

David Sims, based at the Marine Biological Association in Plymouth and a professor at the University of Southampton describes using electronic tags to reveal shark responses to environmental change



MBA movement ecology of marine predators research group. R to L: Nick Humphries, Freya Womersley, Alex Loveridge, Matt Waller, Emily Southall, Vicky Neild, David Sims.

Sharks are important predators in marine ecosystems but many aspects of their behaviour, habitats and ecology remain enigmatic. The principal reason for this, and particularly for large pelagic sharks, is that they are very difficult to study in their undersea world far from land. Only in the last couple of decades have advances in remote tracking technologies allowed biologists to follow

individual sharks for long enough to monitor movements, behaviour, physiology and environment to help tackle basic questions such as where do sharks go, what are they doing when there, and why are they doing it? Over the last decade the need for answers to these fundamental questions have gathered momentum as it became increasingly clear that many sharks have dramatically declined in

abundance due to anthropogenic impacts such as overfishing.

Work in my research group over the last 25 years, mostly based at the Marine Biological Association (MBA) Laboratory in Plymouth UK, has been focused on shark movement ecology, finding out the patterns, mechanisms, causes and consequences of movements in response to environmental changes and

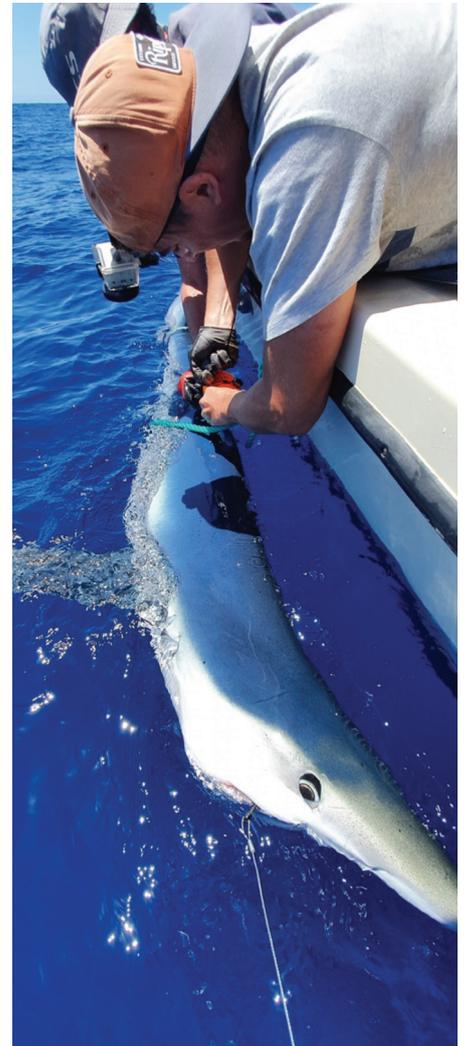


Basking shark *Cetorhinus maximus*. Photo by Jeremy Stafford-Deitsch with permission

human threats. The timing of starting my own group in the late-1990s (first at the universities of Plymouth and Aberdeen then the MBA) was particularly fortuitous as it occurred at a time when miniaturised electronic tags first became available that were capable of recording pressure (depth), temperature and light level and then relaying these data via satellites. This provided the first means to track the long-term, three-dimensional movements and behaviour of highly migratory sharks such as basking, blue and shortfin mako sharks over weeks, months and years. The tag data were used to reconstruct horizontal movements, which together with depth use patterns, were then integrated with *in situ* and remotely-sensed environmental data or with zooplankton maps from the MBA Continuous Plankton Recorder survey (www.cprsurvey.org) to reveal persistence of foraging areas, site fidelity, and drivers of migratory routes. Proving their worth, the new data and results were included in international proposals for conservation. For example, evidence for area fidelity and the crossing of international boundaries by the endangered basking shark contributed to successful listings on Appendix II of CITES (Convention on

International Trade in Endangered Species) in 2003 and of CMS (Convention for Conservation of Migratory Species) in 2005. The tags also enabled us to undertake shark ‘experimental biology at sea’, research which led to new insights of, for example, the foraging responses of basking sharks to prey gradients (*Nature* **393**, 460-464; 1998) and the scaling laws of predator search behaviour (*Nature* **451**, 1098-1102; 2008 & *Nature* **465**, 1066-1069; 2010).

It also became evident that satellite tracking data were valuable as a fishery-independent means to identify fine-scale occurrence and space use patterns of sharks, including commercially important species, up to ocean-basin and global scales. Working with Dr Nuno Queiroz (Universidade do Porto, Portugal) and Dr Nicolas Humphries (MBA), and with collaborators from the universities of the Azores and Miami, we quantified the spatial overlap between over 100 satellite-tagged North Atlantic blue and shortfin mako sharks with hundreds of Vessel Monitoring System (VMS) satellite-tracked longline fishing vessels. We found high overlap between shark space-use hotspots and longliners; habitat selection models confirmed fishers were



DO-logging tag being attached to a blue shark *Prionace glauca*. Photo by Nuno Queiroz

occupying similar habitats to those of blue and mako sharks almost year-round, overlap patterns which were also persistent between years (*PNAS* **113**, 1582-1587; 2016). This raised the prospect that open-ocean shark hotspots were at risk of being overfished.

To extend the idea from the Atlantic to a global analysis, we initiated the Global Shark Movement Project (GSMP) (www.globalsharkmovement.org) in 2016. We appealed to our colleagues in the shark-tracking research community for additional tracking data and were overwhelmed by the positive responses we received. By late 2016 we had formed collaborations with over 40 research groups in 26 countries and by mid-2017 with all data assembled we began analysis of nearly 2,000 pelagic



Shortfin mako shark *Isurus oxyrinchus*. Photo by Nuno Queiroz

shark satellite tracks from 23 species, environmental data, and fishing vessel activity data from collaborators at the Global Fishing Watch (www.globalfishingwatch.org). The environmental modelling undertaken by GSMP member Dr Ana Sequeira (then at the University of Western Australia, now at the Australian National University) showed global density distributions of sharks and longliners were best explained by the same environmental drivers, namely habitat types characterized by surface and subsurface temperature gradients (fronts and thermoclines) and high primary productivity. As a result, globally, there was a 24% spatial overlap per month of sharks and longliners, and up to 76% for blue shark (*Nature* **572**, 461-466; 2019). Shark hotspots were also associated with significant increases in fishing effort, with fishing-induced mortality of pelagic sharks higher where overlap (exposure risk) was greater (*Nature* **595**, E8-E16; 2021). Collectively, the findings suggest pelagic shark hotspots remain at risk, especially in High Seas areas where there is weaker management than in national jurisdictions, and where the non- or underreporting of catches of threatened sharks remain a serious problem (*Biol. Conserv.* **269**, 109534; 2021).

Collecting ever increasing volumes of shark tracking data will continue to improve our picture of distributions and essential habitats that will become of increasing value in aiding management. However it is the new challenges of trying to understand how pelagic sharks will respond to climate warming and ocean deoxygenation and how, in turn, this may alter their vulnerability to fishing which has led the Porto and MBA teams to develop our own tags.

The ocean is losing oxygen, about 2% since 1960, as a result of ocean warming from human-driven activities and amplified by increased stratification, reduced ventilation at depth, and increased microbial respiration. Indeed, open-ocean, mesopelagic hypoxic zones (oxygen minimum zones) are expanding and there are concerns this may alter fish behaviour and distributions primarily through reducing habitable space (so-called ‘habitat compression’). However, the effects on high oxygen demand predators such as pelagic sharks remain unknown because responses to encountered dissolved oxygen (DO) have yet to be measured directly.

Over the last 18 months as part of a European Research Council (ERC) Advanced Grant, new bio-logging tags have been developed with Nuno Queiroz and Bruno

Loureiro at Electric Blue CRL. These shark-attached tags record DO, depth, temperature, but also compass heading, speed and, with a tri-axial accelerometer, fine-scale body movements that can provide proxies for activity levels and potentially energy expenditure. A second version even incorporates a 4-cm long video camera for recording prey encounters. With these new tags we can test the habitat compression hypothesis directly.

Our initial results from tracking blue sharks migrating to the Eastern Tropical Atlantic (ETA) OMZ off west Africa demonstrate that maximum daily dive depths become shallower as DO at depth decreases, but also that sharks chose deeper depths as surface temperatures increase (*eLife* **10**, 62508; 2021). This combined effect reduced blue shark vertical extent that was consistent with habitat compression. A key question then became, does reduced habitat act to elevate fishery catches in the region? When we mapped where blue sharks were caught by longliners in both the OMZ and adjacent regions, it was striking that catches peaked in the OMZ areas where DO declined sharpest. It appears that blue sharks were literally ‘caught in the middle’ between warmer surface waters and hypoxia at depth.

This year, the MBA team of Nick Humphries, Matthew Waller, Freya Womersley, Emily Southall and I will be working with researchers at Porto (Nuno Queiroz, Ivo da Costa, Marisa Vedor, Gonzalo Mucientes) and Prof Evandro Lopes, Gilles Soro and Tolulope Oyikeke from the Universidade Técnica do Atlântico in Cabo Verde to deploy DO-logging tags on shortfin mako sharks in the OMZ, to see how a high speed shark balances warm and hypoxic habitats. We hope the tags will give us a shark’s eye view of their responses to climate-driven ocean changes.

The Journal of Fish Biology is supporting tree planting

As members will know FSBI ceased offering a hardcopy of the *Journal of Fish Biology* to members. Those who have signed up for journal access will still be able to get electronic access. This follows a global trend moving to electronic access only. In the case of our journal, of the approximately 7500 institutions that pay for access to the *Journal of Fish Biology* in 2021 only 3 subscribed to the printed version. Those print subscriptions are likely to be withdrawn in the next year or so.

The publishers the journal, Wiley, has entered an initiative with “Trees for the Future” where they have committed to plant a tree for every hardcopy of the journal that isn’t printed. This initiative helps farmers from Sub-Saharan to plant trees and shrubs that bring local environmental and economic benefit. By the end of last year *JFB* subscribers had contributed to the planting of c. 2500 trees.

You can find out more about this initiative at: [https://](https://www.wiley.com/network/societyleaders/latest-content/new-go-green-fund-reduces-print-environmental-impact-and-supports-reforestation)

www.wiley.com/network/societyleaders/latest-content/new-go-green-fund-reduces-print-environmental-impact-and-supports-reforestation

Editorial

After isolating for just over two years, April and May has seen me make two excursions, one involving a 250 miles journey and two days away and the other only a few miles away but to attend a funeral with about 100 attendees. Ironically it was at the latter that I picked up Covid-19 which has delayed by a few days the production of this newsletter. Fortunately, I have not suffered seriously from the illness. The funeral theme is in keeping with the sudden plethora of death announcements that have characterised this and the last issue. The theme of death also underlies the two main articles in this issue by David Sims and by Anne Gro Salvanes. The warming oceans mean a reduction in oxygen levels which is having serious consequences for fish and other marine life. The two articles describe work being done to understand better how low oxygen levels will influence marine ecosystems or parts of them.

Living a long life comes with the inevitable loss of contemporaries as one ages. The same can be said of the Society. It was founded by mostly middle aged to old men so they fell away in the early years of the Society but there were some who were still in their youth when the FSBI came on the scene. Jimmy Chubb was one such person although in the 1960s when I was an undergraduate at Liverpool he did not seem a younger person although he was in fact only 9 years older than me and my fellow students. As described in both their obituaries, Geoff Parker and Willie Yeomans, Jimmy was a very controlled and formal man who gave the impression of taking life very seriously. It is interesting to read that he was a native of Liverpool. Although his manner of speaking was not strongly Liverpudlian he did pronounce some words in ways that made it possible for a student to pretend they did not understand what he was saying. Although

intended to get a rise, Jimmy never did respond in the manner hoped for and continued to be polite and correct.

Jimmy was of course the first editor of the *Journal of Fish Biology*, persuaded to take the job I presume by his ex-PhD supervisor, Jack Jones. This is another fact of Jimmy’s life I did not know, that we shared PhD supervisors, although in Jones’ case the supervision was light to say the least. The journal was much smaller then and the job not so gargantuan as it now is. Geoff Potts is another recent departure of an FSBI member who was young when the society started. He played a less central role in the activities of the FSBI but still contributed to Council and ran a conference.

We mourn them both.

Paul J B Hart
Leicester, May 2022
Next deadline: 1st August 2022

Editor in Chief's Report

The next cohort

One of the advantages of being the Editor in Chief is that you get the satisfaction of recognising excellence. Hence it is with considerable pleasure that I was able to convene the selection process for the first award of the Huntingford Medal. The medal celebrates the best paper published by an early career researcher. Naturally I cannot reveal the successful medallist in my report, but I thought I would share some of the process. Importantly we had 35 applications for the 2022 award

(based on papers published or in press in 2021). The papers were scrutinised by 12 members of the board. Each board member nominated their top 9 papers in rank order. The compiled results were then scrutinised by a further 6 members of the board, with a final adjudication undertaken by myself, Felicity Huntingford and Colin Adams, and the adjudication was ratified by Council. As you will appreciate, a lot of effort and consideration has gone into the evaluation. Hence the winner and commended papers can be truly proud of their achievement. It also occurred to me that this is a superb

way to recruit rising stars, hence our winner will join the board in due course and has been invited to write an opinion piece on a topical subject. Medals might seem trivial to some, but I know how much they mean when you are an early career researcher, and every boost we can give to ECRs has to be a good thing. On a personal note, it was a true privilege to be able to do the final assessment with Felicity Huntingford who was so supportive of myself and so many other ECRs at different points in our careers.

Anne Gro Salvanes outlines a new project on *The effects of hypoxia on fish in west Norwegian fjords: harnessing the power of multidisciplinary studies (HypOnFjordFish)*

The project is a multidisciplinary research program that uses West Norwegian fjords as natural infrastructure to generate new knowledge on the effects of oxygen loss on mesopelagic and demersal fish communities. Such information is needed to sustainably manage marine resources, and to select optimal coastal and fjord sites for fish farming. Fish farming represents one of Norway's largest, and most successful industries.

The project builds on student-

active research during an annual graduate field course in Marine Ecological Field Methods, which every September takes students on annual research visits to Masfjorden and other neighboring fjords onboard the research ship *G. O. Sars* (see picture). Repeated visits to Masfjorden since 2011 led to the serendipitous discovery of the loss of oxygen from the basin water of the fjord, and that the fjord turned hypoxic in 2016. The oxygen loss is linked to warming of the North Atlantic which has

lowered the frequency of deep-water renewal of the basin water of west Norwegian fjords (Aksnes et al. 2019). The findings generated new research questions that the Research Council of Norway found valid for 4-year funding. The funding allows 4-year salaries for two PhD students and one Post doc researcher, and also for many one-year MSc research projects.

Deoxygenation linked to ocean warming is a large and growing concern worldwide. Loss of oxygen has been observed in the open ocean, in coastal waters, enclosed seas and in fjords (Pitcher et al 2021). In coastal areas, excess nutrient inputs, including from fish farms, can exacerbate climate change-driven deoxygenation. More information is needed on how oxygen loss affects marine ecosystems. HypOnFjordFish aims to improve our understanding



of the effects of hypoxia on fish physiology, growth, behaviour, and community ecology.

While studying these questions in open oceanic ecosystems can be challenging, West Norwegian fjords offer unique semi-enclosed systems. Fjords differ in their state of oxygenation due to differences in their bottom topography and sill depths. As such, their gradients of hypoxia are tractable for study and provide natural parallels with open ocean gradients. Each fjord contains an ecosystem with many physical and biological processes similar and relevant to those of large oceanic ecosystems.

HypOnFjordFish focuses on several fjords with different states of oxygenation. One site, Masfjorden (picture), has



repeatedly been sampled over the years, and it is documented that this fjord turned hypoxic in

2016. We have unique data from before and after 2016, enabling the study of deoxygenation effects on this well-documented ecosystem. Masfjorden will serve as a comparison with other fjords, including Fensfjorden (well oxygenated), Osterfjorden (intermediate oxygen depletion), and Sørffjorden (concern of becoming hypoxic).

HypOnFjordFish will employ innovative and multidisciplinary research techniques. In addition to the use of acoustics and multiple net-based sampling methods, we will use advanced technology to examine if trace-element deposition in ear stones from a long-lived deep-water fish provide information about previous periods of low oxygen levels in the fjords. We will also attempt to establish laboratory populations for two mesopelagic species for studies of physiology and growth.

The project will provide new knowledge on how fish physiologically and behaviourally respond to hypoxia and how this affects populations, trophic interactions, and production in fjord ecosystems. The research objectives are split into 4 primary

work programs as shown in the accompanying figure.

Our web page is: <https://hyponfjordfish.w.uib.no/>

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HypOnFjordFish

Aim to generate new knowledge on the effects of hypoxia on mesopelagic and demersal fish communities.

hyponfjordfish.w.uib.no

UNIVERSITY OF BERGEN

The Research Council of Norway

DOES FJORD OXYGEN ENVIRONMENT INFLUENCE [...]

WP 1: vertical distribution of fish?

Hydroacoustics (echosounders) can be used to investigate fish vertical distribution and behaviour.

WP4: species composition and feeding relationships between organisms?

WP2: metabolism and growth of fish?

WP3: microchemistry of fish ear stones?

Ear stones (otoliths) can give information about fish age and growth, but also surrounding environmental variables (such as e.g. oxygen) throughout the fish' life.

The Fishing Industry Request Scientific Support

Fishing is an important source of employment and revenue for UK coastal communities and an export commodity. Yet, fisheries face challenges to sustainability, particularly for species historically managed on a non-quota basis (“Non-Quota Stocks”, NQS). In the face of reducing resources and a growing need for evidence in fisheries management, new information and a more strategic approach to collecting fisheries data and conducting fisheries science is necessary.

Industry, scientists and government all have unique contributions to make to fisheries research. However, a siloed approach to developing fisheries science has typically prevailed. It is now widely acknowledged that drawing upon the expertise and knowledge of stakeholders through ‘collaborative research’ can enhance research capacity, close important knowledge gaps and solve persistent and emerging problems in fisheries. Engaging with fishers from the beginning, as opposed to the more conventional practice of scientists asking fishers to participate, can also help to increase ownership of problems and cooperation to support sustainable fisheries management.

The realities of developing and implementing a collaborative or ‘co-management’ approach is, however, highly complex. Fishers face organisational and financial challenges to participate in science, and often the funding model is stacked against them. This is particularly so for the small-scale fishing fleet (vessel length <10m), as these fishers tend to be independent, owner-operators and exist outside institutional entities (i.e., producer organisations, trade groups and even fishing associations). Subsequently, challenges remain in linking stakeholders in a coordinated and strategic way.

Creation of FISP Network

Defra’s desire to support collaborative research was evident in the brief of their £10m Fisheries Industry Science Partnership grant scheme. Funding was conditional upon having a strong commitment and active involvement of industry in all stages of the study, from development of the proposal to use of the research results. However, it was recognised across the fishing industry that there was a disconnect between requesting collaboration and enabling it.

The FISP Network, comprised of three fishing charities – Fishing Animateurs, Fishing into the Future and the Fishmongers’ Company’s Fisheries Charitable Trust - was set up in response to the industry’s concerns. An important goal from the onset was to incentivise and re-establish applied research in support of fisheries management objectives. It aimed to do this by giving the industry a voice, forging closer partnerships with scientists, and enabling industry priorities, that are pertinent to sustainable fisheries, a fair and equal opportunity to be developed and funded.

FISP Scheme

The Fisheries Industry Science Partnership (FISP) scheme seeks to:

- improve data collection, particularly for data limited species;
- enhance knowledge of technical measures including fishing gear selectivity, and/or;
- build a better understanding of the ecosystem benefits and environmental impacts of aquaculture.

To develop a unified proposal, Part A of the FISP scheme provides funds to build consensus amongst scientists and industry to develop a study methodology. Whilst Part B of the FISP scheme funds fully-developed, scientific

proposals. Grants up to £20,000 are available to develop research proposals (Part A), and contracts up to £300,000 are available to carry out a full research project (Part B). The FISP Network is a competitive process managed by Defra. The FISP Network does not have any influence over the grants awarded or any formal relationship with Defra, Marine Management Organisation or any other body.

Process

To gather the industry’s ideas, the FISP Network did an extensive online campaign, featuring videos, podcasts and social media posts. In early 2022, funded by Defra, the Fishing Animateurs conducted a UK-wide tour of fishing ports and harbours advertising the FISP scheme and FISP Network. The Fishing Animateurs, who work with the UK’s small-scale fishing fleet to support the development of projects that are eligible for government funding, had already established a strong working relationship with the sector. This trust encouraged the industry to come forward with their research ideas.

After a study had been identified, the FISP Network coordinated and disseminated information between industry and scientists. Workshops, facilitated by the charity, Fishing into the Future, were also on offer to help develop ideas further, whilst The Fishmongers’ Company’s Fisheries Charitable Trust offered matched-funding for bids nurtured through the FISP network and approved under the FISP scheme.

Case Studies

IMPROVING PRAWN FISHING SELECTIVITY

A prawn fisherman in Scotland was looking to reduce the bycatch of whitefish, whilst otter trawling for prawns. He found that using

coverless trawls improved the selectivity of his gear. He wanted to do a gear trial to better understand the impact of this method.

KING CRAB FISHERY IN BRIDLINGTON

A crab and lobster fisherman off the Bridlington coast wanted to look at the viability of a new fishery in the area. Fishermen were noticing more deep-water king crab / stone crabs being caught, possibly due to changes in water temperature. They wanted to do research on stock assessments, trialling new fishing areas and gear, and on understanding the population of these species.

NEW FISHERY IN MALLAIG
Fishermen in Mallaig with 40 years of experience in the industry wanted to understand more about whether sprat, squid and/or herring could be viable fisheries off the coast of Mallaig, west Scotland.

Most fishermen in Mallaig target prawns using trawling methods. Fishermen in the area have noticed the prawn season reducing year on year, despite fishing intensity reducing. If prawn stocks fail, the Mallaig fleet has no quota to fall back on and there would be a collapse of industry.

These skippers have noticed sprat, squid and herring in the area and would like to understand

whether these are viable and sustainable fisheries for the fleet to target alongside prawns. In order to understand more about the fishery, more data needs to be collected. Studies of interest could include trailing new fishing grounds and gear, stock assessments and, understanding life cycles.

For further information on the projects proposed by industry and to learn how you might support the development of these scientific studies, please contact the Fishing Animateurs.

Call: 01736 362782 or 07534580450

Email: fishing@cornwallrcc.org.uk



Freya Cohen



Imogen Smith-Devey



Rob Poole

[Fishing into the Future and of course the Fishmonger's Company are well known to me and no doubt to many others but Fishing Animateurs are not. The term 'animateur' is also strange to me but it means 'a person who enlivens or encourages something'. If the word 'animateur' is looked up online the words appears to be generally used in the arts but its use by this group is clearly appropriate. Ed.]

Inside the FSBI

Check out the latest instalment of our 'Inside the FSBI' series where we hear from Dr Emil Christensen, FSBI member and awardee of an FSBI Small Research Grant. Emil, who is based at Glasgow University's Institute of Biodiversity Animal Health & Comparative Medicine, tells us more about the FSBI funded research into temperature choices of

rainbow trout, and its relevance for climate change.

Like and subscribe to our YouTube channel for more videos delving into the world of fish and fisheries. If you are an FSBI member involved in work that contributes to the aims of the Society, and you would like to feature in the series, please get in touch: perryw1@cardiff.ac.uk



Reporting deaths of more prominent fish biologists

The last issue had obituaries for two fish biologists, Sarah Kraak and Jeffrey Hutchings, who died before their time. As we all know ‘in the midst of life we are in death’ but in my time as editor of this newsletter, I have not had to record so many deaths in such a short time. In this I report the deaths of Jimmy Chubb who was the first editor of the *Journal of Fish Biology* and of Geoff W Potts who was a council member and organiser with Robert Wootton of the 1982 summer symposium on fish reproductive strategies in Plymouth. As his obituary will outline, Geoff was many other things besides.

First, two of Jimmy Chubb’s colleagues and friends, Geoff Parker and Willie Yeomans give their perspective on Jimmy’s life and work.

Jimmy Chubb, the consummate academic

Geoff Parker, Emeritus Professor, University of Liverpool



Jimmy Chubb, a pioneer of the ecology of freshwater fish parasites, sadly died on 25th March, 2022, age 86, after a research career spanning some 65 years. Born in Liverpool, the son of a ship’s captain, the family moved to West Kirby, Wirral, where Jimmy became a good friend of the naturalist Norman Ellison: ‘Nomad’ of the BBC. He remained in West Kirby throughout his life, serving for many years there as a Scout Leader, and marrying Elaine (deceased 2016), with whom he had two children, Fiona (now a general practitioner) and Robin (who now runs his own business).

A devotee of natural history as a boy, it was unsurprising that Jimmy entered his home university (Liverpool) to study Zoology in 1954. Interest in parasites showed early on. In the summer before his final undergraduate year, while helping with a plant survey at Port Erin, Isle of Man (where Liverpool had a marine station), Jimmy found a 6-foot porpoise dead on the beach. He decided to take it back to Liverpool for dissection, to examine it for cestode parasites. He injected it liberally with formalin, strapped it to a board, and with Mike Pugh-Thomas (a fellow student; later an academic at Salford), carried it (one at each end of the board) onto the ferry, and off again to the car of Mike’s father, to the mystified horror of onlookers. (Willie Yeomans reports that Jimmy found no cestodes in the porpoise. *Ed*).

After graduating in 1957, Jimmy began a Ph.D. under the supervision of the well-known freshwater fish biologist, Jack W. Jones. Academia was then very different. Jack banned his postgraduates from talking to other members of staff, but Jimmy particularly needed to discuss his work with Noel Hines (a well-known freshwater biologist) whose office lay beyond Jack’s office; Jimmy had to creep past – with great care – to avoid detection. Two years into his postgraduate research Jack Jones asked him to apply for an Assistant Lectureship; he was successful, and so joined the Zoology staff in 1959. He obtained his Ph.D. in 1961; it had begun as a study of eel biology, but as eels were difficult to find, he suggested switching to the ecology of parasites of freshwater fish, which had attracted his interest. This proved to be a very sound move; it secured his status as one of the pioneers of an emerging field in parasitology, and one that continued to expand rapidly for the next two decades. An excellent lecturer, Jimmy became synonymous with ‘parasitology’ at Liverpool, teaching generations of students on his parasitology course, and supervising countless final year and Ph.D. students until his retirement in 2003.

Throughout most of his long career, Jimmy’s research focused on the ecology and biology of parasites

of freshwater fish. His field work centred on Llyn Tegid, the lake at Bala, N. Wales, where for some three decades, Liverpool Zoology Department maintained a field laboratory. The legendary Bala lab functioned as the research hub for Ph.D. students supervised by Jimmy, Jack Jones and the other Liverpool freshwater biologists. Jimmy recounted many epic tales, such as the workshop technician plaintively calling for help, submerged beneath an upturned fibre glass boat, and the wet-suited Jack Jones, after stressing the importance of getting down to depth, ‘demonstrating’ sub-aqua techniques, but with his bottom sticking up out of the water. As the Bala parasitologist, Jimmy had a unique role and was held in high regard. His many original research publications, and his regular attendance at conferences, gained him international status, culminating in a series of four very comprehensive reviews on the seasonal occurrence of parasites of freshwater fishes (*Advances in Parasitology, 1977-1982*), which became highly regarded and widely cited. With his vast knowledge of helminth parasites, and his careful, meticulous approach, he became well known to parasitologists both in the UK and abroad, and enjoyed many collaborations.

Jimmy was one of the few academics who very successfully merged all three aspects of academic life: research, teaching and administration. His genuine interest in all three, combined with his integrity, geniality, and meticulous care in everything he did, made him quite unique; he was a skillful and diplomatic administrator. He became the first Editor of *Journal of Fish Biology* from its inception in 1969, a post he held for many years. He took on the Headship of the Liverpool Department of Zoology in its final year (1987-88). After restructuring of Liverpool’s biological departments in 1988, he continued as Head of the new Department of Environmental and Evolutionary Biology until 1990. His management style combined unflappable, patiently cooperative leadership, with great efficiency at a difficult time of rapid change for biology at Liverpool. Another ➤

major administrative role was Dean of College Studies, 1984-87, and 1992-2002. Following this, he served, with interest and commitment, on the Council of Liverpool Hope University until retiring from that post at age 80. In addition to photography (particularly wildlife), a major hobby was plants and gardens, and he served on the Management Committee of Ness Gardens and the Gardens Committee for the University.

Towards retirement, Jimmy became interested in one of my own fascinations, the evolution of complex life cycles in helminths. I had sketched a provisional theoretical approach on a flight to USA in 1983, but having little expertise in parasitology at that time, did nothing further until around 2000, when I discussed the project with Jimmy. Then followed a collaboration of over 20 years, initially involving the late Liverpool applied mathematician, Mike Ball, and Manfred Milinski and his group at Max Planck, Plön. After retirement, Jimmy and I met every Tuesday in an office in Liverpool. When departmental space became too limited to support retired staff, Tuesday meetings alternated between our two homes, often involving collaborations led by Dan Benesh in Berlin, formerly at Plön. When covid-19 prevented meeting in person, undeterred, online meetings prevailed. My last few words with Jimmy were by mobile phone three days before he died, a few days after our last joint paper with Dan had been submitted. He showed remarkable dignity and stoicism throughout his final illness. My own debt of gratitude to him is immense, as an academic colleague, research collaborator, and friend. He will be sorely missed by his son, daughter, grandchildren, friends, former colleagues, and many parasitologists around the world.

Willie Yeoman reflects on the life of Dr J.C. Chubb

Jimmy Chubb was a remarkable man. He first visited the University of Liverpool as a schoolboy, returned as an undergraduate student and never left. He was associated with the place for more than six decades and retained an Honorary position until he died recently.

Professionally, he was

probably best known in my field for his painstaking solo work on seasonality in helminth parasites of fish and for a couple of magnificent collaborative keys to tapeworms and spiny-headed worms of British freshwater fishes which were illustrated by the considerable talents of Kees Veltkamp at the Scanning Electron Microscope. He undertook the latter because he believed that most keys were 'written by experts for experts' and his contributions, published in the *Journal of Fish Biology*, have since been well-used by practitioners at all levels.

It was impossible to work on freshwater fish parasites without reading Jimmy's papers and I first came across him during my undergraduate research project, where I was trying to reproduce a three-host tapeworm lifecycle in the laboratory. Interest piqued, I was later introduced to him when he visited my former teacher, Christina Sommerville at Stirling University 'there's someone here you should meet...'

My first impression of Jimmy was that he was an absolute gentleman and this held true for the following 35 years – I never once was able to get him to pass through an open door before me!

I held a job as a fish parasitologist with the National Rivers Authority/Environment Agency for around 10 years and it was the great pleasure of my professional life to have collaborated with him on a number of ad-hoc projects. I had access to a great deal of novel material and we worked through much of it as posters presented to British Society for Parasitology conferences in the 1990s. Jimmy was a founder member and very active supporter of the BSP. His membership number was 008 and he spent 60-odd years wondering who 007 was!

Jimmy was also a founder member of the FSBI, and the first Editor of the *Journal of Fish Biology*. From its inception and for decades afterwards, the JFB had a cover which featured a great deal of red on a white background. This, he told me, was upon the advice of a contact at Academic Press, the first publisher, who advised him strongly that if he wanted the journal to be prominent on library shelves,

he needed something brighter and bolder than the dreary plain greens, greys and khakis prevalent in the late 1960s. For the same reason, when I was looking for a logo for the Clyde River Foundation in 2002, I picked a male three-spined stickleback (with a bright red breast) to stand out against our contemporaries' predominantly green or blue salmonids.

Jimmy was a quietly inspirational man. He was patient and very generous with his time, and he fostered collaborations all over the world. He had an encyclopaedic knowledge of fish parasites and of chronology – which saved us a lot of time. He was unfailingly modest – his tapeworm specimen preparations were flawless to lesser eyes, but he could 'never get them as good as the Russian workers of the 1950s and 1960s'.

My boss at the NRA, Roger Sweeting (who coincidentally had been examined by Jimmy for his doctorate) suggested I might like to take on a part-time PhD as part of my professional development and I asked Jimmy whether he would consider supervising me. We decided to develop one of his ideas from the 1970s and studied the effects of sewage in rivers on the parasite communities of sticklebacks. We had a lot of fun.

I visited Liverpool frequently from the south during the PhD gestation and realised very quickly that Jimmy was relentlessly methodical. Our meetings were always prefaced by him meeting me off the train, telling me what time we'd need to be back there the following day for the return and we'd repair to the San San for lunch before we tackled the climb up Brownlow Hill, then the climb to the top of the Derby Building where he maintained a meticulously organised office, aquarium and lab. Jimmy used to dispense wisdom gently from his desk in the centre of the room with a stuffed bittern looking over his left shoulder. We'd get the kettle on and the chocolate digestives out, and off we'd go. I would sit in the comfy chair, next to Jimmy's lecturing kit, which was a venerable supermarket wire basket containing everything he'd need for his teaching duties, and which contained not one but two spare projector bulbs!

He was literally the most

reasonable person I ever met; firm queries were frequently met with 'Well, yes and no...' followed by balanced discussion while we found a way forward. He didn't like woolly thinking and had even less time for imprecise writing – 'are you sure?' accompanied by a look over the specs!

I regret that we didn't publish more of our work and post-Phd visits to Liverpool became less frequent with changed personal circumstances. For the last 20 years of his life, though, Jimmy became part of a very learned collaboration with colleagues (latterly retired) from the University and beyond and provided parasitological input to some significant papers. The group met weekly at the University and he was also active on one day per week curating his extensive collection of parasite specimens at World Museum Liverpool. He received his final diagnosis on the day he completed his curatorial tasks.

I was privileged to be able to work with and learn from Jimmy. My abiding memories of that time are of being grateful to spend time with him and his family. He was devoted to Elaine, Fiona and Robin. So too to his garden – he was a fine horticulturist.

Jimmy Chubb was a rational and systematic man and he left us as such. I am grateful to have known him.

Geoffrey W Potts



As Geoff has left virtually no online trace, most of what I have written is from those who worked closely with him and are really my memories of time with him garnished with a few extras! Geoff was born on 15th February 1941 and died on Easter

Monday 18th April 2022.

Geoff was a tall man with a craggy face but was gentle with it. His main interest for much of his academic life was in fish behaviour and he was a pioneer in the research community for the use of scuba diving to make observations of fish in their natural habitat. I have memories of him describing to me with great enthusiasm how he had been observing the behaviour of whiting off the Plymouth breakwater. One of the main groups of fish that Geoff worked on were the wrasses and he did much to elucidate the intricacies of their mating and cleaning behaviours. Geoff was a brilliant artist and illustrated his ideas and findings with his own drawings.

It was through fish behaviour work that I came to know Geoff. When I joined Leicester University in 1976, I applied to NERC for a research grant to study pike predation. Geoff was on the committee that assessed the grant. As a result of this he contacted me and encouraged my efforts. On subsequent visits to Plymouth as an external examiner for a degree stream at the then Plymouth Polytechnic, I would call in at the MBA for a chat with Geoff. Later, when Plymouth Poly had become Plymouth University and I was again an external examiner for their fisheries degree, I was invited by Geoff to stay with him, his then wife Sally and his three sons at their house in Harrowbarrow, Callington, Cornwall.

Geoff was an active member of the FSBI and was a Council member in the mid to late 1990s. He put himself forward as President but was beaten to the vote by me! Geoff also convened together with Robert Wootton the 1982 summer symposium held at Plymouth Polytechnic. At that time, the proceedings were published as a book and Geoff and Robert edited *Fish Reproduction: Strategies and Tactics* (1984) Academic Press. Geoff also put a case for the Society to give the MBA, I think it was £5000, to assist with the improvement of the public aquarium which was housed on the ground floor for the Citadel Building where the MBA has its labs and offices. Geoff was the staff member who oversaw the running the aquarium

and he was very aware of the limitations of this Victorian construct with its small tanks and limited space.

One of Geoff's many innovations, helped by Silja Swaby, was to start an online database which was designed to include the biological characteristics and ecology of marine species with the ultimate aim of including all UK species. This was transformed by later contributors into the Marine Life Information Network or MarLin which is now a well-established and well used source of information for scientists in all countries (see <https://www.marlin.ac.uk>).

Geoff's greatest achievement was the design and creation of the National Marine Aquarium in Plymouth which has just celebrated its 20th anniversary. Geoff had the idea, and supported by the then director of the MBA, developed the design together with architects to realise a truly world class aquarium. £20million had to be raised but towards the end of the project there was a shortfall which required a bank loan to bring the project to a conclusion. Geoff had expected to be the director of his creation, which was to be more than just a set of tanks displaying marine organisms to tourists, but also a tool for education and research but the bank, had other ideas and required as a condition of the loan that the director should be someone from commerce. As a result, Geoff resigned and soon retired to Cornwall to work on fish conservation for the Countryside Council for Wales, and a host of personal projects.

If you go to the website of the NMA, Geoff isn't credited. Hopefully the NMA will finally recognise his innovative and entrepreneurial spirit by naming a hall or room after him. After all, if he had not had the idea in the first place it would not now exist. It is true that Geoff did not suffer fools gladly and was probably not good at political glad handing, but he achieved so much and deserves to be recognised for it.

Geoff will be missed by all who knew this brilliant and talented man, who did so much in helping make marine biology in the UK what it is today.

Paul J B Hart



2024 World Fisheries Congress to be Held in Seattle, USA

The World Council of Fisheries Society has voted to hold the 2024 World Fisheries Congress (WFC) in Seattle, Washington, USA, from March 3–9, 2024. The successful bid to host the 2024 WFC was developed by the International Fisheries Section of the American Fisheries Society, who previously hosted the 2004 WFC in Vancouver, British Columbia, Canada.

Seattle, located in the Pacific Northwest of the United State, is a world-class city with easy global travel access and many wonderful attractions. The city is also at the center of internationally important marine and anadromous fisheries, and has deep cultural, academic, and socioeconomic ties to fish and fisheries.

The theme of the 2024 WFC will be “Fish and Fisheries at the Nexus of the Food, Water, and Energy Debate.” The goal of the 2024 WFC will be to focus on current and emerging impacts on the world’s fish and fisheries and examine how

society can successfully develop approaches that allow our marine and freshwater systems to provide sustainable fish and fisheries into the future.

Invitation to a symposium on Biodiversity across the Aquatic-Terrestrial Boundary: Rivers and their Riparian Zones

From Jeff Marker and Jacqueline Hoppenreijns, both at Karlstad University, Sweden.

If you’re interested in aquatic environments and their inhabitants, Prague is the place to be this summer! They are the central topic of the symposium presented by researchers from Karlstad University, Sweden, titled, *Biodiversity across the Aquatic-Terrestrial Boundary: Rivers and their Riparian Zones*, as part of the European Congress of Conservation Biology (ECCB) that will take place from 22 to 26 August.

You are warmly invited to join us and meet a wide range

of speakers from Europe and Africa, led by keynote speaker and biodiversity expert, Prof. Anne Magurran. They will take us on a journey through their work on fundamental and applied conservation, aquatic and riparian restoration research, and the socio-ecological and policy aspects of freshwater and riparian biodiversity. Our speakers feature a range of expertise including soil and geomorphology researchers, riparian restoration practitioners, plankton and fish biodiversity researchers, and freshwater policy experts. We welcome an audience from those backgrounds and everything in between. We especially encourage aspiring and early-career researchers and practitioners to attend and join us for interesting discussions afterwards. Find more information about the specific symposium or the ECCB on www.eccb2022.eu.

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