

H₂O

Produced by Marine & Freshwater Ecosystems Group, Countryside Council For Wales
- Supporting communication by the Maritime and Freshwater Networks in CCW -

Editorial - Collect once, use often

For the past two decades CCW has been steadily building a comprehensive set of environmental data for Welsh lakes. We have done this by making a strategic commitment to survey 5-6 lakes per year using a standard method and looking at a range of biological, physical and chemical characteristics. Although most of this data was collected once, it has been used to answer a wide range of environmental questions at different scales. At a local level we can say if the conservation features are still present and in good condition? Is the lake suffering from pollution?



Llyn Glasfryn. Photo by T. Hatton-Ellis © CCW.

When we look at the dataset as a whole we can comment and advise on the condition of our lakes at a regional scale. As part of the UK National Ecosystem Assessment, we were able to produce maps showing lakes which have been impacted by nutrients or "acid rain". We have also advised on which lakes might benefit from targeted Glastir schemes or support important regional biodiversity resources?

It is even more important to use this approach in the marine environment where our level of knowledge is more restricted and there is high pressure to answer a range of changing questions from a policy advice perspective (e.g. marine spatial planning or

marine protected areas). Although it is often a slow detailed job, there have been a number of times recently when it has been very rewarding to see how marine data from a range of sources was collated to provide evidence or produce maps.

CCW has an excellent track record of commitment to large scale strategic projects, such as the Terrestrial Phase One Habitat Map and

the all Wales Intertidal Survey. Hopefully any new single environment body in Wales will make a similar pledge to collecting and collating reliable large scale sets of environmental data which have a multitude of applications.

The collect once-use often philosophy is also in tune with data sharing initiatives which aim to make better use of information resources for evidence-based policy making and environmental management.

So remember, if you are deciding future priorities, focus on long term environmental information requirements. These may extend beyond your own immediate needs. If you are designing a survey, make sure you secure robust data which once collected can be used many times. Fully document the data collected, archive safely and consider accessibility for others.

Maybe we should get some T-shirts made... **collect once, use often.**

*Dr. Catherine Duigan
Head of the Marine and Freshwater Ecosystems Group, Countryside Council for Wales.*

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Issue 9

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Waterside Code

The CCW has published the Waterside Code whose development was led by the the **Welsh Government** in consultation with the main inland water activity user groups.

Top tips for using Wales' inland waters include:
- Respecting other people by finding out where you can and cannot go before visiting;
- Checking the weather forecast before leaving home as water conditions can change

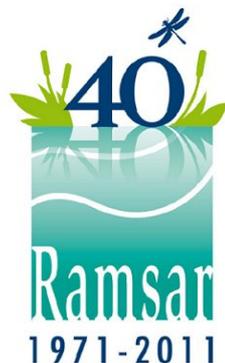
rapidly in rivers and lakes;
- Always making sure that you know how to get in and out of water safely as there can be hidden dangers;
- Being careful not to disturb fish eggs in shallow parts of the river between autumn and spring;
- Using established places to get in and out of the water to protect riverbanks and lakesides;
- Checking, cleaning and drying clothing and equipment

before traveling to new places to stop the spread of invasive species.

Over the coming months, more specific and detailed codes of conduct will be developed for key activities, including angling, canoeing and wild swimming.

Contact: Joe Roberts
(j.roberts@ccw.gov.uk)

Watch video:<http://vimeo.com/26668372>



Living Dunes

In September CCW hosted a **Sand Dune Workshop** to discuss the conservation implications of dune stabilization.

Sand dunes in Wales have changed beyond all recognition, with mobile dunes declining from about 75% in the 1950s to just 6% today. Factors such as depletion of sand supply, nutrient enrichment, enhanced CO₂ levels, soil development, artificial stabilization, and possibly natural climatic variation have been implicated.

This **lack of mobility is now becoming critical** since many of our obligate dune species are totally dependent on early succession habitats where open sand is a major component. These include many

invertebrates and the now critically endangered fen orchid (*Liparis loeselii*). This attractive plant has been lost from all of its former locations in Wales (7 sites) apart from Kenfig Burrows, and here plant numbers have declined from about



Dunes at Talacre. Photo by P. Rhind © CCW.

10,000 in 1970s and early 1980s to less than 160 today.

The workshop proved to be extremely useful providing a basis for developing an agreed strategy aimed at helping to restore increased levels of mobility on selected sites.

Contact: Peter Rhind (p.rhind@ccw.gov.uk)

FishMap Môn

FishMap Môn is a £250,000 project funded by **European Fisheries Fund** and the **Welsh Government** running until September 2012. The project covers an area of approximately 265 km² out to 12 nautical miles around the Isle of Anglesey. The aim is to use a collaborative approach to engage with fishermen in this area to collect data on fishing activity and develop guidance on fisheries management.



Lobster pots. Photo by Bryn Jones © CCW.

Currently, the project is focusing on stakeholder engagement and data collection. The first Steering Group was held on the 15th July and attended by over twenty representatives from local and national organisations including the **Welsh Fishermen's Association**, the **North Wales Fishermen's Co-operative Ltd**, **SeaF-**

ish, Joint Nature Conservation Committee and Environment Agency. Since then, the project's liaison officer, Bryn Jones has been conducting interviews with commercial fishermen, charter boat operators and recreational sea anglers.

Whilst fishermen are generally keen to participate in the project and to contribute towards more sustainable fisheries, they have a lot of questions about how their data will be used. Answering these questions involves explaining how the intensities of the fishing activities will be calculated and used to determine the sensitivity of the benthic habitats in the project area (see references). Anticipated outputs include a tool to allow users to explore habitat maps and their sensitivity to fishing activities, as well as the involvement of stake-

holders in the development of options for fisheries management.

Contact Bryn Jones (br.jones@ccw.gov.uk) or Sue Hearn (s.hearn@ccw.gov.uk) or go to www.ccw.gov.uk and search for 'FishMap Môn'.

Hall, K., O.A.L. Paramor, L.A. Robinson, A. Winrow - Giffin, C.L.J. Frid, N.C. Eno, K.M. Dornie, R.A.M. Sharp, G.C. Wyn, and K. Ramsay (2008). **Mapping the sensitivity of benthic habitats in Welsh waters - development of a protocol**. CCW Policy Research Report No. 08/12.

Tyler - Walters, H. and C. Arnold (2008). **Sensitivity of intertidal benthic habitats to impacts caused by access to fishing grounds**. CCW Policy Research Report No. 08/13.

Tern Take Aways

CCW has been working with the **Joint Nature Conservation Committee (JNCC)** to find out the areas of importance to our tern colonies in terms of feeding. This summer saw the third and final year of tern surveys on the north coast of Wales. The first summer's fieldwork in 2009 involved a very novel monitoring technique of following Sandwich Terns in a RIB out from the colony at Cemlyn Bay. The route of the bird was recorded by GPS as well as where they fed and the type of prey.

The following two summers transects were carried out around Anglesey and adjacent to the Little Tern colony at Gronant, noting all tern species, as well as behaviour. Further work was also carried out at the Gronant colony over the three summers, counting little terns at sea from the



Sandwich tern. Photo by M. Hammett

shore, at increasing distances away from the colony. These count points were situ-

ated at 1 km gradations away from the colony up to a maximum of 6 km. At each of these points a 20 minute count took place recording all little terns as well as their flight direction and feeding behaviour.

This winter will see the production of a report by JNCC collating together the Welsh surveys and similar information gathered around the UK at other tern colonies.

Contact: Matt Murphy (m.murphy@ccw.gov.uk)

A summary of Special Protection Areas in Wales can be found on the JNCC website: <http://jncc.defra.gov.uk/page-1403>

Changing Marine Habitats

Last year, CCW was asked by the Welsh Government to undertake an assessment of the vulnerability of marine habitats to climate change.

After a workshop to define methodology, we commissioned a study from **HR Wallingford**. It identified sea level as having the most significant impact, since the affected habitats (i.e. coastal intertidal habitats) may have nowhere to retreat. Intertidal mudflats, littoral seagrass beds and coastal saltmarsh often have sea defences or roads on the landwards side, and 40% of the Welsh coastline currently has a railway line that is either acting as, or is close to, a coastal defence. Moving these barriers to allow retreat of these habitats is unlikely meaning that as sea levels rise they will be squeezed and eventually be replaced by subtidal habitats.

Coastal saltmarsh, intertidal mudflats, littoral seagrass beds and saline lagoons were most vulnerable to climate change impacts. In the case of intertidal mudflats, increasing wave height was also noted as having a significant impact, in addition to sea level rise. Subtidal broad-



Sabellaria Reef. Photo by P. Brazier © CCW.

level habitats (such as circalittoral mixed sediment) were found to be less vulnerable to many climate change impacts, though species associated with such habitats were individually likely to be effected by parameters, such as ocean acidification and temperature

increases. As a result, the biological composition and integrity of such habitats may change over time, even though the sediment environment upon which such broad-level habitats are described may remain the same.

On a more positive note, it was noted during the assessment that **there may be scope for some habitats to extend into new areas of Wales or for new habitats to be created due to increasing temperatures and / or sea level rise.** For example, several areas in Wales have the potential to support new saline lagoons as sea levels rise. This may mean that lagoons lost due to sea level rise could potentially be replaced by new ones, and it is

possible that more lagoons would be created than lost (though locations may differ from existing lagoons, and the biodiversity of new ones is likely to be initially lower than long-established ones). *Sabellaria* reefs (see photo) could also potentially benefit from climate change as they are particularly susceptible to cold weather. Potentially milder winters in Wales may aid the survival of *Sabellaria* reefs in the longer term.

Contact: Karen Robinson
(k.robinson@ccw.gov.uk)

Gubbay, S., Earll, R., (2010). Assessing the vulnerability of marine biodiversity in Wales to the impacts of climate change: workshop report. CCW Contract Science Report No: 934, 21pp, CCW, Bangor.

Jones, D., Bain, V., Dawson, S. & Watt, T., (2011). Assessing the vulnerability of marine habitats in Wales to the impacts of climate change. CCW Contract Science Reports. Report No: 969, 192pp, CCW, Bangor.

The Eurasian Beaver, *Castor fiber*

Beavers are legendary for their huge tree-felling teeth and their broad flat tails which they use to slap the water surface when alarmed. They fell trees to provide material to build their lodges and dams, and as a means of creating a winter food store. They can add to the habitat diversity of an area by creating areas of open water next to rivers and streams, and on wetlands. Their dam building means they have an area to swim in and to cover the entrances to their lodges.

In the Middle Ages they supported a beaver hat industry around Carmarthen and Tregaron. You can see an example of these hats on display at Chirk Castle. They were last recorded in Wales by Giraldus Cambrensis in 1188, who reported that the Teifi was unique in England and Wales in supporting them.

Beavers are one of the few freshwater organisms that can have significant ecosystem effects. Their coppicing, grazing and damming activities are likely to cause significant changes to various ecosystem level parameters including vegetation structure, aquatic plant biomass, availability of riparian and in-river dead wood, patterns of erosion and deposition and extent of riparian shading. Most importantly, they will increase connectivity between terrestrial and freshwater systems and help to slow the rate of flow down our rivers. The magnitude and impact of these changes is likely to be highly context-specific and is



Scottish beaver lodge, Knapdale. Photo by T. Hatton-Ellis © CCW.

likely to involve a mixture of positive and negative effects, both from a conservation perspective and a wider economic / ecosystem services perspective.

A good example of the complexity of these effects is fishery management for migratory salmonids. At present, rivers trusts (often grant aided by CCW, Environment Agency and European funding) spend hundreds of thousands of pounds annually managing riparian habitat. Much of this work includes activity such as coppicing riparian trees. Beaver activities will do this at no cost and also promote a more structurally diverse river system, thereby increasing habitat quality in many locations. However, dam construction could also restrict adult fish access to spawning areas and result in a reduction in the extent of available spawning habitat, entailing a small management cost to maintain fish access. Likewise, an increase in instream woody debris will make angling more difficult. Beaver pools behind dams can provide a refuge from predators and drought, but may also promote warming of river water.

Beavers could also restore an ecosystem that has been absent from Wales for more than 600 years - beaver meadows. These unique habitats occur behind beaver dams as they silt up, and consist of fertile riparian wetlands that support a wide range of biodiversity. We know very little about what species might utilise this habitat in Wales, but the poor quality of many riparian areas is a major conservation concern and the reinstatement of such a habitat is a valuable prospect.

In North Wales, beaver pools in relatively low fertility rivers are likely to create good conditions for floating water-plantain *Luronium natans* which often grows in naturally occurring slow-flowing river reaches and has shown itself able to exploit man-made habitats such as canals. Other species of conservation importance such as otter, bats and water vole could all benefit from this type of habitat.

The Welsh Beaver Assessment Initiative was established in 2005 to investigate the feasibility of reintroducing the European beaver to Wales. It is funded by **CCW, People's Trust for Endangered Species, Environment Agency Wales, Wild Europe Foundation, Wildlife Trusts Wales and Welsh Power Ltd.**

Contact: Liz Halliwell
(l.halliwell@ccw.gov.uk)

Celtic Sea Exercise

A large, **multi-agency maritime pollution exercise** staged over two days took place in SW Wales in October. It sought to ensure a co-ordinated and efficient agency response to an incident involving both oil and chemical pollution from shipping. The exercise involved a series of table-top exercises accompanied by the live deployment of resources and equipment.

There was a **hypothetical collision** of a tanker carrying North Sea light crude with a container ship just outside the Haven, 1.5 miles south of the port. This resulted in significant damage to the tanker and several containers being lost to sea. The Secretary of State's Representative instructed that the damaged tanker be brought into the Haven and it was moored off Dale Point, but throughout the exercise the situation became progressively worse as weather conditions deteriorated with a force 6 – 8 storm predicted. The tanker was then moved and the resultant spill

forecast to hit areas of the open coast either side of the Haven entrance and many areas within the Haven, from Dale in the west to as far south as the Pembroke river. Then the lost containers containing volatile chemicals re-appeared around the south coast at Tenby and Pendine. The sense of realism was maintained with "real time" updates, and different groups spread across locations in south Wales. To test the emergency services response to chemical spills, students were drafted in as "casualties" and put through the decontamination process.

CCW input was mainly via **the Environment Group**, where decisions were made related to the protection of marine species



The Haven. Photo by C. Duigan © CCW.

and habitats, areas which were to be boomed and clean up techniques. Liaison with other groups was very good, if not a little exhausting for those involved!

Overall the exercise was very useful and it highlighted some gaps in the pollution response procedure which will result in some improvements to future

plans. It was also an excellent opportunity to build relationships with partner organisations. The organisation of the event was no small task given the sheer number of staff involved across a number of locations in South Wales, so a big thank you to all those involved.

Contact: Anne Bunker (a.bunker@ccw.gov.uk) or Gareth Cunningham (g.cunningham@ccw.gov.uk)

Peatlands Inquiry

For centuries peatlands have been regarded as wastelands – not fit for anything useful except to be exploited and transformed wherever possible. The 1980s saw an increasing recognition of their unique biodiversity value. More recently their role in water quality has been addressed and today their part in carbon sequestration has come to the fore.



Cors Caron National Nature Reserve. Photo by P. Jones © CCW.

The **IUCN (International Union for Conservation of Nature) Commission of Inquiry on Peatlands** was instigated to provide an up-to-date and authoritative briefing on the state of peatlands within the UK, on how current use was impacting

them, and the benefits of restoration in terms of the many ecosystem services peatlands provide. The aim was to provide a consensus between science, policy and practice than would result in positive action. The Inquiry was to work through partnership and to encourage broad ownership.

From the beginnings in December 2009, a major task has been the commissioning of nine technical reviews, each covering a critical aspect of peatlands. Evidence for these was gathered throughout 2010 culminating in the outstanding reception at the parliamentary inquiry. Now the evidence

has been distilled into the final Assessment Report, in which the top key findings, the areas of uncertainty requiring further investigation, and the key policy suggestions for the future are laid out.

This article was an abstract for a presentation by S. Chapman (steve.chapman@hutton.ac.uk) at the autumn meeting of the British Ecological Society, Sheffield.

CCW Contact: Peter Jones (p.jones@ccw.gov.uk)

Find out more about the IUCN UK Peatland Programme at <http://www.iucn-uk-peatlandprogramme.org/>

Holden's Reef

Methane-Derived Carbonate Reefs (MDCRs) are rock-like mineral and carbonate rich structures formed as a by-product of anaerobic oxidation of methane gas seeping from the seabed into the saltwater environment. Numerous MDCRs have been described around the continental shelf of the UK but few are known in shallow-water (<20m). A number of MDCRs occur in the Irish Sea, including a location in Cardigan Bay.



Dog fish on Holden's reef. Photo by R. Holt © CCW.

Since 2004, CCW has been monitoring the fish community at a recently discovered MDCR called Holden's Reef as part of our obligations to assess the status of reefs in Special Areas of Conservation. We reported the findings at the recent international temperate reefs conference in Ply-

mouth. There have been no scientific published reports associated with the composition of the reef fish assemblages on temperate shallow-water MDCRs. Temporal evidence from Holden's Reef indicates a reduction in fish diversity since 2005, particularly for resident species and may indicate the influence of other abiotic factors (i.e. temperature, wave exposure).

MDCRs are considered unique habitats and should be conserved in their own right.

The present study is the first comparative investigation into the reef fish community structure of shallow-water MDCRs in the UK.

Contact: Rohan Holt (r.holt@ccw.gov.uk)

Text derived from conference poster: **Monitoring Fish Communities on a Shallow-Water Methane Derived Carbonate Reef in a Welsh SAC.** B.R. Wray, R.H.F. Holt, R. Irving, D. Stanwell-Smith, T.B. Stringell, J.R. Turner & W.G. Sanderson.

The Big N! Nitrogen!

Water and air are two very closely related substances which readily mix together in the environment. Just think of walking through a shower of rain or a foggy day. In addition, water and air can exchange polluting agents, such as sulphur (S), nitrogen (N) and its close relative ammonia. We are all guilty of facilitating the release of N into the environment, as we go about everyday tasks, liking driving and turning on the light. Although we can't see these pollutants, recent research lead by the **Joint Nature Conservation Committee (JNCC)** and the other conservation agencies (including **CCW**) has revealed the impact nitrogen is having on conservation resources in the UK and beyond.



Heather being replaced by wavy hair grass. Photo supplied by Natural England.

Today wetlands, such as wet grassland and peatlands, and some other habitats are especially vulnerable to the impact of N, while there is an even longer recorded history of the impact of S deposition on fresh waters (see H2O issue 8). However, although there is convincing evidence of nitrogen deposition impacts on (semi-) natural habitats across Europe, there is also a high spatial variability in the magnitude of nitrogen deposition and its impacts on the Natura 2000 network.

The latest scientific evidence provides a clear picture of the scale of the threat from nitrogen deposition. It demonstrates the different effects caused by the various forms of reactive nitrogen compounds. It supports and strengthens the use of "critical loads" and critical levels as effects thresholds at the European and site levels. A critical load is a threshold, set by scientists, below which there should be no harm to the ecosystem.

The JNCC lead analysis is the largest of its kind and examines four widespread habitats - calcareous and acid grasslands, heathlands, and bogs. Each habitat was assessed for evidence of vegetation change caused by nitrogen deposition. This study also provides another good example of how data from a range of sources can be collated and analysed (see editorial) to inform future policy. Data was used from the **Vascular Plant Database, Botanical Society of the British Isles Local Change Survey, British Bryological Society, British Lichen Society, Plantlife Common Plant Survey** and three country grassland datasets (including Wales) were used to support the analysis.

A significant response in 91 plant and lichen species and other ecosystem properties indicate changes in ecosystem structure and function at a national

scale. Species that showed decline included the Biodiversity Action Priority species Annual Knawel (*Scleranthus annua*), three species/species groups protected under the Habitats Directive and many positive indicator species for condition of protected sites. The results confirm that species are being impacted once the nitrogen 'critical load' is exceeded. For some species in acid and calcareous grasslands and heathlands, changes are even being seen below the set critical load.

The JNCC study highlights the serious challenge of nitrogen deposition and its implications for meeting the UK's conservation commitments.

The challenge also applies to other European countries, with more than 60% of the European Union's Natura 2000 sites subject to aerial nitrogen pollution inputs above sustainable levels. Many Annex 1 habitats are naturally adapted to low nitrogen supply, so that fertilization with nitrogen compounds from the atmosphere alters the natural ecological balance. This results in the loss of the most sensitive species, which are often a priority for protection, and their replacement by invasive species that prefer higher rates of nitrogen supply. In addition, the evidence also points to a net loss in the overall number of species.

Alongside the analysis of UK vegetation data, JNCC organised a European workshop on Nitrogen Deposition and Natura 2000, in collaboration with the **Stockholm Environment Institute and Centre for Ecology & Hydrology**. The workshop brought scientists, policymakers and conservation practitioners together to review new science of nitrogen deposition on biodiversity, and to compare approaches to assessing nitrogen impacts in relation to the requirements of the Habitats Directive. The proceedings, including best practice recommendations, have recently been published, and a summary leaflet is available on the JNCC website.

The findings of this study also have future research and policy development implications. Existing legislation controlling emissions to the air of reactive nitrogen compounds does not adequately, or systematically address the impacts of nitrogen on the Natura 2000 network, or the wider objectives of the Habitats Directive. A common approach to assessing nitrogen deposition impacts on individual Natura 2000 sites, and on the conservation status of habitats and species, is urgently needed to provide reliable information on the stock at risk, evidence of recovery, and potential for restoration. There is a need to standardise approaches for nitrogen impact assessment, building on established methods such as critical loads, for the 2013 reporting round under Article 17 of the Habitats Directive. Further reductions in nitrogen emissions are required to reduce their adverse impacts on the Natura 2000 network, supporting the case for more ambitious commitments in revision of the Gothenburg Protocol and National Emissions Ceilings Directive.

To conclude policy options that require further consideration are the strengthening of existing legislation and its implementation (such as opportunities within the Common Agricultural Policy for reducing nitrogen impacts on the habitats and species listed under the Habitats Directive). Also there is potential for the development of spatial planning policies linking nitrogen and Natura 2000 and establishing a limit value for ammonia applicable over Natura 2000 sites. Finally we need to think about incorporating the concept of ecosystem services into assessment techniques. Although this might be challenging for nitrogen which can increase timber production and thereby promote carbon storage, but its detrimental impact on biodiversity is demonstrated by this study.



Birch tree covered in algal slime near Moninea Bog, N.Ire. Photo supplied by Mark Sutton, CEH.

Contact: Khalid Aazem
k.aazem@ccw.gov.uk
or Simon Bareham
s.bareham@ccw.gov.uk

Read more about N on the JNCC website: <http://jncc.defra.gov.uk/page-5910>

W.K. Hicks, C.P. Whitfield, W.J. Bealey and M.A. Sutton (eds.) (2011) *Nitrogen Deposition and Natura 2000: Science & practice in determining environmental impacts*. COST729/Nine/ESF/CCW/JNCC/SEI Workshop Proceedings, published by COST. Available at: <http://cost729.ceh.ac.uk/n2kworkshop>

Maes y Ffynnon,
Penrhosgarnedd,
Bangor, Gwynedd,
LL57 2DW

Phone: 0845 1306 229



Cyngor Cefn Gwlad Cymru
Countryside Council for Wales



Noddir gan
Lywodraeth Cymru
Sponsored by
Welsh Government

H₂O Editors: Catherine Duigan
(c.duigan@ccw.gov.uk), Rhian Thomas
(rh.thomas@ccw.gov.uk) & G. Cunningham
(g.cunningham@ccw.gov.uk)

Marine and Freshwater Ecosystems Group

New

Following an internal restructuring exercise the former Marine and Freshwater Sciences Group has transformed into the Marine and Freshwater Ecosystems Group, with the addition of marine management, ornithological and coastal ecology specialists.

This new group will bring together CCW's science and wider evidence and advisory base on marine, coastal and freshwater ecosystems so that they are safeguarded, used sustainably, and support social and economic well-being.

This group will also provide the marine and freshwater evidence base for the Natural Environment Framework.

Head of the Marine & Freshwater Ecosystems Group:
Dr. Catherine Duigan (c.duigan@ccw.gov.uk)

Deputy Head of the Marine & Freshwater Ecosystems Group: Dr. Kirsten Ramsay (k.ramsay@ccw.gov.uk) /
Gabrielle Wyn (g.wyn@ccw.gov.uk).

New

Editor's Notes

This newsletter can be downloaded from the marine and freshwater habitats pages of the CCW website:
<http://www.ccw.gov.uk>

Feedback on content and suggestions for future issues welcome.

A collection of back issues of H₂O is available on Ffynnon within CCW.

H₂O Production: Catherine
Duigan & Clare Somerville

TheWelshView—the blog of the Countryside Council for Wales

To celebrate our organisation's 20th birthday, Catherine Duigan looks back at the past two decades and recalls the fight against Acid Rain in the 90's, and the ongoing battle against the acidification of our waters into this new century...An Acid Reign—20 years at CCW: <http://thewelshview.co.uk/an-acid-reign-%e2%80%9320-years-at-ccw/>

Staff Profile— Emmer Litt, Marine & Coastal Physical Scientist, Marine & Freshwater Ecosystems Group

With a mother as an archaeologist, early life was spent travelling around and explaining my name wherever I went, (Emmer = the first wheat plant cultivated by man which is pest resistant, and no, it doesn't always work!). We settled in **Weymouth** for my schooling and it was there I got a deep sense of fun out of the sea... sailing, beach life-guarding, canoeing, and anything that meant I was outside with my friends. After school I moved to **Devon** to study outdoor leisure where, in my summers, I worked in the Ardeche in France for two seasons as a canoeing instructor and Greece for one summer as a sailing instructor, living on a 32ft yacht... I wonder why I left sometimes!!

After Greece and 3 years of college, I went to work in Lancaster as an Outdoor Education Instructor, before moving to **Ambleside** for a year. In Ambleside, I worked in a shop *Fat Face* (when there were only 19 stores in the whole of the UK!) during the day and a pub at night, in my hours break between the two jobs, I watched *Seaquest DSV*... that Star Trek like programme with Darwin the talking dolphin... anyway, this was where my inspiration came from to study Ocean Science!



Emmer Litt. Photo by N. Rimington © CCW.

Having not studied A-levels, I went to Plymouth University to do an access course. However missing the quiet(ish) life, I transferred my degree to Bangor University and changed to Geological Oceanography.

Coming from a non-academic background, I surprised myself by getting the top ocean sciences degree and was offered a funded

Masters. With nothing else springing to mind and a chance to stay a student, I thought this was a great idea but choose to change tack slightly and move into the Physical Oceanography world, much harder than imagined! For my thesis I looked at *The effect of tidal stream turbines on non-localised morphodynamics*, based in the Bristol Channel. Of course not wanting to make life easy, I changed tack again for my PhD and looked at the *Variability of CO₂ fluxes in two contrasting shelf sea regimes on the NW European Shelf*. The PhD was a

joint project between **Plymouth Marine Laboratory (PML)** and **Bangor University**, so I have spent the last 4 years moving backwards and forwards between the two, but I've met some fantastic people and have some good links within PML and the Marine Biological Association, and philosophically have completed an educational circle!

When it came to career decisions, it was a tough one. I knew, after my brief spell travelling, that ultimately I wanted to settle in North Wales but how I was going to achieve this, I wasn't sure? I was doing some temporary work for **SEACAMS** after my PhD and was having a crisis half hour looking at job pages when I saw this perfect job advertised to join CCW. After that, the decision wasn't hard at all! It's going to be a steep learning curve, but I'm really looking forward to getting stuck in and having the chance to put all those years of studying marine science into practise. When not at work, you'll find me playing in the mountains and volunteering for the Search and Rescue Dog Association.

Contact: Emmer Litt
(e.litt@ccw.gov.uk)

You can nominate a watery colleague to appear here by contacting the editors