and therefore appreciating, protecting and managing it is an important challenge and requirement for the future. While people such as public servants like myself have a role, it is involvement and work of local communities that are the key to success. This is summed up in the quote from 'Saving Eden: A Manifesto' www.savetheeden.org "It's people who save rivers, not plans ….".

Donal Daly, Catchments Unit, Environmental Protection Agency. www.epa.ie July 2017

[1]Quote from Luna Leopold, hydrologist and son of the famous environmentalist Aldo Leopold.



Causes of unsatisfactory water quality (Note: half of all unsatisfactory water bodies are impacted by more than one human activity.) (UWW = urban wastewater; STS = septic tank systems; DU = diffuse urban (misconnnections, leaky sewers and runoff from paved and unpaved areas)

Ireland's Flora in a Matchbox?

By Matthew Jebb

Images courtesy of National Botanic Gardens

Prompted by a conversation with the late Maura Scannell, the noted Irish botanist, Matthew Jebb went on to demonstrate how one seed from each of the 834 native species in the Irish flora could fit in a single matchbox.

SOME years ago, I was having a conversation with the late Maura Scannell (1924-2011), during her weekly visit to the Herbarium, about the relative merits of Botanic Gardens, Museums and Art Galleries. She pointed out that an art gallery required millions of Euros to buy its exhibits. Botanic Gardens, on the other hand, simply had to obtain the seeds of their 'exhibits' and then expend time and energy in germinating, pricking out, planting and nurturing these into adulthood. As she explained it, for the price of a postage stamp a plant could be sent anywhere in the world. Indeed the National Botanic Gardens has exchanged seeds with nearly 500 other Botanic Gardens throughout the world over its 222-year history.

It was a simple enough idea but still a thoughtful and considered insight, so typical of Maura. It was thus that Maura Scannell sparked the idea that if you put one seed of each member of the Irish flora into a jar, how full would it become?

There are 970 taxa of vascular plant native to Ireland. By native, I mean those species, subspecies or varieties that have probably reached our shores since the last ice age without the agency of humans. Of these 55 are species of ferns or their allies, which reproduce by spores, leaving 915 seed plants. If we ignore the more subtle segregates of subspecies and varieties, we are left with 835 distinct native seed plants making up the flora of Ireland. From this list I also removed three species that form remarkable selfing lines of 'microspecies', referred to as apomicts (Greek for 'without mixing', i.e. they produce their seeds as clones of the mother plant); these comprise 56 microspecies of hawkweeds (*Hieracium*), 103 dandelions (*Taraxacum*) and 109 blackberries (*Rubus*). Aficionados of this last genus have the satisfaction of calling themselves batologists after the Greek name for blackberries - *Batus*.

You might consider that over 800 seeds would make quite big pile. There are after all, some big seeds in our native flora - think of acorns and hazel nuts for example. However, others would be smaller, such as most grasses or annual species, while the thirty-three species of orchids would be but a mere pinch of dust by comparison. But the 80 grass species and 79 sedges would surely add up? I anticipated the final collection would be a handful, perhaps as large as a small apple. As the collection built up, so too did my surprise that in the end the collection would be far smaller than I had imagined at the start. It was soon apparent that the entire flora could be fitted into a space as small as a matchbox, with room to spare!

Of course, I did not assiduously track down every last species. I made a few presumptions about some of the larger genera, targeting just three sedge species for the 80 seeds needed to cover the full gamut of sizes. Likewise all 33 orchid taxa came from just one ripe pod from one *Dactylorhiza* specimen. The careful selection of a few common species enabled me to make an accurate proxy collection with the precise number from each of the big families in our flora: Poaceae (80), Cyperaceae (77), Asteraceae (56), Rosaceae (51), Fabaceae (36), Caryophyllaceae (35), Orchidaceae (33), Scrophulariaceae (33), Brassicaceae (29), Apiaceae (28). Using native seed collected in the Garden's seed room over the past 10 years, it was soon possible to put together a set of all 835 seeds.

What can one say of its appearance? After the two acorns, a hazel nut, ash key and pine (recently reinstated as a true native by TCD botanists), things become a lot smaller. The two cherries, holly, blackthorn, whitethorn, yew, Buckthorn and Alder Buckthorn are of a reasonable size. After that there are a number of seeds scarcely above 5mm including Agrimony (*Agrimonia*), Houndstongue (*Cynoglossum*), sea holly (*Eryngium*), hogweed (*Heracleum*), yellow iris (*Iris pseudacorus*), yellow waterlily (*Nuphar*) and the distinctive pink, heart-shaped seeds of the guelder-rose (*Viburnum opulus*). After the seeds of some of the roses (*Rosa*) and sedges (*Carex*) the remainder resemble little more than chaff and dust.

Asking fellow botanists what they thought such an imaginary collection would look like, in terms of size, invariably led to an overestimate. The reality of the final collection is a most pleasing talking point. When shown to people without any clue to what they are looking at there are some wild guesses followed by a dawning realisation that it is indeed a remarkable sight. That the entire flora of our Emerald Isle can fit into a package so small is a thought-provoking reminder of the amazing ability of plant seeds.

My next project is somewhat more ambitious: What would one seed of every plant species in the world look like? and how big a box would that fill?

Matthew Jebb, Director, National Botanic Gardens, Glasnevin, Dublin 9.
www.botanicgardens.ie

The National Botanic Gardens has exchanged seeds with nearly 500 other Botanic Gardens through the world over its 222-year history.

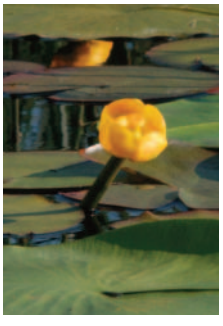


Image courtesy of National Botanic Gardens

Plant images courtesy of Robbie Murphy

Top left (clockwise): YellowWater-lily (*Nuphar lutea*); Dog Rose (*Rosa canina*); Yellow Flag Irish (*Iris pseudacorus*); Sea Holly (*Eryngium maritimum*).

THE SILVER EEL

Irish researchers help solve mystery of one of the great animal migrations as part of new international research

By Dr Ciara O' Leary
& Dr Ciaran Byrne

THE eeliad programme was an EU funded project aimed at investigating the migration of silver eels from Europe across the Atlantic Ocean to their spawning site in the Sargasso Sea, a journey of 5,000kms. The project used electronic tagging techniques to map the migration of eels released from four regions in Europe across the Atlantic Ocean. The four areas were the North Sea, Celtic Sea, Bay of Biscay and the Mediterranean Sea. The fundamental questions being address by the project were; what route did the eels take out of Europe? How long does it take for the eels to get to the far side of the Atlantic Ocean? How do eels migrate in the Ocean? What depth do they travel at? What is the impact of predators on silver eel survival at sea?

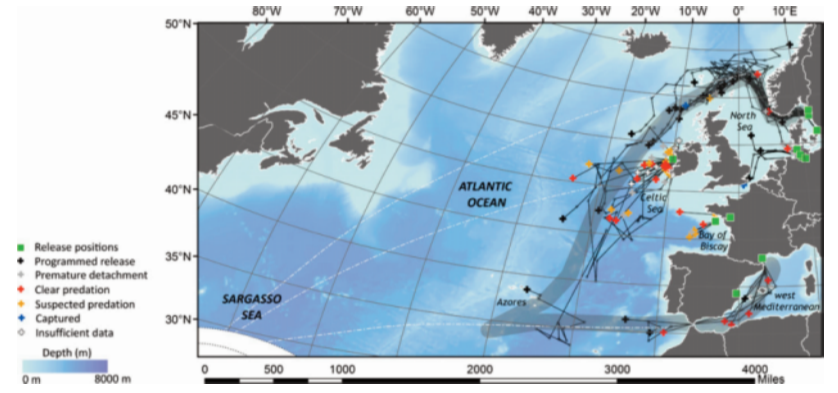
In order to address these issues and undertake the project, big female eels from around Ireland were needed. The reason big female eels were used is that, typically female eels grow larger than male eels, and the bigger eels would be able to carry the satellite tags out to the Atlantic. As scientists didn't know how long the journey would take the battery life of the satellite tags was one of the biggest constraints on the size of eels tagged. Thus scientists were restricted to tagging the long- lived old (wise!) female eels. The hunt for large female eels took scientists to Lough Owel, Athlone and Killaloe on the Shannon system and Lough Oughter and Ballyshannon on the Erne system. And, not forgetting the Corrib system eels from the Galway Fishery and Lough Mask and some large female eels from the Burrishoole system were also tagged. All eels were transported to Galway to be satellite tagged and released into the Atlantic Ocean. This process was repeated over 5 years while the Eeliad team fine-tuned techniques and learned from past mistakes.

So what was learned from this endeavour? The first exciting discovery was that the eels undertake 'diel vertical migration' which means that the eels move up and down the water column, moving up at night and down during the day. It is thought that this is to avoid predators and as a way to control their body temperature, moving to greater depths during the day to avoid the warmer surface waters and moving back up to avoid the very cold night temperatures at these depths. The depths we are talking about are between 200m and 1,000m below the surface! So not only do eels have to travel across the Atlantic, this journey is increased by having to move up and down the water column, sounds like undertaking a marathon in the Alps!

The second discovery was both exciting and disappointing, the satellite tags were divided into batches and programmed to 'pop' off the eels at set dates along the route. Unfortunately existing knowledge of how fast the eels migrated across the Atlantic was a bit off. Scientists did not know that eels essentially did a giant 'zig-zag' up and down the water column, rather than migrate in a straight line at a standard depth, meaning it would take significantly longer to go from point a to point b. Thus the last set of tags popped of at the Azores only half way to the intended destination of the Sargasso Sea. While it would appear to be taking longer for the eels to migrate improved technology with a smaller battery with a good long life would be required to confirm that the drag of the tag is not affecting these results.

The third important and startling discovery was the rate of predation on tagged eels, 42 of the 87 eels with detailed migration data encountered a predation event. Predation and tag loss was found to be quite high on the continental shelf but also occurred out in the open ocean. The data recovered from the tags after being passed by the predators gives important information on who the potential eel eaters were, as the tags still record pressure to indicate depth and light levels so we know when a tag is inside the belly of another beast as the temperature rises rapidly and lights are turned off. It is suspected that the eels were preyed on by a range of different creatures from marine mammals to large ocean fish, deep sea fish and sharks. This is because of the different depths, diving behaviour and temperature profiles that were recorded on the tags from predated eels. It is thought that the eels go through "predator hot spots" and as the European Eel migration is a consistent annual event it's not surprising that ocean predators have evolved to take advantage of this reliable source of food.

So the numbers, over the course of the project 707 eels were tagged and of this 237 were tagged in Ireland. Of the Irish eels 98 were tagged with satellite tags, 20 eels were tagged with an external data storage tags and 119 were tagged with an internal data storage tags. Only a limited number of satellite tags were available due to their high cost, which can be in the thousands of euros. Data storage tags record the same information but in order to get the data the tag has to wash up on an inhabited shore and be picked up by observant coastal walkers and beach combers and fed back. Thus there is a risk of getting no information back however even getting back a handful of tags gives scientists such amazing information that it is worth taking the risk. To date 82 data storage tags have been recovered, from expected places such as around Ireland, UK, Franc and, Spain. Some tags have also been recovered from more unusual places such as off the coast of Italy (where a French eel data storage tag drifted across the Mediterranean) and the northern most point of Norway near Valdo in the Barents Sea. Scientists are hoping that over the next few years bright orange tags will continue to be washed ashore and intrepid beachcombers will find them and send them back to CEFAS where scientists will continue to gain information about eel migration. Who knows maybe one of the tagged eels will have made it to the Sargasso Sea and all the information is in a tag just waiting to be picked up.



Pop-off or recovery positions of Data Storage Tags (DSTs) and Pop off Satellite tags(PSATs).

Tags, satellite and data storage used during the study.

Silver eels tagged with pop off satellite tag.

Images courtesy of Inland Fisheries Ireland

Dr Ciara O'Leary
& Dr Ciaran Byrne,
Inland Fisheries Ireland
www.fisheriesireland.ie

Review of the Aquaculture Licensing Process

The Minister for Agriculture Food and the Marine appointed an independent three-person review group to conduct an independent review of the aquaculture licence process and associated legal framework. The Independent Aquaculture Licence Review Committee (IALRC) included Ms. Mary Moylan (Chair), former Senior Civil Servant, Mr. Lorcán Ó Cinnéide, Commercial Fisheries Leader, and Dr Ken Whelan, Research Director, Atlantic Salmon Trust. At the end of May 2017, the IALRC submitted their report to Minister Michael Creed for his consideration. Here is a short summary of the report and of its recommendations.

THE Irish aquaculture industry is largely concerned with the cultivation of salmon, oysters and mussels, which had an output in 2016 valued at €163 million, and employs 1,900 people mainly in peripheral coastal areas. Government policy proposes that the volume of aquaculture production be increased from 45,000 tonnes to 81,700 tonnes per annum by the year 2023. Many in the industry consider that development of the sector has been hampered by an inefficient licensing process. However, some aquaculture proposals have been very controversial. It has been suggested that delays in the licensing process and public notice provisions, in particular, are inadequate and have added to the controversy.

Aquaculture is licensed under the Fisheries (Amendment) Act, 1997 and its associated Regulations which have been amended to give effect to various EU environment protection Directives. The licensing process is complex. Considerable information, much of it technical, has to be assessed. The public and various State Bodies must be consulted and the determination of a licence requires the balancing of many interests. Current EU policy on aquaculture urges Member States to simplify administrative procedures, including reducing timescales for processing applications. There are 740 aquaculture licences currently in operation, of which 444 are operating within their stated time period and 296 are operating under section 19A of the Fisheries (Amendment) Act, 1997. There are 612 licence applications currently awaiting determination by the Minister, of which 33 are finfish, 540 are shellfish and 39 are land based.

The Group received 385 submissions in response to its public consultation process and also met with stakeholders to understand the issues surrounding the licensing process. The consultations and submissions reflected a diverse range of views, the main themes of which were focused on

- the length of time for deciding licence application decisions,
- lack of transparency around the process,
- the period and conditions of licences,
- differing perspectives on enforcement of licence conditions and
- the multiplicity of public bodies which have a role in the licensing process.

Views were expressed by some that the current legislation needs to be consolidated and by others that the current Act is unworkable and outdated. The lengthy period involved in the introduction of new legislation was also acknowledged. Other issues which were identified were the introduction of Maritime Spatial Planning, the need for more rigorous analysis of the business case for applications, and attracting young people to industry.

A list of the stakeholders that the Group met during the review

Aquaculture and Foreshore Management Division, AFMD, Department of Agriculture Food and Marine.
Aquaculture Licences Appeals Board, ALAB.
An Bord Pleanála.
An Taisce.
Bord Iascaigh Mhara, BIM.
Environmental Protection Agency, EPA.
Food and Veterinary Authority, Faroe Islands.
Inland Fisheries Ireland, IFI.
Irish Farmers' Association, Aquaculture, IFA Aquaculture.
Irish Salmon Growers Association.
Irish Shellfish Association.
Legal Services Division, Department of Agriculture Food and Marine.
Marine Engineers Division, MED, Department of Agriculture, Food and the Marine.
Marine Institute, MI.
Marine Scotland with representatives from The Crown Estate/Crown Estate Scotland, Scotland Environmental
Protection Agency, Scottish Government, Landscape and Natural Habitats and Argyll and Bute Local Authority
National Parks and Wildlife Services, NPWS, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs
Norwegian Embassy
Norwegian, Ministry of Trade, industry and Fisheries.
Sea Fisheries Protection Agency
Socio Economic Marine Research Unit (SEMRU), National University of Galway

The Group considered comparative consenting systems within Ireland, specifically An Bord Pleanála and the Environmental Protection Agency, which operate under the same EU legislative code.

Recommendations

As an overarching conclusion, the Group recommends that a root-and-branch reform of the aquaculture licence application processes is necessary. The reform needs to be comprehensive in scope and focus both on immediate actions which can produce results in the short term as well as initiatives which will bear fruit in the longer term. Further recommendations are:

- A six month time limit should be set in which to determine a licence and that this should apply to all new licence applications submitted after January 1 2018.
- The establishment of a pre-application process to ensure that applications are complete and contain all of the material required to ensure an efficient processing of the application. As a first step, this should be introduced as soon as possible on an administrative basis.
- Formalise the existing liaison between BIM officers and potential applicants, and the relevant BIM staff should be assigned the role of Aquaculture Liaison Officers in this context.
- Public notification should form part of an e-licensing system to provide a more appropriate vehicle for public notification.
- The Minister should specify the appropriate media and format for the publication of notices.
- Applicants should be required to show evidence of public notice of the making of the application; this can be enabled by amending the existing application regulations.
- AFMD should also consider practical arrangements for the erection of site notices to provide information to the public on licences and tackle the perception that the licensing process is opaque.
- Consultation with public and the statutory bodies should be carried out concurrently. This can be addressed in administrative procedures and guidelines.
- The establishment of an open-access, web based aquaculture application and monitoring system
- The proposed Aquaculture Management Information System should comprise a single portal to all relevant administrative, engineering and scientific material 8.5 (3): Scientific and technical data sets from both the NPWS and MI databases should be integrated with the proposed Aquaculture Management Information System.
- From the point of view of the efficiency of the determination process, the Group considers that a dedicated technical and scientific resource in the Division itself is essential.
- Procedural guidelines should be available to the licensing authority and to ALAB.
- The components of an EIA Report should be listed on the AFMD website and comprehensive guidance provided as to the extent of the material which should be included.
- That a Memorandum of Understanding be drawn up between the NPWS and AFMD setting out clearly the roles and functions of each and the manner and timing of consultations.
- The Minister consider availing of the provisions of the 1997 Act and delegating the power to determine licences to an official
- That in preparing new legislation consideration be given to assigning the aquaculture licensing function to an independent body either a new body set up for the purpose or one of the existing environmental Regulatory Bodies.
- It is recommended that ALAB be sufficiently resourced to the same standard of technology, guidelines and access to expertise so that it too can deliver determinations on appeals in a timely and effective manner.
- A Service Level Agreement should be agreed between the Minister and ALAB.
- In reviewing the legislation, it should be open to consideration to determine the appropriate structures for an independent appeals body with resources to execute its functions to the required standard and within an acceptable timeframe.
- The Group recommends that AFMD establish a task force to devise and implement a strategy to deal with the backlog within an achievable but ambitious, accelerated timeframe and not beyond the end of 2019
- In planning for the future of licensing, the Department sets out how it will manage the orderly acceptance of applications.
- The Group recommends that a 20 year period should be adopted for new and renewed licences, subject to the following:
  - that the format of licences be revised so that central terms are separated from technical annexes, the latter which can be amended in light of emerging best available technology or best environmental practice in the relevant activity;
  - that the licensing process include a comprehensive assessment of the financial and operational capability of the applicant to operate a licence in a manner compliant with the various terms of such a licence; appropriate and proportionate to the nature of the activity to which the licence applies;
  - that licences should be capable of being reviewed, updated and amended without compensation to reflect the development of new requirements, standards and assessments as these may arise from national or EU legislation.
- A dedicated procedure should be established for trial licences, by regulation, and if possible, a distinction should be drawn between commercial and non-commercial requirements. The time limit for decision on trial licence applications, as for other new licence applications, should be six months.
- It is essential that licence conditions are monitored and enforcement action taken for non-compliance.
- In the context of preparing a new Aquaculture Act, consideration should be given to the type of penalties that should apply to various offences under the Act and on the possibility of graduated and implementable penalties where these would be appropriate.
- A renewed effort should be made to reach a consensus on a scientific assessment method and criteria for the development of appropriate conservation objectives for populations of all relevant species with NPWS (Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs), Inland Fisheries Ireland and Marine Institute.
- The Group considers developing a Marine Spatial Planning framework is essential for future development of a sustainable aquaculture sector.
- The recommended Aquaculture Management Information System should be designed so as to facilitate the implementation of national MSP and CZM initiatives.
- The Group recommends that work commence immediately on the preparation of new Aquaculture legislation, having regard to best practice in other jurisdictions and in other relevant consenting systems here In Ireland.

The Group agrees that the aquaculture licensing system is in urgent need of reform. The legislation must be updated. This will take some time but an immediate start should be made by identifying the main issues and the options for addressing them. While the preparation of legislation is underway, the Group believes that it is essential to implement reforms under the current legislation as soon as possible, benefitting all stakeholders.

The full report is available for download at:
http://www.fishingnet.ie/media/fishingnet/content/ReviewoftheAquacultureLicensingProcess310517.pdf

George Victor Du Noyer

(1817 – 1869)

Irish artist and scientist

Fold in Old Red Sandstone, Doneen Rock, Mallow, Co. Cork.

Unconformity between the Old Ref Sandstone and the Lower Palaeozoic rocks at Waterford Harbour.

Images courtesy of GSI

Cherty Limestone, Brown Island, Killarney, Co. Kerry.

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

By Siobhán Power

FOR the first time in over 20 years, the work of Du Noyer will be on public exhibition at the Crawford Art Gallery in Cork. The exhibition, which will run from November 2017 to February 2018, will mark the 200th anniversary of the birth of the artist. For someone who left such a remarkable record of Ireland in the mid-19th Century, and whose work is of both artistic and scientific value, very little is known by the general public about the artist or his work. People involved in earth science and geology in Ireland have all heard of Du Noyer and have possibly even seen his original work. His name is used by the Geological Survey Ireland for their annual photographic competition and postcard copies of paintings he did as part of his fieldwork are available for purchase from their shop. But who is George Victor Du Noyer? Why does he mean a lot to a few and little to most? Should he be held as one of the great Irish painters and scientists?

George Victor Du Noyer was born in 1817 to a French Huguenot family. He grew up and was educated in Dublin and it appears showed enough artistic flare to be encouraged and taught by the artist, and later Ordnance Survey employee, George Petrie (1790 – 1866). Throughout his life, Du Noyer produced work for Ordnance Survey Ireland, the National Botanic Gardens, private commissions, and most famously, the newly formed Geological Survey, for whom he worked from 1847 until his death at the age of 51 in January 1869. He was employed as a draughtsperson and surveyor but his observational and descriptive skills, his attention to detail, and his artistic abilities meant that he produced scientifically accurate works of art for his employers. As he was mainly a government worker, his work remained as whole collections in the ownership of his employers and is now part of the Irish National Archives. Although having no official training in geology, he became a geologist through experience, presented scientific papers, became a member of the Royal Irish Academy, and was highly praised as a geologist by the great geologists of the day, including Sir Roderick Murchison. He was known and appreciated as an artist during his life but perhaps restrained by his role as a government employee.

Du Noyer left a considerable collection of scientific and artistic work behind him. His work is valuable to geologists as although the science has changed since the middle 19th Century, his accurate descriptions, maps and illustrations make it possible to apply modern understanding to his work. He left a scientific snapshot of the physical geography of the time, particularly along the coast, and an incidental snapshot of the human geography as he exploited geology exposed along the new railway lines for his work and used people, animals, and boats in his paintings to add depth, interest, and most importantly for a geologist, scale.

A major exhibition of his work entitled 'Stones, Slabs and Seascapes' curated by Peter Murray, former Director of Crawford Art Gallery, and lifelong Du Noyer scholar, Petra Coffey, will run in the Crawford Art Gallery in Cork from November 17th, 2017 to February 24th, 2018, before transferring to the National Museum of Ireland in Dublin. A significant number of the works on exhibit are from the collection of the Geological Survey Ireland and include field sketches, annotated maps and landscapes from Kerry, Cork, Waterford, Wexford, Wicklow, Dublin and Antrim. Other works in the exhibition are fro, the National Botanic Gardens, Royal Irish Academy, National Museum of Ireland and the Royal Society of Antiquaries of Ireland. The exhibition will be accompanied by a lecture series and an education programme for children. It is hoped the exhibition will bring Du Noyer's work to new audiences and a new understanding and appreciation of his work as an artist and scientist will grow.

Dr Siobhán Power, Geologist, Geoheritage, Geological Survey Ireland, Beggars Bush, Haddington Road, Dublin D04 K7X4, Ireland.
www.gsi.ie

FREE Stamps for Young Collectors

Padraig O'Shea of Raven Stamps 12c Washington Street West, Cork City (www.ravenstamps.com), the largest stamp dealer in Ireland, has kindly given *Sherkin Comment* extra sets of 300 different world stamps so that you can start your new hobby. If interested in a set please contact us by postcard, letter or email at Sherkin Island Marine Station, Sherkin Island, Co. Cork or sherkinmarine@eircom.net to receive a set (limit of one request per family).

If you have previous received a set, these are the same stamps.

Foxes can be found in most parts of the world. In Ireland they are very common and widespread and can be found both in the country and in the city. In the countryside, they like to live near forests or in scrub or tall vegetation. In towns and cities they make homes in large gardens or derelict properties.

FOXES - A Photographic Study

Photography by Robbie Murphy

Foxes are very good parents to their young.

A male fox is known as a dog, a female is a vixen and a young fox is a cub.

Cubs are born in March or April and the average size of a litter is 4-6 cubs.

Foxes are usually nocturnal animals, preferring to venture out at night under the cover of darkness to search for food. However, it is still possible to see foxes out and about during the day.

The fox looks very like a dog, this is because it belongs to the same family – Canidae. Foxes have dog-like features but are typically smaller and thinner than average-sized dogs.

The cubs are gradually weaned from approximately six to ten weeks of age, but will still attempt to suckle from the vixen after weaning.

Cubs stay with the family until adult size and will then leave their parents to find territories of their own.

Foxes usually live in a shelter called an "earth" or a "den". This could be a hole in the ground or in a bank or sometimes between the roots of trees. They can be hard to see as they are often concealed by thick undergrowth.

Foxes are omnivorous – they eat most small animals like rats, mice, frogs and rabbits, but also like fruit, berries, earthworms and insects.

The International Council for the Exploration of the Sea (ICES)

A global organization that develops science and advice to support the sustainable use of our oceans

By Paul Connolly

IRELAND has a long tradition of working closely with ICES and has held the Presidency of the organisation on three occasions. It relies on the organisation to coordinate many international marine science activities in the waters around Ireland. ICES also provide impartial scientific advice to its member countries and many international organisations (e.g. EU Commission) on marine related issues. Many Irish scientists use ICES as a forum to showcase their scientific work. This article will briefly outline what ICES is, what it does, how the organisation works and some key focal points for future marine science at ICES. Much of this information is available on the ICES website (www.ices.dk).

What is ICES?

The International Council for the Exploration of the Sea (ICES) is an intergovernmental organization based in Copenhagen, Denmark. The main objective of ICES is to increase scientific knowledge of our marine ecosystems (including its living resources) and to use this knowledge to provide unbiased, non-political advice to Member States and other competent authorities (e.g. the EU Commission) . ICES is a network of more than 5,000 marine scientists from over 690 marine institutes in 20 member countries and beyond.Through strategic partnerships, ICES work also extends into the Arctic, the Mediterranean Sea, the Black Sea, and the North Pacific Ocean.

ICES is committed to building a foundation of science around one key challenge, that of an "integrated ecosystem understanding" of our oceans. ICES advances this through the coordination of oceanic and coastal monitoring and research, and advises international commissions and governments on marine policy and management issues.

What does ICES do ?

ICES science and advice considers both how human activities affect marine ecosystems (e.g. fishing) and how these ecosystems affect human activities (e.g. climate change). In this way, ICES ensures that best available science is accessible for decision-makers to make informed choices on the sustainable use of our marine ecosystems. ICES also delivers scientific publications, information and management advice requested by member countries and international organizations and commissions such as the Oslo Paris Commission (OSPAR), the Helsinki Commission - Baltic Marine Environment Protection Commission (HELCOM), the North East Atlantic Fisheries Commission (NEAFC), the North Atlantic Salmon Conservation Organization (NASCO), and the European Commission (EC).

A Brief History of ICES

The International Council for the Exploration of the Sea (ICES) was established in 1902 by "exchange of letters" between Denmark, Finland, Germany, Netherlands, Norway, Sweden, Russia and United Kingdom. These countries were concerned about overfishing in the North Sea and about improving international cooperation on marine science issues. Ireland became a member of ICES in 1925, and it was one of the first international organisations the new state joined.

The sequence of countries that joined ICES from 1902 are:

1902: Denmark; Finland, Germany, Netherlands, Norway, Sweden, Russia, UK;
1903: Belgium;
1912: United States;
1920: France, Portugal;
1922: Poland;
1923: Latvia;
1924: Estonia, Spain;
1925: Ireland;
1938: Iceland;
1967: Canada;
2006: Lithuania;
Italy was a member for four years from 1927 and again 1956-1974.

In 1964, through an agreed Convention, ICES received a legal foundation and full international status. ICES revisited its objectives through the signing of the Copenhagen declaration in 2002.

How is ICES organised?

The Council is the principal decision and policy-making body of ICES. The Council comprises the ICES President and two delegates appointed by each of the 20 member countries. The work of the Council is carried out through the Bureau (Board of ICES), Advisory Committee (ACOM), Science Committee (SCICOM), Data and Information Group, and the Secretariat.

The Bureau of ICES is composed of 7 Council delegates and is chaired by the ICES President. It meets every quarter and ensures that the decisions of Council are implemented through the ICES annual work programmes.

Scientific Advice is a key output of ICES. The Advisory Committee (ACOM) is responsible for providing this scientific advice to competent authorities in support of the sustainable management of marine resources and ecosystems throughout the North Atlantic Ocean. ACOM's work is built upon the scientific analyses that are prepared by expert groups. ACOM is composed of one representative from each of the ICES member countries. Annual meetings take place between ICES, the recipients of advice and stakeholders to discuss issues of common interest.

The Science Committee (SCICOM) is the main scientific body in ICES. It oversees all of the scientific work that underpins the advice and has three main roles; (1) to keep the science programme dynamic, internationally relevant, and impactful; (2) to ensure seamless links between science, data and advice; (3) to engage with scientists in ICES member countries and beyond by planning an annual cycle of meetings and workshops as well as the ICES Annual Science Conference. All member countries have representatives on SCICOM.

ICES has a well-established Data Centre, which manages a number of large dataset collections related to the marine environment. The majority of data – covering the Northeast Atlantic, Baltic Sea, Greenland Sea, and Norwegian Sea – originate from national institutes that are part of the ICES network. The ICES Data Centre provides marine data services to ICES member countries, scientific expert groups, world data centres, the European Environment Agency (EEA), Eurostat, and various other European projects. The current ICES datasets include contaminants and biological effects; fish eggs and larvae; fish predation (stomach contents); fish trawl survey; historical plankton; Oceao physics and chemistry.

The ICES Secretariat has been based in Copenhagen, Denmark, since 1902. The staff provides secretarial, administrative, scientific, and data handling support to the ICES community.

How does ICES Work ?

The work of ICES is accomplished by various committees, expert groups, and workshops. The Science Committee (SCICOM) oversees all aspects of the scientific work, whilst the Advisory Committee (ACOM) provides advice to clients on fisheries and marine ecosystem issues. Working under both are expert groups, workshops, steering groups, advice drafting groups, and review groups. The ICES Annual Science Conference (ASC) is a landmark event for the ICES community. During the conference hundreds of marine scientists gather to present and discuss the latest marine science, develop new ideas, establish partnerships, formulate research projects and plan their future work. The scientific programme provides opportunities for everyone, from students and early career scientists through established leaders of large research institutes, to engage and contribute. ICES also organize and support other international science symposia on high-profile topics in marine science. The 2017 ICES Annual Science Conference was held at Fort Lauderdale, Florida, US in late September, amid the debris from Hurricane Irma.

Some Key Focus Areas for ICES

Over the coming years, ICES will position itself to advise on key requests from decision and policy makers. The Arctic, ecosystem overviews, integrated ecosystem assessments, the marine strategy framework directive and aquaculture are some key focus areas for ICES into the future.

The Arctic marine environment will undergo major changes in the coming decades due to ongoing climate change and increases in human activities. Complex ecological changes are expected to take place leading to increases in productivity, losses and gains of individual species and changes in food web structure. This makes Arctic research a priority area for ICES from the perspective of better understanding ecological processes and human impacts in this ecosystem.

Ecosystem overviews provide a description of the ecosystems, identify the main human pressures, and explain how these affect key ecosystem components. ICES will developed these overviews for the Barents Sea, Bay of Biscay and the Iberian coast, Celtic Seas, Greater North Sea, Icelandic Waters and the Norwegian Sea.

Integrated ecosystem assessments will be a key focus area for ICES, converting our improved understanding of the marine ecosystem into effective advice. While marine ecosystems are complex, our understanding of their functioning is constantly evolving. This increasing knowledge will allow ICES to provide scientific advice that integrates more and more elements of the ecosystem.

The Marine Strategy Framework Directive (MSFD) - the environmental pillar of the European Union's (EU) Integrated Maritime Policy - was adopted in July 2008. The aim of the MSFD is "Good Environmental Status" (GES) in European marine waters by 2020. EU Member States with marine territories are required to introduce a series of measures to achieve and maintain GES according to eleven key descriptors of environmental status. The ICES scientific community and advisory services will play a key role in providing scientific guidance to define GES indicators and standards.

Aquaculture is one of the fastest growing food production sectors in the world today.

The increasing global demand for food has meant that aquaculture has leapt from a 3.2% share of total fisheries production in 1950 to 47% in 2011. ICES recognises that the aquaculture industry is experiencing increased environmental challenges and that there is a need for advice on sustainable management approaches. Research into interactions between aquaculture and the environment has high priority. ICES expert groups research various environmental, genetic, and epidemiological effects of aquaculture.

Final Comments

The oceans are a life support system for planet earth and play a key role in shaping our lives. Climate, weather, tourism, transport, food and natural resources are all shaped by our oceans, either directly or indirectly. The ocean economy is becoming more important for jobs and wealth creation. However, our marine ecosystems are under enormous pressure from the impacts of human activities. Now more than ever we need ICES science and advice to guide our decision makers. It is a key organisation for the marine science community of Ireland and the North Atlantic. It is an essential forum for cooperation and coordination of marine science. If we did not have ICES we would have to invent it. The quote of Aristotle is very apt for ICES – "the whole is greater than the sum of the parts".

The International Council for the Exploration of the Sea (ICES) is a international organization that develops science and advice to support the sustainable use of the oceans. ICES is a network of more than 5,000 scientists from over 690 marine institutes in the 20 member countries that border the North Atlantic. The member countries are Belgium, Canada, Denmark, Estonia, Finland, France, Germany, Iceland, Ireland, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Russian Federation, Spain, Sweden, United Kingdom, and the United States of America.

Paul Connolly, The Marine Institute, Galway, Ireland (Former President ICES - 2013 to 2015)

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

A Life in the Trees

IN mid-November 2007, Declan Murphy was surveying oak woodland in County Wicklow as part of the Atlas 2007-11, a project co-ordinated by BirdWatch Ireland, the British Trust for Ornithology and the Scottish Ornithologists Club. He was completely absorbed in a group of Jays going about their business when he heard a loud *KIK* from the surrounding woodland. Half-registering it as "something different", he went back to the Jays but when another *KIK* sounded in the distance he knew immediately what it was - a 'Great Spotted Woodpecker'.

Declan sets the scene for this encounter through excerpts from his new book: *A Life in the Trees - A personal account of the Great Spotted Woodpecker in Ireland*:

"At this time, Great Spotted Woodpeckers were extremely rare birds and had not yet bred in the Republic of Ireland. To be precise, they were classified as a vagrant, not even a native species. I had only ever seen two before in Ireland, a young bird in Ashford, County Wicklow a couple of years earlier and a female in Annamoe, also in County Wicklow, late the previous December. All thoughts of the survey and counting Jays were now gone from my mind, to be replaced by something resembling blind panic as I hurtled through the woodland in the vague direction of where the bird had last called from, clearing Bilberry bushes in a single stride and bounding down an escarpment while my mind raced with questions: What age was it? What sex was it? Was it alone? How long had it been here?

"All these questions, yet no sign of the bird. I leant against the bole of a large beech trying to catch my breath, when from almost overhead came a loud piercing *KIK... KIK*. I looked up, and there on the trunk of a tree, with his back to me and his head turned around to watch me, was a male Great Spotted Woodpecker."

Declan was not to see the bird again that summer, despite finding evidence of its existence. However, the following spring, as he walked through the woodland when a loud *KIK* erupted nearby:

"He was perched on an oak tree about fifty metres from me and was happily engrossed in extracting a fat white grub with a shiny mahogany head from a rotting limb near the top of the tree. Having succeeded, he quickly swallowed his prize and flew off, bounding through the naked treetops in the same manner as penguins leap through the waters of Antarctica. Moments later, from deep inside the woodland, came a sound so eloquent and beautiful yet so alien to this country that it seemed to belong to another woodland realm; the sound of the woodpecker drumming - and it was the first time I had ever heard it in Ireland.

"For me it was this sound, perhaps more than any other, which separated the nature of Great Britain and Ireland. Many British natural history television programmes, atmospheric sound recordings and birdsong recordings all feature the drumming noise that a Great Spotted Woodpecker makes in the spring. A beautiful sound, like a mellow drum-roll on a wooden percussion box, it reverberates throughout the early spring air and into the countryside beyond; yet until now Ireland had been bereft of this acoustic wonder...

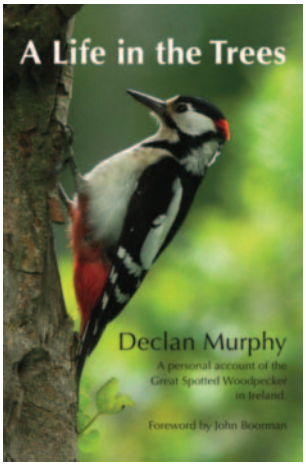
"It seemed that was now set to change."

The book was launched by John Boorman, the noted film director, who also wrote a beautiful foreword, perfectly encapsulating Declan's encounters with the bird:

The woodpecker chose a primal wood with no evidence of human activity. Using just its beak it began to drill a deep hole high up in a tree. The familiar knocking sound echoed through the valley. It attracted the attention of a man with the curious eyes of a child.
He searched the wood for the woodpecker, but when the bird heard his approach it would stop drilling until the man left. But the man persisted and eventually identified the nascent nest. The birds waited... but the man did not go away.
He did not act like a predator; but what did he want? He did not look like a Pine Marten that could climb the tree and drag the chicks out of the nest!
The man seemed kindly disposed. He kept still.
Well, the nest had to be drilled, so the woodpecker started pecking and knocking again... with the man watching.
He watched the completion of the nest.
He watched the laying of eggs.
He watched and watched... until he became part of the wood.
And he relates the fascinating outcome of the story in these pages.
That man is my neighbour, Declan Murphy.

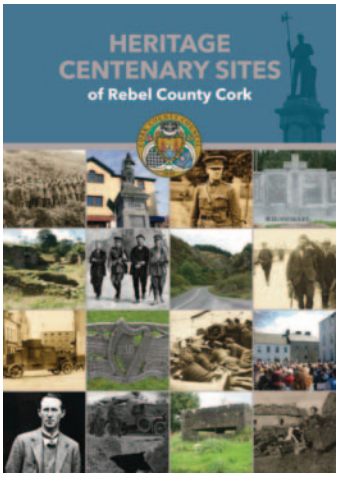
John Boorman, July 2017.

I am in awe of the patience Declan had in staying in his bird hide to observe the woodpeckers. I am not a birdwatcher but enjoy seeing the birds around our island. I so envy the likes of Declan who can recognise these beautiful creatures so effortlessly from their song, their flight or their colours. He notices so much. Every page has a story, from his descriptions of the nesting parents feeding their young and the siblings jostling for position in an attempt to reach the food first, to his love hate relationship with the Pine Marten. Though he encountered many woodland inhabitants whilst watching the woodpecker, with the Sika Deer, the Irish Hare, the Red Squirrel and the Fox being frequent visitors, the only predator that he found to pose a risk to the bird was the Pine Marten. It was fascinating to read how he set up a feeder and camera so that he could study the activities of the Pine Martens near the woodpeckers. I found this to be a very accessible book and a beautiful read. As the story gently unfolds, it provokes many emotions and almost without knowing it, the reader absorbs so much information about Ireland's incredible wildlife.



A Life in the Trees - A personal account of the Great Spotted Woodpecker in Ireland by Declan Murphy. The book is available directly from the author who can be contacted at declanmurphyalifeinthetrees@gmail.com or from www.birdwatchireland.ie Price €20.00 plus postage. ISBN: 9781911180739.

HERITAGE CENTENARY SITES of Rebel County Cork



***Heritage Centenary Sites of Rebel County Cork* has been produced by the Heritage Unit of Cork County Council.**

A Review by Matt Murphy

HERITAGE CENTENARY SITES of Rebel County Cork gives an overview and understanding of the challenges facing Ireland for many centuries, and why the County of Cork had such a bearing on the country's quest for Independence. It highlights the major events that took place in the county, ranging from the Battle of Kinsale to Béal na mBláth, and documents the key figures, men and women, of County Cork, who all played such as invaluable role including household names such as Michael Collins and Diarmuid Lynch as well as those not so well known.

Throughout these pages the reader will marvel at the role that Cork's people and places played in Ireland's quest for Independence. It features numerous first-hand accounts of the events that took place and also documents a number of sites that can be visited today, where people can indeed revisit this very important period of our collective heritage. Though it contains ten chapters, I will mention just a few.

Chapter 2: The Scene is Set: Cork's Conflict History begins with the arrival of the Vikings in the 9th century. It progresses through to the Anglo-Norman period in the 12th – 13th century and on to the Landing in Kinsale of 3,500 men from Spain in September 1601, who came to support the Gaelic Irish as part of the Nine Years' War. Details of O'Neill and O'Donnell, who marched the length of the Country to support them, and records of the ensuing battle and their subsequent defeat, give a most interesting insight. Following on to 26th July 1651, I was intrigued when I read that the last major open field battle of confederate wars in Ireland took place on that day at Knockbrack near Banteer. Little did I know that I lived half a mile from the site in the 1960s. Indeed the lands I rented were part of the battle fields.

Chapter 3: Moving Towards Revolution – Following the Great Famine (1845-1852), came the rise of one of the most noted Fenians of the 19th century, Jeremiah O'Donovan Ross. The destitution of the poor of Cork impacted him deeply. Part of this chapter references his work on Cape Clear and Sherkin in the 1860s. On one occasion he distributed one ton of meal there among the poor, reaching 81 families, with 225 individuals, on Cape Clear – going to one house he found a dead child and on seeing her he realised she died from want and starvation. On Sherkin he distributed sacks of meal to 53 families, in all 172 individuals. His death and return of his remains to Ireland in 1915, having been exiled to the United States, represented one of the key events on the road towards the 1916 rising. Patrick Pearse's oration at O'Donovan Rossa's funeral has such historical significance that its commemoration was the first event in the Ireland 2016 Centenary Programme.

Chapter 4: 1916 Rising. The story began five years before the events of Easter Week 1911 when the prospects of Home Rule elicited a strong reaction from Ulster Unionists, led by Sir Edward Carson in Ulster and from there bitterness grew.

The chapter explains about The Irish Republican Brotherhood and The Irish Volunteers. The Cork volunteers were under the leadership of Terrence McSweeney and Thomas MacCurtain. We read of the confusion amongst them at Easter 1916, with receiving MacNeill's cancellation order on Good Friday 21st April for the Rising.

What I found fascinating in this chapter are the recollections of people from that time. Tom Barry, who was to become one of Cork's most famous guerrilla leaders in the War of Independence, read of the Rising in Dublin when he was aged 18 years old and serving the British Army in Mesopotamia, "… Thus through the blood sacrifices of the men of 1916, had one Irish youth of eighteen been awakened to Irish Nationality."

Chapter 5: Cork at War, 1918-21. The War of Independence differed greatly from the 1916 Rising. It witnessed volunteers engaging in guerrilla tactics to strike suddenly and swiftly. Women in Cork's Cumann na mBan played a very strong role and large numbers were active. For example, the Clonakilty District Council Cumann na mBan consisted of 135 member.

Chapter 6: The Civil War and Cork – A County Divided. The Irish Civil War was bitterly fought in County Cork and it was to divide families. Brother fought brother and neighbour fought neighbour. Where they were divided, the bitterness lasted for many decades. Growing up in the 40s the Civil War was never referred to in detail in our history class. All we knew at such an early age was that those who voted Fianna Fáil were one side and those who voted Fine Gael were on the other.

Chapter 7: Thirty sites have been chosen to document both people and places and to give one a good overview of Cork's influence in Ireland's fight for freedom. Each of the sites has a short introduction, an ordnance map of the area and photography of the site. I want to specially mention Site No. 7 – the Cork District Cemetery at Carr's Hill on the N28, known locally as the Pauper's Graveyard, Carrigaline - Cork Road. In the 1950s I have vivid memories of a Mr. Sorenson, a Cork Taxi driver who lived near Victoria Road. He started to campaign for a monument to recognise the thousands buried there from Famine Times and in the end he succeeded in getting a steel timber monument erected at the site. As the books says: "it is impossible to divorce the revolutionary movement of the later 19th and early 20th centuries from the cataclysm that befell the island between 1845-52, when the Great Famine descended.

Chapter 9: Researching Your Revolutionary Past. This is a great starting point for anyone who wants to research those that were involved in the events of 1913-1923. It also lists some useful websites with material pertaining to Cork that may help you in your research.

This is a wonderful fourth book published by Cork County Council. It is a very important history book and gives a real insight into our past. It is only by being aware of the sacrifices made by those that have gone before us that we can truly be thankful for what we have today.

The book can be downloaded for free at: http://corkcc-cms.cms-migrate.firmstep.com /sites/cork-cms/files/2017-04/Heritage%20 Centenary%20Sites%20.pdf Printed copies of the book are available for €10 in a range of locations throughout the County, including Skibbereen, Clonakilty, Schull, Bantry and Bandon in West Cork or via www.skibbheritage.com for €14 inc. p&p.

A timeline detailing the main moments in chronological order of Cork's in many of Ireland's most pivotal events.

Beaumont Quarry Project

Image courtesy of Zoe Devlin

Fairy Flax (*Linum catharticum*).

Image courtesy of Calvin Jones

Sparrow-hawk (*Accipiter nisus*).

Image courtesy of Emer Keaveney / CNN

The speckled wood (*Pararge aegeria*) butterfly.

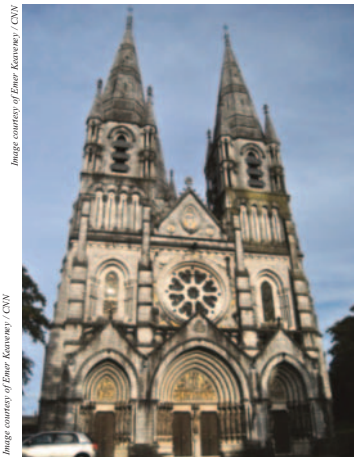


Image courtesy of Emer Keaveney / CNN

St. Finbarr's Cathedral made with limestone from Beaumont Quarry.

Image courtesy of Emer Keaveney

Berwick Fountain on the Grand Parade, which was also made from limestone from Beaumont Quarry.

Image courtesy of Cork Nature Network

Wet willow woodland Beaumont Quarry.

Image courtesy of Cork Nature Network

Photo of 2016's Beaumont Quarry Picnic.

Image courtesy of Cork Nature Network

Karen a manager of Cork Nature Network explaining how to identify the different species of bee's found in Beaumont Quarry at Beaumont Quarry Picnic 2017.

By Emer Keaveney

BEAUMONT QUARRY is one of Cork's best-kept secrets. Located on the south east side of Cork's suburbs between Ballintemple and Ballinlough, Beaumont Quarry is a 3.5 hectare site, which is composed of a variety of diverse flora and fauna with multiple habitat types ranging from calcareous grassland, tall grassland and an extensive limestone cave system. Located on the quarry floor is semi-natural woodland.

The habitats found in Beaumont Quarry support an abundance of diverse organisms, from rare plant species, fungi, butterflies, bumblebees to bat species. Beaumont's unique ecosystem make it an especially distinctive site that offers local residents, naturalists and student's rich geological, botanical and zoological interest accessible to the inhabitants of one of Ireland's largest cities.

Beaumont Quarry is also an area with a rich cultural heritage. Beamish & Crawford brewery was established in 1792, and the family resided in Beaumont House, historically located on Beaumont Hill. ("Beaumont" is a word derived from the French beamish, used to describe a beautiful view).

Beaumont Quarry provides an insight into the growth of Cork City, having provided high-grade limestone for notable landmarks such as the Berwick Fountain, St. Finbarr's Cathedral, Beaumont House and No. 1 Lapps Quay (which is Cork's oldest bank building). Limestone from the quarry was also used in the construction of quay walls, bridges, churches and other public buildings within the city. Beaumont quarry was one of many limestone quarries located along the north and the south of the city.

During the construction of the Berwick Fountain in 1860 Patrick Joseph Scannell, a monument mason with a workshop on Douglas Street, owned Beaumont Quarry. In 1960, Beaumont Quarry closed and after the demolition of Beaumont House, in 1968, Beaumont National boy's and girl's school (Scoil Barra Naofa) was established in its place.

Cork Nature Network and Cork City Council manage Beaumont Quarry. There are 10 different habitat types in Beaumont Quarry, from amenity grassland with species such as broadleaved herbs such as daisy (*Bellis perennis*), dandelion (*Taraxacum* spp.), clovers (*Trifolium* spp.) and plantains (*Plantago* spp.) to dry meadows and, scattered trees and parkland areas. Scrubland is present in the quarry including, shrubs and stunted trees or brambles along with ornamental/non-native shrub such as rhododendron (*Rhododendron ponticum*),

Hedgerows or linear strips of shrubs, often with occasional trees, form along the sites boundaries. There are also treeline habitats and exposed calcareous rock. The quarry has 95 species of herbaceous plants, 36 species of trees and shrubs, 20 species of grasses, rushes and sedges, 15 species of fungi, 5 species of ferns and horsetails, and 2 species of slime mould have been recorded in the quarry.

This diverse ecosystem in turn supports a myriad of faunal species, with 8 mammal species, 33 species of birds, 10 species of butterfly, 5 species of moths, 8 species of bumblebee, 2 species of wasps, 3 species of woodlice, 3 species of spider, 6 species of beetles (4 of these are ladybirds) and 8 more species of invertebrates. This list of species can be found on www.corknaturenetwork.ie.

The quarry is of special importance because it supports a surprisingly diverse range of calcareous grassland, from fairy flax (*Linum catharticum*), yellow rattle (*Rhinanthus minor*), eyebright (*Euphrasia*) and wild carrot (*Daucus carota*).

Of particular interest in the quarry is the rare plant "Little Robin" (*Geranium purpureum*). Little robin has a limited and fragmented distribution along the south coast of Ireland, present in 9 sites in Cork City but only 1 site in Skibbereen and in Dungarvan (O'Mahony 2009). As the majority of Little robin's population is found in Cork it has been included in Cork City Council Biodiversity Action Plan as it is of an area of notable conservation interest primarily because of the presence of the Little Robin. In addition, two nationally scarce plant species (pale flax and common toadflax) can be found in the quarry along with species such as great burnet saxifrage that is also of restricted distribution in Ireland (Preston, Pearman and Dines 2002).

An extensive cave system provides an important habitat for roosting bats, in particular three species have been recorded feeding here, including common (*Pipistrellus pipistrellus*) and soprano pippistrelle (*Pipistrellus pygmaeus*) and leisler's bat (*Nyctalus leisleri*).

Common bird species observed in Beaumont Quarry include blackbird (*Turdus merula*), wrens (*Troglodytidae*), robins (*Erithacus rubecula*) dunnocks (*Prunella modularis*), mistle thrush (*Turdus viscivorus*), collard doves (*Streptopelia decaocto*), common snipes (*Gallinago gallinago*), starlings (*Sturnus vulgaris*) and birds of prey such as the Eurasian sparrowhawk (*Accipiter nisus*).

Cork Nature Network's (CNN) Beaumont Quarry Project was established to protect and enhance the historical, ecological and cultural character of the quarry, as it is a valuable resource to both recreation, popular with local dog walkers and children and conservation. Beaumont Quarry project is managed by CNN, in co-operation with Cork City Council and local community groups. The aim of the future management strategies is to encourage the recreational use of the quarry, facilitate accessibility and undertake measures to protect the natural environment in the quarry.

Measures will include:

- conserving and enhancing the dry calcareous grassland,
- to protect bat species and other native species of flora and fauna,
- to control and eradicate invasive plant species, the encroachment of shrubs,
- to reduce the impact of trampling on calcareous grassland, and
- to encourage bats to roost in the cave system for roosting.

The quarry is important as a recreational amenity area in a semi natural setting for public use within the city and it is one of the management goals to develop this further and to provide facilities and opportunities for education in conservation and natural history, while reducing the impact of human disturbance.

Major issues to the management and conservation of Beaumont Quarry include: dumped waste and household rubbish, scrub encroachment and non-native invasive plant species, such as japanese knotweed (*Fallopia japonica*) and winter heliotrope (*Petasites fragrans*).

The Beaumont Quarry Project aims to spread public awareness and local knowledge of the importance of the quarry as a valuable recreation and educational site through on-site talks, guided walks, "Leave No Trace" workshops and family fun days. Cork Nature Network also run regular voluntary clean-up days and an annual picnic "Beaumont Quarry Picnic" during heritage week to celebrate the beauty of Beaumont as a valuable resource that can be found in the city.

Beaumont Quarry Picnic includes walks and talks, music, children's events, stalls and other activities including a talk on ladybirds, a woodland walk and more. To keep up to date with news and events, visit our Facebook page "Beaumont Quarry Project - Cork Nature Network and check out the Cork Nature Network web site www.corknaturenetwork.ie for further updates on the project and the organisation itself.

Emer Keaveney, Project Manager- Beaumont Quarry Project - Cork Nature Network.

Acknowledgements: Thanks to Gill Weyman, Chair of Cork Nature Network and to Jo Goodyear, previous project manager, for her excellent botany skills that has helped map the various habitat types of Beaumont Quarry and management of the site. Thanks to Cian Gill for all his work running excellent events, such as Beaumont Quarry Clean Up and the Annual Picnic Event, you will be missed this year, but we hope you are enjoying your travels.

ECO ECHOES:

PCBs: They Seemed Like a Good Idea at the Time

By Walter Mugdan[1]

July, 2017

IN 1881 chemists in Germany first synthesized a type of chemical that we know today as polychlorinated biphenyls – PCBs for short. In the following decades, it was discovered that PCBs had marvelous properties that made them useful in a wide range of industrial and consumer products. But as has often been the case, there was a dark side to this discovery: PCBs are highly toxic. To make matters worse, one of their most useful attributes – their longevity, or resistance to breaking down – ensures that PCBs are common, even ubiquitous, many years after their production ceased.

What's in a name? The chemical name explains the chemical structure. "Biphenyl" is a molecule composed of 12 hydrogen atoms and 10 carbon atoms, arranged in two equal rings that are attached to one another. "Polychlorinated" means that multiple ("poly") chlorine atoms are incorporated into the biphenyl rings as part of the molecule. In fact, there can be anywhere from one to ten chlorine atoms in the molecule. And for molecules with fewer than the maximum of 10 chlorine atoms, there are a variety of different places on the biphenyl rings where the chlorine atom(s) can be attached. Consequently there are over 200 different possible varieties of PCBs, depending on the number of chlorine atoms and their attachment locations on the biphenyl rings.

Some of the PCB varieties look and behalf a lot like dioxin, one the most toxic chemicals known. Not surprisingly, these are referred to as "dioxin-like PCBs."

It is the chlorine atoms in the PCB molecules that help make this class of chemical compounds so useful, and also so dangerous. Chlorine kills living organisms. That's why we put chlorine into our drinking water, our swimming pools, and our treated sewage – the chlorine kills the bacteria that could make us sick. (If done right, we use just enough chlorine to kill the bacteria, but not so much that the excess chlorine harms us.)

Dredging at the Hudson River PCBs Superfund Site

Elemental chlorine, which is a gas, is particularly toxic; it was used in World War I as a chemical warfare agent, one of the reasons why soldiers were equipped with gas masks. Fortunately, chlorine is highly reactive and is almost never found in nature in its elemental or pure form. It is almost always bound up with other atoms into compounds, many of which are harmless, like salt — a compound of sodium and chlorine (sodium chloride) that is essential to most animals including humans.

Seemed like a good idea at the time. More later about what's wrong with PCBs, but first let's consider what was right about PCBs – why did this class of chemical compounds become so widely used, in so many ways?

Images courtesy of US EPA

PCBs were used as plasticizers and stabilizers and extenders in paints, cement, caulk, floor finishes, pesticides, adhesives, waterproofing materials and much more.

It turns out that PCBs have many very useful attributes. One of the most important was mentioned earlier: they don't break down easily, even when exposed to high heat, flames, high pressure, electrical current, sunlight or other the forces of nature.

PCBs have excellent "di-electric" qualities. This means they are poor conductors of electricity and so can be used as electric insulation; while at the same time they can support an electrostatic field, necessary for electricity to be accumulated and stored, as in a capacitor.

PCBs are oily liquids that are very fire resistant but also good conductors of heat, so they were used extensively to insulate and cool electrical and electronic equipment like capacitors, transformers, and high voltage power lines. By the 1970s utility poles all over the world had mounted on them PCB-containing transformers. And most fluorescent lights had "ballasts" (small capacitors) filled with PCBs that provided the jolt of electricity needed to turn them on.

Because PCBs resist breaking down under heat or pressure, they were used as hydraulic fluids in heavy machinery.

PCBs were used as plasticizers and stabilizers and extenders in paints, cement, caulk, floor finishes, pesticides, adhesives, waterproofing materials, coatings for bridges and other structures, and much more.

Perhaps most astonishingly, PCBs were used for decades in "carbonless copy paper," which allowed what was written on a top sheet of paper to be transferred to sheets below in a manner similar to old-fashioned carbon paper.

Industrial manufacture of PCBs began in 1929 and expanded rapidly as all these different applications were developed. It's estimated that somewhere between 1 million and 1.5 million tons of PCBs were manufactured during the twentieth century, with the U.S. accounting for about 600,000 tons and the European region about 450,000 tons.

So, what's the problem? PCBs are toxic to humans and many other organisms. The danger was recognized as early as 1922, when it was observed that exposure to high levels of PCBs can cause acute reactions such as chloracne (a dangerously intense form of acne) and dermatitis. In 1936 a U.S. Public Health Service official made the connection between serious skin problems experienced by the wife and child of an employee at a PCB factory, and exposure to the chemicals on the employee's clothing when he came home from work. The following year Harvard University School of Public Health hosted a conference on the hazards of these chemicals. By 1940 a number of scholarly articles on the subject had been published.

We learned that PCBs can cause liver damage, eye lesions, irregular menstrual cycles and lowered immune responses, among other effects. And PCBs can cause cancer. The U.S. government classifies PCBs as "probable" human carcinogens; the International Agency for Research on Cancer, part of the U.N.'s World Health Organization, classifies dioxin-like PCBs (the most dangerous group) as definite human carcinogens.

But despite some 50 years of warnings, it was not until 1979 that manufacture of PCBs was banned in the U.S., and not until 2001 that it was banned under the Stockholm Convention on Persistent Organic Pollutants.

Everyone, everywhere, is exposed. Although the manufacture of PCBs has ceased, that doesn't mean the use of PCBs has ceased, and it certainly doesn't mean that exposure to PCBs has ceased. In fact, exposure is literally worldwide – everyone everywhere is exposed.

The 1979 U.S. ban on manufacturing PCBs didn't stop continued use of the chemicals. Countless PCB-filled transformers and capacitors remained in operation; PCB-containing materials like caulk, paint and waterproofing remained in buildings; even the PCBs in carbonless copy paper remained in circulation as the used paper was recycled to make new paper.

Prior to the 1970s – when meaningful regulation of pollution began in the U.S. and elsewhere – PCBs were often discharged onto the ground or into waterways. In fact, this was the typical and (in retrospect) completely negligent way in which most industrial pollutants were disposed of at the time. But even since the ban on their manufacture, and even since their intentional disposal has been regulated, PCBs have continued to find their way into the

environment unintentionally from leaky equipment, and from regular wear-and-tear of structures that had PCB-containing components (e.g., flaking paint, crumbling caulk, old fluorescent light ballasts, etc.).

PCBs have found their way into rivers, lakes and harbors, and the ocean. Additionally, PCBs can volatilize (evaporate from a liquid into a gas), and then travel through the air and literally around the globe, until settling back onto the ground or into the water far from where they originated.

And wherever the PCBs have landed, they have entered the food chain. As an example, one of the most famous – or rather infamous – PCB contamination sites is the iconic Hudson River, with its mouth at New York City. Some 200 miles north of the city, the General Electric company (GE) had two factories that made electronic equipment. From the 1940s to the 1970s, GE used PCBs, and discharged an estimated 1.3 million pounds of the chemicals into the Hudson. The pollution made its way downstream all the way to the city and into the ocean beyond. The PCBs (like many environmental pollutants) tend to stick to the very small particles that make up the mud or silt at the bottom of the waterway. Within and atop that silt there live myriad small animals, from micro-organisms invisible to the eye to larger worms, mollusks and crustaceans. These little creatures are eaten by larger animals such as fish; and those in turn are eaten by still larger animals – bigger fish, otters, mink, eagles, ospreys, herons and, of course, humans.

The littlest creatures that live in and on the mud ingest PCBs that are stuck to silt particles. The PCBs tend to stay in their bodies, accumulating predominantly in fatty tissues because PCBs are "lipophilic," meaning that they readily combine with or dissolve in fats. With each successive link in the food chain, as littler creatures are eaten by larger ones, the PCBs in the bodies of the prey end up in the bodies of the predators. And because a single predator may eat hundreds or thousands of prey animals during its life, the predator ends up with a much higher concentration of PCBs in its body than the prey animals had in theirs. This process is called "biomagnification." The result is that the predators at the top of the food chain have the highest PCB body burden. And people are at the top of the food chain.

In the Hudson River, a tasty and commercially valuable type of fish called striped bass became loaded with PCBs; the fishery consequently had to be shut down, causing many millions of dollars of economic loss. Warning signs are posted along the length of the river advising anglers to avoid eating fish; and the same warnings are provided when recreational anglers apply for fishing licenses. Nevertheless, it is well documented that people continue to catch and eat Hudson River fish, just as they do in nearly every other polluted waterway.

What's to be done? In the U.S., the national "Superfund" law and similar laws enacted in many individual states have provided legal authority, and in some cases the necessary funding, to clean up the lingering PCB contamination. The job is enormous, complex and costly. For the Hudson River, the U.S. Environmental Protection Agency (EPA) in 2002 determined that PCB-contaminated sediment from a 40-mile stretch of the river downstream of the two GE factories would have to be dredged; this is where the highest concentrations of PCBs remained from the factories' decades of pollution discharges. GE started the work in 2009 and finished in 2015, removing some 2.75 million cubic yards of mud (2.1 million cubic meters) containing about 300,000 pounds of PCBs (135,000 kilograms). The project cost the company an estimated $1.7 billion (about € 1.5 million). And the company will likely have to spend millions of dollars more cleaning PCBs from the floodplains along the river.

A similarly difficult and expensive cleanup is underway in the Fox River in Wisconsin, where a number of paper mills made PCB-containing carbonless copy paper, or used it in recycling operations.

The Passaic River, which like the Hudson empties into the New York/New Jersey Harbor, is considered the birthplace of the Industrial Revolution in North America. It carries a pollution load that reflects this industrial legacy, and PCBs are one of the primary contaminants. In 2016 the U.S. EPA determined that the lower 8.3 miles of the river would have to be dredged and covered with a protective cap of clean sand, at an estimated cost of $1.4 billion (€ 1.2 billion); that project is now being designed.

PCBs in the sediments of the New York/New Jersey harbor, one of the busiest in the world, are contaminated with PCBs from the Hudson and Passaic Rivers, and from multiple other sources. The shipping lanes and berths in this large harbor must be dredged on a regular basis to maintain the necessary depths for today's enormous ocean-going vessels. Because of the PCB pollution, the dredged mud cannot be disposed of at sea, and instead must be managed on land, at a much higher cost. The PCB pollution has imposed hundreds of millions of dollars of excess disposal costs over the years.

Projects such as those in the Hudson, Passaic and Fox Rivers can dramatically reduce the level of PCBs in in the fish that inhabit those waterways, and thus reduce PCB exposure in the people and other animals that eat those fish. But it is impossible to eliminate PCB entirely from these waterways, let alone from the entire rest of the world. The sad fact is that we have fouled our nest, and there is little we can do about it on a global scale.

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[1] *Walter Mugdan is currently serving as Acting Deputy Regional Administrator for Region 2 of the U.S. Environmental Protection Agency, New York City, NY, USA. Any opinions expressed in this article are his own, and do not necessarily reflect the views of the EPA.*

Powering the Future

By Alex Kirby

THERE'S doom and gloom on every side these days, so much so that you hesitate to open a newspaper or watch the TV news. And so much of it seems insoluble: what hope is there for poor wretched humanity? The answer - and I hope it's not a facile one - is that there are signs of hope, pointers to a better world that's within reach if we can nurture them. One is the rampant energy revolution, which some defiant entrepreneurs are convinced is now well and truly under way, and which will mean a better world for us all.

Quite a few pulses were set racing in the summer when the Swedish carmaker Volvo announced that from 2019 all its new cars would be partly or totally battery-powered. But if that sounded like a brave new dawn for renewable energy, it left Volvo's critics underwhelmed.

It will still make a lot of vehicles with internal combustion engines, they point out. It's preparing to do what it will have to do by law - and a little bit more. The people most likely to succeed, the critics insist, are companies like Tesla, a maker of out-and-out electric cars, a distinct advance on the hybrid internal combustion/electric versions which will make up much of Volvo's new build.

Volvo apart, though, we are already into a new era, thanks to the huge advances in solar and wind power, and the huge drop in the cost of both. And these are Trump-proof gains, as you might expect a business leader to see. "It's the economy, stupid!", as someone once said

There are obvious problems with energy both from the Sun and from the winds. One is what's called "intermittency" - the fact that the Sun isn't always shining nor the wind blowing. Possible answers include batteries (which tend to be heavy) and charging points to top them up - if you can find one when you need it.

And there's always the risk that if you're driving a vehicle which needs periodic recharging, the current you're filling it up with may not be green at all. If the electricity available at the charging point is produced by fossil fuels, all you'll have succeeded in doing is relocating the pollution your vehicle emits to a (you hope) distant power station.

Matthew Wright, the UK head of Dong Energy, the world's biggest developer of offshore windfarms, said in August that it would be "a pyrrhic victory" if electric cars had to rely on power stations which ran on fossil fuels.

That's why many experts are now arguing for what are elegantly called energy independent vehicles, or EIVs.

One spotted in Italy several months ago is called the Restaurant Car. Its bodywork is covered in solar panels, and it has four propellors which capture the wind and generate more current. So it's self-propelled, and it has enough power to cook hundreds of meals a day, with one microwave oven and two induction plates.

EIVs are the world we're moving into - at least, if we want to. Too expensive? Far from it, say its fans. Some years ago, when solar-powered wristwatches came onto the market, they were prohibitively expensive. Now they sell for $3 each in China. The cost of solar panels is falling in the same way.

Wind and solar power in combination are a winner. And they're just as good, perhaps even better, in entirely new applications as well. Take solar roads, already a reality in several countries. Covered in special paving, they can generate enough energy from the Sun to power lane marking, traffic signs and nearby buildings. But that's just the start.

Image courtesy of Robbie Murphy

With huge advances in technology, the future is bright for solar and wind power.

With technology that should be available some time this year, a solar road can also provide power to the traffic running on it, in effect turning a heavy truck into a version of a goods train with rubber tyres. The technology is called inductive charging, and can work with the simple addition of a concealed coil to a vehicle. Another version relies on a pick-up device, similar to those used on electric trains, which collects current from overhead wires to drive the lorry's engine.

What's perhaps most remarkable of all is the scope of solar roads to do away with the need for highly-polluting diesel and petrol engines. In Germany, Sweden and the US trials are running of what's called "an intermediate catenary system". That requires providing the overhead wires at intervals along the road, leaving the lorry to work out when it's beneath a stretch, and then suck up the juice. It's estimated that installing the system along 400 kms (250 miles) of Germany's main roads will be enough to power the whole country's trunk road system. There'd even be plenty of power left over to run every home in nearby towns.

There's also the prospect of bi-facial solar systems, double-sided photovoltaic cells which collect energy not only from in front but from behind as well, exploiting the substantial amount of reflected light available from the Earth, rooftops, clouds and atmosphere.

With wind as a fuel, one new possibility is airborne wind energy (not as convoluted as it may sound: it involves using kites and tethered drones to fly above the heights where conventional turbines operate to capture the superior power of the winds found there - typically four times more powerful than those closer to the ground, and much more consistent).

The future can be different - and better.

Alex Kirby is a founder editor of the Climate News Network www.climatenewsnetwork.net

Publications of Interest

Kerry - The Beautiful Kingdom

By John Wesson

The O'Brien Press Ltd

www.obrien.ie

ISBN: 9781847179302

Price: €24.99/2017

This book takes us on a photographic journey through Kerry – the beautiful Kingdom. For over 30 years, John Wesson has had an association with the county, returning there on a regular basis. He has also had a lifelong interest in photography which began when "first picking up my dad's camera as a schoolboy and taking it on fishing trips to record the catch". John's first camera, which he still has, cost him a month's wage when he was an engineering apprentice.

Not only does John want to show us the beauty of Kerry but he reminds us that "there is a lot more to Kerry than just scenery. Its people are fierce and proud of all things 'Kerry', be it sport, culture or produce." As he hoped, his enthusiasm for Kerry's landscape, people and wildlife shines through in the book. It is an invitation to go and explore this phenomenal natural wilderness, nestled on the Atlantic's edge. His short descriptions add interest to the photographs and sparks a curiosity in the subject.

The journey starts in North Kerry, taking the reader from Ballybunion beach and castle to the streets of Listowel, the home of the late John B. Keane. It continues on from Tralee to Dunquin on the Dingle Peninsula, and on to the beautiful Blaskets to see the remains of past life there. It includes a stunning panoramic shot of Peig Sayers' house, with the mainland in the distance.

The Iveragh Peninsula section is stunning, with a magnificent two-page shot of Cromane taken at dawn. This one of my favourite photographs in the book, along with the Atlantic breakers pounding St. Finan's Bay and the view of The Skelligs from near St. Finan's. Finishing up in Killarney, the book has fuelled a desire to go see Kerry again.

Matt Murphy

The Eternal Darkness

Robert D Ballard with Will Hively

Princeton University Press

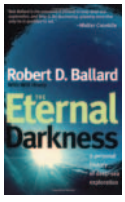
https://press.princeton.edu/

ISBN 978-0-691-17562-1

Price: €22.34/2017

Of the volume available on our planet, about 1% is occupied by land life. A further 2-3% is represented by the upper layer of the oceans, to a depth that can be penetrated by light. The remaining 97% is the realm of the deep sea and total darkness.

Robert Ballard is best known for his discovery of the resting place of the Titanic. In this personal account of his endeavours, he gives due credit to the heroic explorations of the pioneers during the 1930s, in vessels that were little more than steel balls into which the adventurers squeezed in the knowledge that they might not return. Their goal was to reach record-breaking depths, culminating in a descent to the Challenger Deep, in the Marianas Trench in 1960, a feat that has not been repeated.



The era of serious scientific research began with the use of free-diving submersibles, leading to the discoveries of the mid-ocean ridge, which confirmed the theory of plate tectonics, and the hydrothermal vents and black smokers that harbour exotic life that is independent of photosynthesis.

The final section deals with the use of unmanned submersibles in the archaeology of the deep seas, including the Titanic expedition and the search for ancient wrecks in the Mediterranean. In parallel with developments in space exploration, these vessels can now be controlled by scientists working in land-based laboratories.

This is a well-told story of an exciting adventure that has just begun, with many more as yet unimagined discoveries still to be made.

Anthony Toole

Catchments Newsletter

Issue 6: Autumn 2017

Downland free from:
www.catchments.ie/catchments-newsletter/

The Autumn issue (No. 6) of Catchment Newsletter has just been published. It is, as always, full of local news. We learn about the newly formed Maigue Rivers Trust in Co. Limerick, whose mission is 'to protect, enhance and cherish the rivers and lakes of the Maigue catchment for the benefit and enjoyment of all'. The Inishowen Rivers Trust in Co. Donegal held a very successful 'River Care Knowledge Share' event. A trout fishing event was held for Wicklow Youths from Rathdrum and Roundwood where young people are empowered to enjoy angling and appreciate the importance of conservation and protection. The newsletter is full of other interesting articles. One in particular: "Climate Change can bring us together; if we have the wisdom to prevent it from driving us apart", questions why in the face of one of the most important global issues of our time, people are still struggling to respond effectively to climate change and to curb their own greenhouse emissions. Another "Tackling invasive Species – biosecurity needs to be second nature to us all" highlights this important issue; "Forestry - satisfying hearts and minds" explains how farm woodlands are making a growing contribution to a Roscommon farmer's quest for environmental, social and economic farm sustainability. Filled with many more interesting articles, this is another excellent issue in the series.

Matt Murphy

Longyearbyen

Life Beneath the Waves

A Celebration of the Marine Life in the Heart of Svalbard

By Piotr Kuklinski & Piotr Balazy

Contact kuki@iopan.pl for purchases

ISBN: 978-83-941037-7-4

2017

Longyearbyen is a former coal mining city on Spitsbergen in Norway's Svalbard Archipelago in the Arctic Ocean. It is situated halfway between mainland Norway and the North Pole at 78o North. This book of underwater photography has been produced by two marine biologists who have carried out work at Longyearbyen every year since 1997, using scuba diving as their research tool. Much of what is known about the Arctic is ice and snow and large charismatic animals such as the polar bears, whales and walruses. They want to share the hidden beauty of the "Life Beneath the Waves" in the town's backyard. With increased human activity in the region, this book aims to highlight the richness and diversity of the marine life in the area and emphasise the importance of the Arctic region for marine life in the northern hemisphere.

Scuba diving in such a remote area is not the usual pleasure it is in our waters. It is more complicated. They explain that besides the standard boat equipment, all divers should have extra fuel and that an extra outboard engine is also necessary. A flare gun and rifle are mandatory as outside Longyearbyen you can spot a polar bear anytime and that they are great swimmers. Hot drinks and high energy snacks are desirable as weather conditions can change very quickly leading to unpredictable events. Above all a dry suit is essential for diving there. On the island there is a decompression chamber 20-30 minutes away by helicopter. It does not have designated operating staff and in case of a serious diving accident resulting in decompression sickness it is your buddy who has to operate the engine.

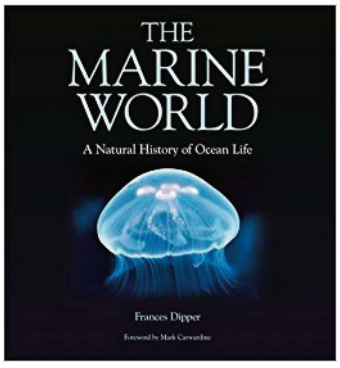
Though the underwater scenery in these cooler waters are not as striking as that of warmer waters, nonetheless the photographs introduce us to the rich and varied marine life of the cool waters around Longyearbyen. One of my favourite images is of the sea anemone Ceriatnhus lloydi. As the book explains, sea anemones found in areas of soft seabed often have an unusual colour variation like in this case. I was also struck by another anemone the reddish or orange Cribrinopsis olegi – whose tentacles seem shorter and thicker than many sea anemones. On the opposite page to this are a trio of photographs of another sea anemone feeding on a sea urchin. Elsewhere, large numbers of sea urchins feeding on kelp detritus make a striking image. Accompanied by interesting and informative descriptions, the variety of species featured in the book include polychaete worms and sea spider crabs, polar shrimp and sea slugs. The vivid colour of the Sea Star Pteraster militaris, also known as the wrinkled sea star, is but one of a number of featured starfish. Skate, Raja radiata, are not an uncommon sight in the area, are also included along with a number of other fish.

The authors point out that there are plans to explore the rich natural resources of this region, oil in particular. Therefore, ship traffic and the hazards related to it, will also increase considerably in the near future. They believe there is a great need to protect this unique place and as it is a place where few will ever have experience of diving in, the exposure that this book is giving the region can only be of help.

Matt Murphy

The Marine World

A Natural History of Ocean Life



A Review by Matt Murphy

A SENTENCE in Mark Carwardine's Foreword summons up this book: "All you could possibly want to know about everything from El Niño to elasmobranchs and waves to whales is crammed into Frances Dipper's irresistible book."

This is a fantastic book. It goes a step beyond a general wildlife book but not so far that it is beyond the reach of many laypeople that want to delve a little more into the marine world.

It is divided into three main sections: The Physical Ocean provides a brief overview of the physical environment within which marine organisms live; The Living Ocean describes the main environments and ecosystems within which marine organisms live; and Marine Life, which makes up the main part of the book, cover the large taxonomic groups into which life is divided by scientists. It incorporates information on identification, distribution, structure, biology, ecology, classification and conservation of each group. From bacteria to plankton, lichens to seaweeds, worms to starfish, molluscs to crabs, to marine fish, mammals and birds, the book covers the full spectrum of marine life. Though it could not possibly cover every single species on Earth, there is enough to whet your appetite and it is detailed enough that you will feel confident to explore further afield.

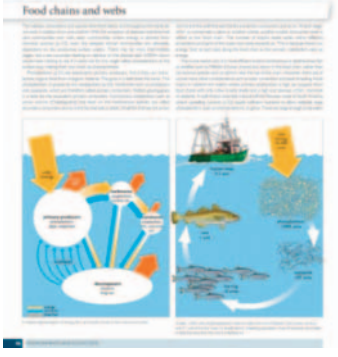
Packed with stunning photographs, colour illustrations and line drawing, they bring the whole book to life. If you want to learn about a subject, you can dip into the book and concentrate on a particular section. In fact, it is hard not to be drawn into the book to investigate a topic.

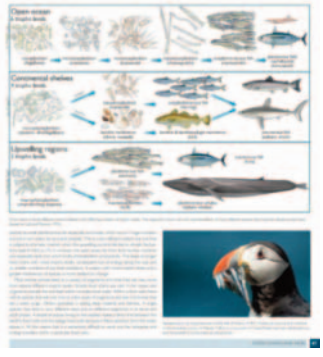
Though it consists of only two pages, I found the very last Appendix in the book a real eye-opener. It covers the Latin and Greek derivations of some of the more common prefixes and suffixes likely to be encountered in the vocabulary of the marine environment. For some, this vocabulary can be a stumbling block or off-putting. As it explains, becoming familiar with these terms can give an insight into the appearance and way of life of marine organisms and can help a layperson get to grips with the language used around marine life.

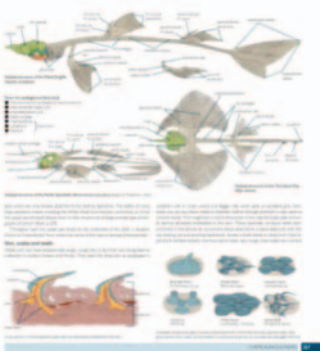
This is an excellent book for the inquisitive: for the naturalist, for the student, for the scientist, for the conservationist, for the diver, for the fisherman, for parents, grandparents and children alike. It gives a comprehensive overview of many of the topics related to the subject without overwhelming the reader.

The amount of work that has been put into putting together "The Marine World – A Natural History of Ocean Life" is truly impressive. I can see it becoming a go-to reference for anyone with questions about the marine environment. A product of a lifetime spent by Frances Dipper happily observing and studying marine organisms the world over, it is a book of which she should be extremely proud. I highly recommend it.

The Marine World – A Natural History of Ocean Life *by Frances Dipper.*
Wild Nature Press www.wildnaturepress.com
ISBN: 978-0-9573946-2-9
Price: £45.00/2016







Junior Pages

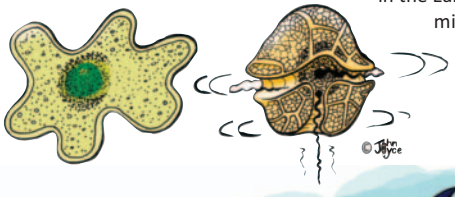
Black John the Bogus Pirate

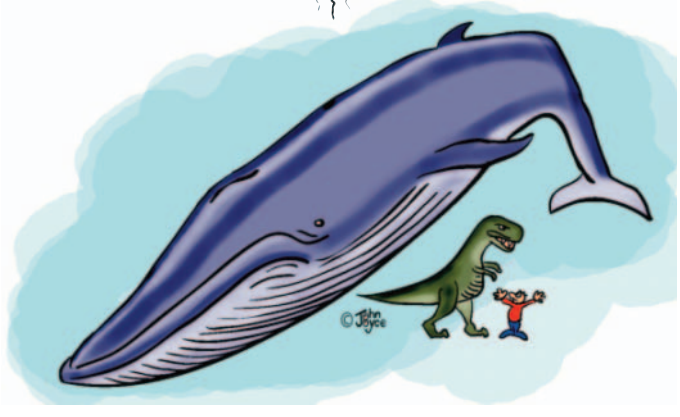
Loppy the Parrot

The Ocean supports a great Diversity of Life and Ecosystems

The Fifth Principle of Ocean Literacy tells us that the Ocean covers some 70% of our planet and is its largest physical feature. It stretches from beneath the frozen wastes of the North Pole, down through the warm waters of the Equator and southwards to the shore of Antarctica. With all that space, depth and variety of habitats, it is no wonder that the Ocean should be home to a breath-taking diversity of life.

Most of this life, both in terms of numbers and 'biomass' (weight of living matter) belongs to the trillions and trillions of microbes at the bottom of the food chain – microscopic animals and plants – that live in the Ocean. While these are so small as to be invisible to the human eye, their sheer numbers make them vitally important to life on Earth. The microscopic plants produce almost half the oxygen in the Earth's atmosphere and the microscopic animals provide the foundation for most of the 'food chains' in the Sea.





But you won't need a microscope to see its largest inhabitant, the Blue Whale. This is the largest living thing that has EVER lived on this planet. The largest specimen ever caught was 29 metres long and weighed 158 metric tonnes. Its heart was the size of a small family car and its aorta (the large blood vessel that leads from the heart) was wide enough for a person to crawl through. The largest land animal that ever lived – the Brontosaur – was only 30 tonnes (a quarter of the size of a fully grown Blue Whale!).

In spite of its vast size, the Ocean does not contain an even distribution of life. Most of the living things that inhabit it, tend to congregate along shorelines and estuaries, around coral reefs or in dense congregations in the open ocean. This is because the microscopic animals and plants which larger animals feed on also congregate in fertile inshore waters such as coral reefs, estuaries and mangrove swamps, or as 'plankton blooms' in the open sea where nutrient rich water is heated by the Sun.

Recent advances in deep water exploration have also revealed communities of animals living in complete darkness along volcanic ridges in the abysses of the Ocean. All the energy and nutrients they need is provided not by sunlight, but by superheated seawater that brings heat and chemical nutrients from the underlying volcanic rock up into the waters of the deep ocean.

But you don't have to travel to the open ocean or dive to the mid-Atlantic ridge to see a diverse range of marine life in a small space. Pay a visit to any rocky seashore at low tide and you will see an incredible array of animals and plants all adapting to the changing conditions of temperature, salinity and exposure which takes place as the tide goes in and out.

Check out the Principles of Ocean Literacy at http://oceanliteracy.wp2.coexploration.org/
Follow Black John the Bogus Pirate and his crew on Facebook at https://www.facebook.com/BlackJohntheBogusPirate/

Sherkin Island Marine Station's

Environmental Competition for Primary School Children in Munster 2017

THE WILDLIFE RACE

Sam the Snail and his friends are racing through the countryside. Join them as they meet lots of wildlife along the way and help them to reach the finish line. Using a marker for each player, take turns to throw the dice and move the required number of spaces. Follow the directions as you go.

START

Bats find an old roof to live in. *Go forward 4 spaces.*

Flowers are helping bees make honey. *Go forward 2 spaces.*

Rubbish in the sea makes a dolphin sick. *Go back 2 spaces.*

The animals cannot breathe when the air is polluted. *Go back 3 spaces.*

A bird finds worms in the garden for her baby chicks. *Go forward 1 space.*

A tree is planted and small creatures get a new home. *Move forward 1 space.*

Frogs lay frog spawn in rain-filled ponds. *Go forward 1 space.*

Animals wait for the snow to melt to find food. *Miss a turn.*

The hedgehog cannot find its home. *Go back 3 spaces.*

Children feed the birds every day in the winter. *Move forward 2 spaces.*

Miss a turn while a robin waits for its eggs to hatch.

A father wraps his child up warm on a cold day. *Move forward 1 space.*

Logs in the school garden make a home for insects. *Go forward 2 spaces.*

A family collects rain water to water the garden. *Move forward 4 spaces.*

The fly hides from the spider. *Miss a turn.*

The squirrel has lost all its nuts. *Go back 3 spaces.*

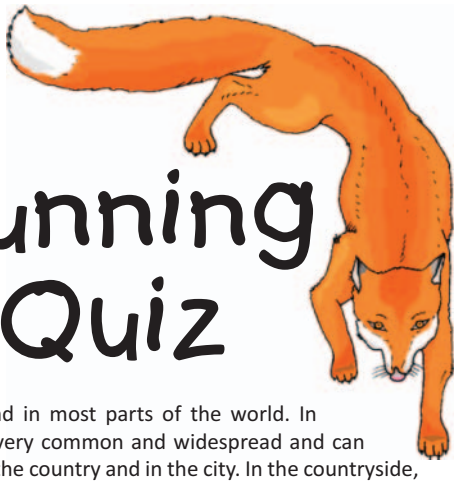
A mouse finds clean water near its new home. *Go forward 3 spaces.*

The fox cubs wait for danger to pass before leaving their den. *Miss a turn.*

Fallen leaves help to make rich soil for growing plants. *Go forward 2 spaces.*

Animals lose their home when a tree is cut down. *Go back 5 spaces.*

FINISH LINE



A Cunning Quiz

Foxes can be found in most parts of the world. In Ireland they are very common and widespread and can be found both in the country and in the city. In the countryside, they like to live near forests or in scrub or tall vegetation. In towns and cities they make homes in large gardens or derelict properties. They are usually nocturnal animals, preferring to venture out at night under the cover of darkness to search for food.

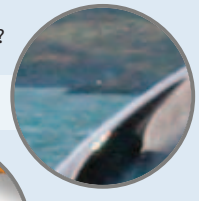
How much do you know about foxes? Check out this quiz....

1	F					What amphibians do foxes eat?
2		O			■	To which domestic animals are foxes related?
3			X			What is a female fox called?
4	E					What is a fox's home called?
5	S			■	■	Foxes are known to be what?

Wildlife Detective

With help from items mentioned in "The Wildlife Race" on page 28, can you identify what's hidden in the circles below?

1 _ _ _ _ _ _ _



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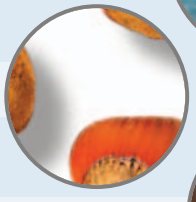
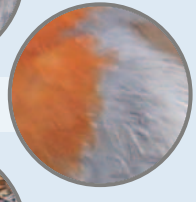


3 _ _ _ _ _ _ _ _ _

4 _ _ _

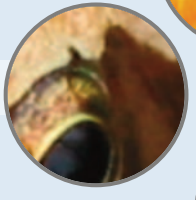
5 _ _ _ _ _



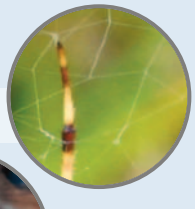
6 _ _ _ _

7 _ _ _ _ _

8 _ _ _ _



9 _ _ _ _ _ _



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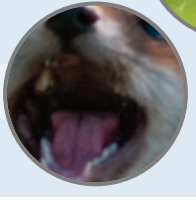


Answers to How Much Do You Know About Sea Life on page 30: 1. a; 2. b; 3. b; 4. c; 5. c; 6. a; 7. a; 8. a; 9. a; 10. c; 11. c; 12. c*; 13. b*; 14. c; 15. a; 16. a; 17. b; 18. a; 19. a; 20. b. [*errors corrected in online edition]

Answers to Sea Life Search page 31 (Over,Down,Direction): basking Shark (13,11,W); Butterfish (13,11,N); Hermit Crab (22,11,W); jellyfish (5,2,E); Limpet (20,5,S); lobster (18,10,N); Mackerel (1,2,SE); Octopus (16,4,SE); Periwinkle (16,1,SW); Sea Anemone (18,7,W); Sea Urchin (4,6,E); Seaweed (14,9,NE); Shore Crab (5,3,SE); starfish (22,4,S); Topshell (1,3,SE).

Answers to A Cunning Quiz on page 29: 1. Frogs; 2. Dogs; 3. Vixen; 4. Earth; 5. Sly.

Answers to Wildlife Detective on page 29: 1. Dolphin; 2. Nuts; 3. Earthworm; 4. Log; 5. Robin; 6. Snail; 7. Honey; 8. Frog; 9. Spider; 10. Fox.

How much do you know about...

SEA LIFE

How much do you know about sea life? Find out with this fun quiz. Choose one of the answers and see how many you can answer correctly.

1. Which marine animal can regrow a lost arm?
a. Starfish
b. Dolphin
c. Mussel

2. Which of these is the largest?
a. Bottlenose Dolphin
b. Blue Whale
c. Grey Seal

3. There are three seaweed colours:
a. Green, Red and Yellow
b. Red, Brown and Green
c. Brown, Green and Yellow

4. Which of these are you least likely to see in a rockpool:
a. Shrimp
b. Beadlet Anemone
c. Mackerel

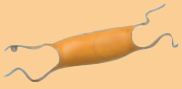
5. What crab makes a home in another shell:
a. Shore Crab
b. Edible Crab
c. Hermit Crab

6. Which animal has an outer shell, called an exoskeleton:
a. A lobster
b. A fish
c. A Octopus

7. Which one is a sea snail:
a. Periwinkle
b. Eel
c. Sea anemone

8. Which of these is lowest on the food chain:
a. Plankton
b. Fish
c. Bird

9. The Mermaid's Purse contains the young of which fish:
a. Dogfish
b. Salmon
c. Plaice



10. Where might you find a flat fish:
a. In a rockpool
b. On the shoreline.
c. On the sea floor.

11. Which animal is most likely to sting:
a. An octopus
b. A Sponge
c. A Jellyfish

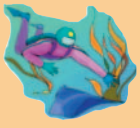
12. Which shellfish does not have two shells:
a. Oyster
b. Mussel
c. Limpet

13. Where are you most likely to find sandhoppers:
a. On the rocks
b. On the beach
c. In a rockpool

14. Which one of these is not usually found in Irish waters?
a. Porpoise
b. Basking Shark
c. Walrus

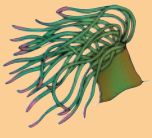
15. Which one of these can be found in the sea and in rivers?
a. Salmon
b. Starfish
c. Herring

16. Which one of these seaweeds can form a forest underwater:
a. Kelp
b. Carrageen Moss
c. Sea Lettuce



17. The hard shell that covers a crab's body is called a:
a. Shield
b. Carapace
c. Vest

18. Which one of these has tentacles:
a. Sea Anemone
b. Basking Shark
c. Butterfish



19. Which one of these is blue?
a. Mussel
b. Limpet
c. Painted Topshell

20. What are you most likely to find on the tidal line:
a. Killer Whale
b. Flotsam & jetsom
c. Shrimp

Answers on page 29.

SEA LIFE SEARCH

K	G	J	Z	D	T	E	P	C	R	G	D	O	H	M	P	H	T	B	M	W	M	N	F	P
M	C	W	A	J	E	L	L	Y	F	I	S	H	W	E	M	J	Y	E	P	E	F	K	B	O
T	A	Z	P	S	B	A	K	X	L	C	W	S	R	V	D	Z	M	N	D	V	T	V	R	U
Q	O	C	D	L	H	C	O	H	L	W	B	I	O	N	O	C	R	E	G	I	S	E	L	J
Z	T	P	K	J	Z	O	I	L	N	E	W	F	Z	V	K	C	E	M	L	H	T	P	I	E
D	N	K	S	E	A	U	R	C	H	I	N	R	W	L	M	W	T	A	I	M	A	M	G	O
A	T	U	B	H	R	G	Z	E	N	O	M	E	N	A	A	E	S	O	M	O	R	Q	B	I
O	R	G	B	S	E	E	N	K	C	V	B	T	T	E	M	D	B	C	P	A	F	S	N	Y
T	W	C	Y	M	R	L	L	A	U	R	U	T	S	R	L	K	O	G	E	U	I	N	N	M
O	K	W	S	B	M	E	L	Z	N	Z	A	U	E	A	W	H	L	P	T	J	S	P	E	Q
B	K	R	A	H	S	G	N	I	K	S	A	B	A	R	C	T	I	M	R	E	H	E	T	J

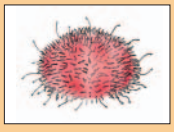

Shore Crab


Mackerel


Limpet


Hermit Crab


Octopus


Sea Urchin


Basking Shark


Butterfish

All the sea life here are mentioned in the quiz on page 30. Can you find them in the wordsearch?
Answers on page 29.


Periwinkle


Lobster


Jellyfish


Topshell


Sea Urchin


Seaweed


Starfish


Sea Anemone

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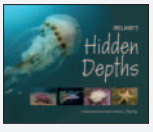

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Chesapeake Bay Report Card

By Michael Ludwig

IN the 1970s, the water in parts of Chesapeake Bay, on the east coast of USA, was found to be depleted of oxygen for persistent amounts of time leaving organisms dead or dying. This was the first example of what has come to be known as "marine dead zones." These "hypoxic" (low oxygen) or the most severe "anoxic" (no oxygen) areas are created by a cycle of nutrient enrichment and algal blooms. They, in turn, deplete the oxygen when these, primarily phytoplankton, die and are decomposed by bacteria.[1] Dead zones are often unable to support life, resulting in marine die-offs of aquatic species that obtain their oxygen from the water. The Bay's dead zone areas are estimated to kill upward of 75,000 tons of bottom-dwelling species incapable of escaping the loss of oxygen. This often, annual, cycle of benthic species death weakens the estuary's food web (food chain) robbing more desirable species of the habitat and food they need and increasing the impact of the problem. For instance, when a dead zone occurs blue crabs are sometimes observed crawling out of the water and onto shore to escape the low oxygen water. In Louisiana along Lake Pontchartrain, the event is known as a "crab jubilee." The name does not appreciate the environmental consequences!

The Bay is almost 200 miles long with a catchment area of about 64,000 square miles covering parts of six states and the District of Columbia (see picture).The Bay is home to more than 3,700 species of plants, fish and other animals. Today, almost fifty years after the Dead Zone situation was first identified but well after it started to occur, the residents of the Chesapeake Bay Watershed continue to struggle with its effects. Their restoration will require an additional $18.7 Billion Dollars on top of the more than a $9 Billion invested since studies began in the 1970s. Currently, the pollution, sedimentation and aquatic diseases, along with overharvesting, have turned much of the Bay's bottom into a muddy wasteland.

The Bay has improved slightly in terms of the overall health of its ecosystem, up from a 28 out of 100 rating in 2008 and, even worse in the prior decades. A "blue ribbon panel" estimated in 2006, that cleanup costs would be $15 billion if it was even possible, due to cultural and economic constraints within the watershed. The constraints include the religious restrictions like the Amish who shun "modern technology" and suburban communities with poor soil conditions that limit the natural purification of sanitary wastes and lack the money to build centralized sewerage treatment. Compounding these problems are the 100,000 new residents that move to the area each year. To address these problems in 2010, the U.S. Environmental Protection Agency (EPA) established a Total Maximum Daily load (TMDL) for the Bay and its tidal tributaries.[2] A TMDL identifies the nutrient and sediment loads that must be achieved to maintain a desired water quality condition. The EPA's TMDL is to be in operation and compliance by 2025. The EPA and jurisdictions in the Bay catchment prepared Watershed Implementation Plans (WIPs) to specify nutrient and sediment loading to meet the TMDL. Two-year milestones were developed to help track progress. They seek to improve the "health" of streams so that 70 percent of them rate fair, good, or excellent by 2025. Yes, thirty percent of the waters do not need to meet the TMDLs!

A TMDL is a "pollution diet" that identifies the maximum amount of pollutants a waterway can receive and still meet applicable water quality standards. These limits are the sum of wasteload allocations for point sources, nonpoint sources, and include a margin of safety to account for surprises. Point sources include sewage treatment plants, stormwater discharges, industrial discharges, etc. Nonpoint sources include pollutants carried by runoff from forests, agricultural lands, atmospheric deposition, abandoned land mines, etc.

US States in Catchment Area.

Sewerage Treatment Facilities.

Image courtesy of U.S. EPA

The Bay TMDL set annual Bay watershed limits of 185.9 million pounds of nitrogen, 12.5 million pounds of phosphorus, and 6.45 billion pounds of sediment entering the waterway every year. That, based on 2009 levels, is a 25 percent reduction in nitrogen, 24 percent reduction in phosphorus and 20 percent reduction in sediment. These limits are divided by state and river basin based on state-of-the-art modeling tools, extensive monitoring data, peer-reviewed science, and close interaction with Bay partners. Note that the reductions are less than a quarter of the 2009 pollution levels! How many of us can afford the cost of these "cleanups?" Our current President thinks we cannot and our national budget seeks to limit funding these efforts.

[1]Dead zones typically result from algal blooms triggered by residential, farm and industrial runoff. The runoff and associated pollution contribute to algal blooms by providing phosphorus and nitrogen compounds (fertilizer). Algal blooms reduce sunlight penetration while alive and consumes oxygen when they die and rot reducing the availability of oxygen in the water column. Sediment erosion and transport into the Bay, exacerbates the loss of water clarity. The impact has degraded the Bay to a point where seafood harvesting has cost thousands of jobs and incomes. Beds of eelgrass, the dominant submerged aquatic vegetation in the southern Bay, have shrunk by more than half since the early 1970s.

[2]The Bay TMDL is a combination of 276 nitrogen, phosphorus and sediment TMDLs for 92 individual tidal segments. Pollution limits were selected to meet applicable water quality standards for dissolved oxygen, water clarity, underwater Bay grasses and chlorophyll-a, an indicator of algae levels.

Mike Ludwig, COWI, 1000 Layfette Blvd. Suite 1010, Bridgeport, CT 06604, USA.