fsbi
An International Society for Fish Biology
Autumn 2019

Molly Czachur, a PhD student at, Stellenbosch University, South Africa, reports on the 2019 FSBI Symposium: *Advances in eDNA-based Approaches to Fish Ecology and Management*

In July 2019, the FSBI achieved a truly captivating symposium. Researchers from across the world were brought together to share their uses of molecular tools for answering a range of questions about fish ecology and management.

We gathered in Hull, the UK's city of culture, which sits at the junction of the Humber estuary and the River Hull. This city is home to one of the UK's most historically important ports and is also home to the host of FSBI19- the University of Hull. The main symposium activities were held in the spacious Canham Turner Venue, which allowed us to explore the stunning campus in our spare time. This meeting of minds made it possible for a variety of fields to collide in a single forum and discuss the many aspects of using environmental DNA, or eDNA, for the study of fishes.

Speakers and attendees had expertise in freshwater rivers and lakes, coastal waters, the open ocean and the deep sea. Some were utilising eDNA methods for detecting single fish species, whilst others were using tools such as eDNA metabarcoding to uncover whole fish communities. The breadth of research at FSBI19 was refreshing and exciting, and we will be eagerly anticipating what emerges from this fast-paced eDNA field in the coming years.

Bernd Hänfling (2nd from right) and conference team from the University of Hull.

Stand-out stories from #FSBI19

The topics covered at FSBI19 initiated lively discussions throughout the week. This productive atmosphere was evident when participants were caught making a splash outside the symposium venue during lunchtime. We often talk about the repeatability of eDNA results, so researchers from the Bernd lab put this to the test. They collected water from nearby rivers of Hull, then filtered the water to collect eDNA (from a paddling pool!). The multiple researchers that were involved each took the filtrates back to their labs across the world for processing. This will allow them to understand more about how eDNA results can differ between labs.

CONTENTS: Editorial ... 3 Conference and Travel Reports ... 6 Notices ... 8

Sampling eDNA from local river water. Photo credit: Rita Castilho, Twitter @rcastilho_r2c2

Back in the conference venue, we heard an engaging keynote by esteemed Prof Masaki Miya. His eDNA metabarcoding methods, including the "MiFish" primers, have allowed many of us to generate our eDNA-based fish data. Prof Miya presented his teams' impressive results, including a nationwide eDNA survey of over 500 sites in Japan.

Their vision is to create a survey that is achievable on a large scale, is repeatable, and ultimately allows for continuous sampling. Hopefully, these eDNA monitoring methods could lead to a worldwide fish forecast that is delivered by data-driven results. This is an exciting notion and one that many participants are also indirectly making possible through their eDNA research, building an ever-growing understanding of how eDNA exists and persists globally.

There are inherent uncertainties when using eDNA to infer ecological answers, especially when managing fisheries. The eDNA molecules can be transported in the water, and we're still learning about how eDNA exists in the environment. Dealing with these uncertainties during management applications was the theme for this years' Jack Jones lecture delivered by Prof Chris Jerde. He highlighted the importance of preliminary experimentation when designing projects. Jerde also outlined the details that managers desire when making management decisions, and pointing out that they often still want fish data from "traditional methods" to initially support the eDNA data. We are therefore approaching a stage where we can use eDNA data for management, with additional validations needed. Jerde also described the idea of eDNA exploration, where we can use eDNA methods in areas that we can't currently monitor, which gives us previously unavailable baseline information that we can delve into further. There was a consensus that eDNA methods can provide powerful complementary data alongside existing fish monitoring methods.

Advancements in eDNA research could lead to a world of biodiversity knowledge at our fingertips, which makes it even more relevant to unwrap how eDNA exists and persists, to move us closer to this goal. The ecology of eDNA session hosted keynote speaker Dr Kristy Deiner. She urged us to consider the state of eDNA because we don't yet understand various mechanisms of eDNA, including how accessible it might be. Even when we capture eDNA, is it in a state that we can extract? Deiner stated that we do not know if seasonal detection is due to changes in species' distribution, or if it's due to the environmental context that changes the degradation and transport of eDNA seasonally. This is an important detail to unpick if we want to use eDNA-based methods in robust and routine monitoring of fish populations

Deiner was an inspiration for many of us because she brought practical questions to the forefront, adding a new dynamic to the way that we were previously talking about eDNA. Given the uncertainties, she was also optimistic that the field is maturing, which was agreed by many others in the forum who felt that we are rapidly progressing our understanding of eDNA.

The week was also rich in presentations about new methodological advancements (such as the use of CRISPR for single species detection by student prize-winner Molly-Ann Williams), advances in using eDNA metabarcoding for haplotype data (Cristoph Hahn), and the implementation of eDNA data in biomonitoring and policy (namely by keynote Didier Pont, but also by numerous other speakers). There were commercial-scale applications as presented by the likes of Kat Bruce (founder of NatureMetrics), and the potential uses of eDNA in aquaculture (by student prizewinner Toni Dwyer), and topics also covered molecular food webs (Michael Traugott) and pathogens (Hana Hartikainnen). There were presentations on standardising eDNA methods for biomonitoring (for example PISCeS in Canada).

Prof Stefano Mariani chaired the marine eDNA session, guiding us on a geographical research journey that spanned Japan, Antarctica, South Africa, the Mediterranean and more. Even in such dynamic systems as the oceans, Prof Mariani felt pleasantly surprised that the field was expanding from the important presence/absence studies towards also informing us about migrations, habitat use, reproductive behaviour, and even trophic ecology.

FSBI medals and prize winners

The presenters inspired us throughout the week. The award winners were no different, bringing a new dynamic to the symposium, and a glimpse of fish biology in a wider context.

The FSBI medal winner was Dr Shaun Killen, who despite not using eDNA methods himself found the symposium "friendly and welcoming". Dr Killen gave accounts of his fish ecophysiology studies, and ended his talk with inspiring words to address mental health issues in academia, specifically encouraging students and ECRs.

The support for young scientists continued with the Le Cren medal winner, Prof Isabelle Côté. She showed us how she engaged her students in a "fun" project over many years, whereby they compiled and analysed newspaper articles of big fish catches, and noted how fish sizes were changing in the media.

Neil Metcalfe and Shaun Killen celebrating their receipt of the Beverton and FSBI medals.

She admits that she came to the FSBI19, with its eDNA theme, as a "closeted sceptic", yet left the symposium more informed and open-minded. The main themes that Prof Côté saw during the week were that eDNA is often being used alongside traditional methods for ground-truthing and that we don't yet seem to know a lot about the processes of DNA release, dispersal and degradation. She was also surprised that one universal gene (such as COI) is not being reported for eDNA studies, but rather multiple markers are used. Overall, Prof Côté has left FSBI19 thinking that "(1) eDNA methods are going to be powerful in the future, as kinks in the method are sorted and hopefully generalities arise, and (2) they are a useful complement to conventional ecological surveys, and although the number of applications and inferences is likely to grow, they'll never completely replace observations and experiments".

The third medal to awarded at the dinner was to Neil Metcalfe who is the Beverton Medal winner for 2019. Neil achieves the distinction of being the first FSBI medal winner (1999) to show that the award to 'young and upcoming researchers' does really pick the talent. In the 20 years since he received the FSBI medal at the summer symposium in St Andews, Neil has established himself as one of the leading fish biologists of his generation and is an inspiration to all early career researchers.

The FSBI is known for their generous support for students and ECRs, which seems well-founded when seeing the high quality of student presentations at this years' symposium. Amongst these students were the following prize winners: The first prize talk winner was Molly-Ann Williams, with runners up Sachia Sasano and Cristina Di Muri, and speed talk prize winner Toni Dwyer. The first prize poster winner was Kirthana Pillay, with runner up Madalyn Cooper. A special recognition prize for science outreach was awarded to Molly Czachur.

Social events

There wasn't a dull moment at FSBI19 with all the exciting eDNA advancements. The schedule was also packed with social activities. We were welcomed on the first day with a wine reception at Brynmor Jones Library. The second day saw a pub quiz and pub crawl, followed the next day by a BBQ & lively ceilidh. We ended the week with a conference Banquet amongst the tanks of The Deep aquarium, where we ate our dinner in the company of two green sawfishes, a truly unique experience!

Molly Czachur and Owen Wangenstein meeting with Prof Masaki Miya.

Isabelle Côté accepting the LeCren Medal during the conference dinner.

Acknowledgements

Many thanks for the feedback that allowed this article to be written from multiple perspectives, including from Prof Masaki Miya, Dr Kristy Deiner, Prof Stefano Mariani, Prof Isabelle Côte, Dr Shaun Killen and Molly-Ann Williams.

Editorial

This year the Institute of Fisheries Management (IFM) celebrates 50 years since it foundation. I am sure that members of the FSBI would like to congratulate the organisation on this milestone. I think that Jack Jones was one of the people instrumental in setting up the Institute and it has always been a mystery to me as to why it was thought necessary to start the IFM, given that Jones and Tombelson had started the FSBI two years earlier. Both organisations are inheritors of the Liverpool based Coarse Fish Conferences that were run by Jones in the 1960s. The FSBI was intended to promote the science necessary for the better management of fisheries, and given the interests of both Jones and Tombleson, 'fisheries' meant freshwater fisheries although I would speculate that they did not intend to exclude marine fisheries. As the two societies have developed, the FSBI has become more the home of those working on marine fisheries and is more focussed on research whilst the IFM is now dominated by people working in the Environment Agency and is focussed on management.

In the US, the American Fisheries Society fills the two roles occupied in the UK by the FSBI and IFM. Given that the US is a large land mass, freshwater fisheries tend to dominate its interests. As does the IFM, the AFS offers professional training for people working in fisheries management. This is something the FSBI has never done which instead has gone down the route of promoting research through its PhD sponsorship programme and small research grants. I know that some members of both organisations are also members in the other but over the past fifty years there has not been a lot of interaction between the two. At one time I was a member of the Regional Fisheries Ecology and Recreational Advisory Committee of the Midlands region of the Environment Agency, during which time I was also President of the FSBI. Another committee member was Peter Bottomley who was then President of the IFM. We often talked about the two societies doing more together but nothing happened, for which I must be partly blamed.

The two organisations are each well established in their particular niche and it would take quite a major event to bring them closer together. Each fulfils its particular role excellently and may we both continue to prosper.

Paul J B Hart
Leicester, August 2019

Next deadline: 1st November 2019

Jack Perks, with financial help from the FSBI, has filmed every freshwater fish in the UK. He describes how the project started and some of the fish he has encountered

I think it's the mystery of fish that intrigues me most, that hidden nature and for most of us 'out of sight out of mind'. I've always had a fascination with the natural world and started fishing when I was 11. I then turned to photography at 16 and the perfect combination seemed to be to try and photograph fish. I looked into what other photographers had done with fish in the UK and was a little surprised to find out that many freshwater fish hadn't really been photographed before in their natural environment.

In 2013 I set up a crowd funding campaign to try and film every freshwater fish in Britain. The project was doing well but was a long way off completion until the FSBI funded the rest of it so

without the Society I'd never have been able to complete my quest. My thinking was that I'd get the 53 species in a year, but it ended up taking 7! Of course, I had issues of what constitutes a British freshwater fish? Do I only include native species? Naturalised ones? And what about marine fish that enter freshwater? In the end I used Mark Everards books as a basis for the list with one or two additions focusing on all the native species, naturalised and common non-natives along with the few marine fish that can stay in freshwater for prolonged periods.

A Zander (*Sander lucioperca*) in the River Trent, UK. Copyright: Jack Perks.

Over time I've developed my techniques from scuba diving, snorkelling, pole cams and underwater camera traps to get the images I was hoping for. In the space of the project cameras have changed massively with underwater cameras being relatively affordable now and its now far more common to see fish footage online so I knew I had to try and find the best spots possible to make my pictures stand out. I relied on the many fisheries scientists, Environment Agency staff, anglers and river keepers to be my eyes and ears. When certain species turned up I often had to leave at a moment's notice in the vain hope of finding a fish hardly anyone has ever heard of!

I travelled all over the UK from Cornwall to Northern Scotland and just about everywhere in-between! When I first started, I couldn't drive so had to get the train or beg for lifts with all my camera kit. Through the course of the project I've dislocated my arm, become ill from river water and cut the end of my finger off when chasing after vendace! (it wasn't a monster pike that had it rather me adjusting my camera with a pen knife and it slipped)

Many or the rarer fish actually weren't too difficult to photograph as I joined in many surveys and electro fishing trips. Seeing the last river spawning population of arctic charr was a highlight with crystal clear water in the Lake District perfectly showcasing the vibrant reds and greens of the fish. Grayling are by far my favourite fish though barbel come a close second. I've spent the most time filming these ladies of the stream in the Peak District as it's not too far from where I live in Nottingham. It took years of observation to work out where the fish breed and the best times to see this. The males fight each other in something reminiscent of stags rutting. The darkened males then slink off with the paler female grayling and find an area of fine gravel. They mostly return to the same spot each time like a salmon or trout returning to a redd so using this information to place a camera was sometimes frustrated when they failed to return as expected! I watched as the male placed his dorsal fin over her and they began to spawn which is an amazing sight taking years of work to film.

The filming has largely taken over from the fishing for me though I do sometimes wet a line still. Filming has been a fantastic tool for seeing fish behaviour like shoaling species such as perch and roach which will mob predators such as pike when they spot them, keeping behind the predator and close to its tail, much like songbirds mobbing a buzzard. I've seen fish team up or at the very least take advantage of each other with perch shadowing eels and when the eel is rooting around for prey the perch will grab fleeing bullheads and small invertebrates. Because of the effectiveness of filming it's now being used to monitor fish as it has low interference and in addition the increase in drone use equipped with cameras has helped massively with counting salmon and trout redds.

Allis shad (*Alosa alosa*). Copyright: Jack Perks

The future of our fish is uncertain with species such as the houting and burbot extirpated and the outlook for others such as the vendace not looking good it would certainly be a shame to lose another species. Some of the non-natives I've filmed have more or less been eradicated such as top mouth gudgeon and black bullhead catfish which is of course a good thing as invasive species in freshwater can be notoriously difficult to get rid of.

Undoubtedly the list will always be up for debate, I half-heartedly included burbot with a stuffed one I photographed in Wollaton Hall caught from the Trent in the 1930's I figured that's the only one I'd realistically never see! I also didn't include the many non-native sturgeon or pink salmon though hope to film the pinks should they return on mass again as they did in 2017. New species will undoubtedly appear with warming waters and my bets are on the round goby that's currently making its way through western Europe.

In terms of what's next I'd like to do another book maybe on the places, people and fish I've come across as well as to try and film more marine fish, though not all of them as there's around 400 species and most are deep sea! Some of the European fish like cozimo barbel, Amur pike and huchen sound like a challenge too.

You can watch the full film of every species on Jack's website www.jackperksphotography.com

Conference and Travel Reports

Alexandra M. Watts from the Ecological Genetics and Conservation Lab at Manchester Metropolitan University reports on the 5th International Whale Shark Conference in Exmouth, WA, Australia.

Multi-disciplinary data can be most informative when applied to elusive species, and the 5th International Whale Shark Conference (IWSC5) provided an excellent platform to communicate my current findings in the species while soaking up new research from other disciplines; several chapters in my PhD will be developed alongside data from climate change, adaptation and movement ecology for the most robust research outcomes. With the kind support of the FSBI, I was able to connect with some of the most prolific and influential whale shark researchers in a flurry of introductions, catch-ups, and general excitation at the newest techniques and breakthroughs out there. Excellent keynotes from Dr. Neil Hammerschlag and Prof. David Sims whetted appetites for collaborations and infectiously motivated discussions on a variety of shark research topics. Three days of talks and poster presentations were punctuated by a day on the water to showcase the fantastic ecotourism of Australia's Ningaloo Reef. Whale shark welfare issues have been the highlight of much research to help keep interactions sustainable for this IUCN endangered species within the multi-million-dollar industry. Ningaloo researchers and operators led the way developing this and resulted in one of the safest, longest, and most peaceful encounters I have personally ever had, both for myself and for the shark!

Thanks to Manchester Metropolitan University and the Marine Megafauna Foundation, I began my PhD on whale shark genetics in 2017 and have collected a substantial number of tissue samples from all over the world. My talk for the conference was focused on St. Helena Island, a

British Overseas Territory, and one of the most unique populations of this species in the world. While many of the spatially explicit data we have such as from satellite and acoustic tags, biochemical studies and photo-ID around the world are limited to coastal juveniles, technological limitations prevent large-scale long-term tracking of adult whale sharks. In these situations, indirect inferences from genetics can really help to clarify global connectivity patterns. Other movement data covered at IWSC5 included new ranges for whale shark juveniles from several sites in Indonesia, highlighting the large scope of research on the species there. Further to movement studies, new physiological data such as heart and breathing rates, reproductive information from ultrasound scans and haematological parameters are being approached from researchers from Japan and are further adding to biological knowledge on the species.

In light of heightened mental health awareness in academia, IWSC5 was an inspiration for high-quality science and applicable conservation outputs through working together, good communication and the development of complimentary and transparent research goals. Global collaborations inherently come with the price-tag of long-distance cold-calling, communications and negotiations with people you have likely never met, and it can be incredibly difficult to remotely motivate sampling efforts (and especially the associated paperwork!) in this way. IWSC5 presented a welcome opportunity to meet and thank these people as well as to recruit new collaborators – the tactility of a handshake and a face-to-face connection go way beyond even the most charming email! I'm pleased to say that several international collaborations have been developed after my attendance at the conference including during a genetics workshop at the end of the week which coincidentally paralleled some of my own research. My attendance at IWSC5 will allow me to stay current with the latest research themes above and beyond publications that are invariably produced much later down the road. This will ultimately provide better context for my research and hopefully improve the applicability of my results, and for this is I am extremely grateful to FSBI for their contribution.

Sara Mynott, from the University of Exeter, presented her research at Future Oceans 2 in Brest, France.

Few weeks have been as inspiring as this one. An array of innovative thinkers – each one a powerful ➤

unit of change – united in Brittany to discuss the future of our oceans. For me, this meant zipping between transdisciplinary talks, workshops and poster sessions, conversing over buttery pastries, and presenting my research on how ecology and industry can work together to reduce bycatch.

Future Oceans 2 kick-started with a day devoted to early career researchers: captivating talks, science speed-dating and training in how to make great infographics. Integrating with others from the Interdisciplinary Marine Early Career Network (IMECaN) sparked discussions around how we can achieve ocean sustainability for the benefit of society. The event also gave me ideas for how to support such networks as they grow.

Being surrounded by diverse researchers working across science, policy and industry instilled a deeper understanding of the challenges facing our oceans and the opportunities to address them. Through talking to academics, practitioners and government scientists I gained invaluable feedback on my work, forged new collaborations and massively enhanced my marine science network. I look forward to seeing how they change the shape of marine and fisheries science in the years to come.

My talk focused on how light can be used to make fishing gear more selective – a project I carried out with the tech start up SafetyNet Technologies earlier this year. Working closely with gear technologists gave me a unique insight into what it's like to collaborate with industry and how such collaborations can facilitate positive environmental change. Others from the science-industry interface session shared their perspectives and, together, we will develop a guide to working with industry – a fantastic outcome from the meeting!

I left the conference with new ideas for projects and papers, invitations to visit other institutes, a wealth of new knowledge and, best of all, a wonderful science family.

Sara has her own website at https://saramynott.com.

Kirthana Pillay, one of the Society's PhD students working at Bangor University, reports on her attendance at the 5th Mangrove, Macrobenthos and Management 2019.

The Mangrove, Macrobenthos and Management (MMM) meeting held in Singapore recently is the fifth installation as part of the MMM series. These series of international conferences are dedicated to the understanding and conservation of mangrove forests. The MMM conference series first began in 2000 in Kenya and since then has been hosted in Australia, Sri Lanka, the USA and just last month in Singapore. The 5th MMM meeting was the largest of the MMM series with 321 abstracts submitted from 34 countries. The sessions included were, 'Mangrove loss and deforestation', 'Mangrove degradation', 'Impacts of people on mangrove structure and function', 'Mangrove genetics and connectivity', 'Mangroves and climate change', 'Ecosystem services of mangroves', 'Blue carbon', 'Mangrove rehabilitation', 'Mangrove macrobenthos' and 'Mangrove management'.

The fist keynote paper was by Dr Jurgenne Primavera from the Zoological Society of London-Philippines. Dr Primavera's presentation reiterated the lessons that she had learnt while working closely with local communities when she was rehabilitating mangrove habitats. The next keynote was presented by Dr Shing Yip (Joe) Lee from the Chinese University of Hong Kong. His presentation focused on the ecosystem services and functions that mangrove forests provide and explained the negative outcomes that may arise when mangroves are lost.

The session that grabbed my interest in particular was 'Mangrove genetics and connectivity' as my PhD project aims to conduct a network-based analysis of mangrove ecosystems by reconstructing food webs of fishes using metabarcoding and stable isotope analysis. Thus, all of the talks from this session was highly relevant and applicable to my own research topic.

Other sessions of interests included 'Mangrove Rehabilitation' and 'Mangrove management'. In these sessions researchers presented their results and experience on working with local communities. They provided solutions for sustainable resource use for the provision of timber and small-scale fishing activities. A talk that was particularly interesting delivered by Samantha Chapman from Villanova University, Pennsylvania, USA, in the session of 'Mangroves and climate change' focused on the negative effects of mangrove forest expansion. Due to climate change, mangrove forests have encroached further inland into salt marshes. Salt marshes like mangroves are also important estuarine habitats and the effects of mangrove encroachment on salt marsh ecosystem services are still unknown from this conversion.

I would like to express my thanks to FSBI for enabling me to attend this international conference. I have benefitted from the valuable feedback received from engaging in conversations with researchers who are experts in this field of mangrove ecology. The feedback received and contacts made will greatly aid me in my PhD project and future research career.

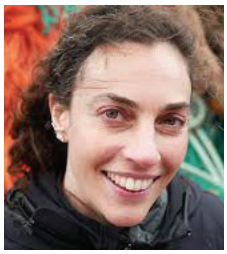
Notices

At the Society's Annual General Meeting which took place at the University of Hull on Wednesday 17th July 2019 the following new officers and council members were elected:

President: Professor Gary Carvalho, Bangor University.

Vice- President: Professor Colin Adams, University of Glasgow.

Council members: Katie Longo, Marine Stewardship Council



Rui Vieira, Centre for Environment, Fisheries and Aquaculture Science

Katie and Rui replace Phil McGinnity and Michel Kaiser. Michel of course stays on as a Guest of Council in his capacity as Editor in Chief of the *Journal of Fish Biology*.

WORLD FISHERIES CONGRESS ADELAIDE • AUSTRALIA 11-15 OCTOBER 2020

The response from our international fisheries community to our recent call for expressions of interest has been overwhelming, with over 100 submissions received.

As work on developing the program continues, four key themes are set to shape the WFC2020:

- Sustainable fisheries (assessment, management, regulation and enforcement)
- Fish and aquatic ecosystems (biodiversity, conservation and ecosystem function)
- Fisheries and society (contributions to sustainable development)
- Future of fish and fisheries (innovations in fisheries)

If you missed the call for expression of interest, and have ideas or suggestions you would like to share please e-mail: conference@aomevents.com.

The Call for Abstracts will be open late in 2019.

Information Desk

For all membership enquires (except subscription payments), including grant application submissions, please contact the FSBI office at:

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See http://www.fsbi.org.uk/membership/joining-the-fsbi/ for further information.

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